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Worldwide Equipment Guide

Volume 1: Ground Systems



TRADOC G-2 ACE–Threats Integration
Ft. Leavenworth, KS

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ATTENTION OF:

ATIN-ZAL

15 December 2016

MEMORANDUM FOR: Distribution unlimited

SUBJECT: Worldwide Equipment Guide (WEG) Update 2016

1. In today's complicated and uncertain world, it is impossible to predict the exact nature of the next conflict that may involve U.S. joint forces. We must be ready to meet the challenges of any type of conflict, in all kinds of places, and against all types of threats in all Complex Operational Environments. As a training tool, the opposing force (OPFOR) must be a challenging, uncooperative sparring partner capable of stressing any or all warfighting functions and mission-essential tasks of the U.S. force.

2. The Army Training Circular 7-100 series describes the doctrine, organizations, TTP, and equipment of such an OPFOR and how to combine it with other operational variables to portray the qualities of a full range of conditions appropriate to Army training environments.

3. The WEG was developed to support the TC 7- 100 series and all OPFOR portrayal in training simulations (live, virtual, constructive, and gaming). The equipment portrayed in the WEG represents military systems, variants, and upgrades that US forces may encounter now and in the foreseeable future. The authors continually analyze real- world developments, capabilities, and trends to guarantee the OPFOR remains relevant.

4. Published in three volumes, (Ground; Airspace & Air Defense Systems; and Naval & Littoral Systems) the WEG is the approved document for OPFOR equipment data used in U.S. Army training. Annual updates are posted on the ATN website. Therefore it is available for downloading and local distribution. Distribution restriction is unlimited. This issue replaces all previous issues.

5. For comments or questions regarding this document, contact Mr. Cantin DSN 552- 7952, (913) 684-7952, john.m.cantin.ctr@mail.mil. If he is not available (or for specific issues), contact the POCs noted in the chapter introductions.

Gary E. Phillips
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Preface

The WEG was developed to support the TC 7-100 series and all OPFOR portrayal in training simulations (constructive, virtual, live, and gaming). The equipment portrayed in this WEG represents military systems, variants, and upgrades that U.S. forces may encounter now and in the foreseeable future. The authors continually analyze real-world developments, capabilities, and trends to guarantee that the OPFOR remains relevant.

This series of TC/FM and guides outline an OPFOR capable of portraying the entire spectrum of military and paramilitary capabilities against which the U.S. Military must train to ensure success in any future conflict.

Applications for this series of handbooks include field training, training simulations, and classroom instruction throughout the U.S. Military. All U.S. Military training venues should use an OPFOR based on these handbooks, except when mission rehearsal or contingency training requires maximum fidelity to a specific country-based threat. Even in the latter case, trainers should use appropriate parts of the OPFOR handbooks to fill information gaps in a manner consistent with what they do know about a specific threat.

Unless this publication states otherwise, masculine nouns or pronouns do not refer exclusively to men.



Introduction

This Worldwide Equipment Guide (WEG) describes the spectrum of worldwide equipment and system trends in the Complex Operational Environment (COE). Tier Tables provide baseline examples of systems with counterparts in other capability tiers. Other systems are added to offer flexibility for tailoring the force systems mix. Substitution Tables offer other system choices versus baseline examples.

The OPFOR in the COE should also include options for portraying "hybrid threat". Hybrid threat is defined as:

…the diverse and dynamic combination of regular forces, irregular forces, terrorist forces, and/or criminal elements, all unified to achieve mutually benefitting effects.

The OPFOR may use conventional weapons; however regular and irregular forces may also employ improvised systems, as described throughout this guide. Upgrade tables are included to capture WEG systems changes reflecting contemporary upgrade trends. Systems and technologies in Chapter 10, Countermeasures, Upgrades, and Emerging Technology, can be used in simulations for Near-Term and Mid-Term scenarios.

The pages in this WEG are designed for use in electronic form or for insertion into loose-leaf notebooks. This guide will be updated as often as necessary, in order to include additional systems, variants, and upgrades that are appropriate for OPFOR use.

The 2016 version of the WEG has changes in the format and presentation of information. We have attempted to make the information available more user friendly, easily accessible, and concise. Therefore, much of the narrative on some systems has been updated and edited. If you have questions on the presentation of information or anything else included in this guide, contact Mr. John Cantin at DSN 552-7952, commercial (913) 684-7952, email: john.m.cantin.ctr@mail.mil.



How To Use This Guide

The WEG is organized by categories of equipment, in chapters. The format of the equipment pages is basically a listing of parametric data. This permits updating on a standardized basis as data becomes available. For meanings of acronyms and terms, see the Glossary. Please note that, although most terms are the same as in U.S. terminology, some reflect non-U.S. concepts and are not comparable or measurable against U.S. standards. For example, if an OPFOR armor penetration figure does not say RHA (rolled homogeneous armor) do not assume that is the standard for the figure. If there are questions, consult the Glossary, or contact us.

System names reflect intelligence community changes in naming methods. Alternative designations include the manufacturer's name, as well as U.S./NATO designators. Note also that the WEG focuses on the complete weapon system (e.g., AT-4/5/5B antitank guided missile launcher complex or 9P148 ATGM launcher vehicle), versus a component or munition (9P135 launcher or AT-4/5 ATGM).

Many common technical notes and parameters are used in chapters 3 through 6, since the systems contained in those chapters have similar weapon and automotive technologies. Chapters 2 (Infantry Weapons), 7 (Engineer and CBRN) and 8 (Logistics), offer systems with many unique parameters and therefore may not be consistent with those in other chapters.

The authors solicit the assistance of WEG users in finding unclassified information that is not copyright-restricted, and that can be certified for use. Questions and comments should be addressed to the POC below. If he is not available, contact the designated chapter POC.

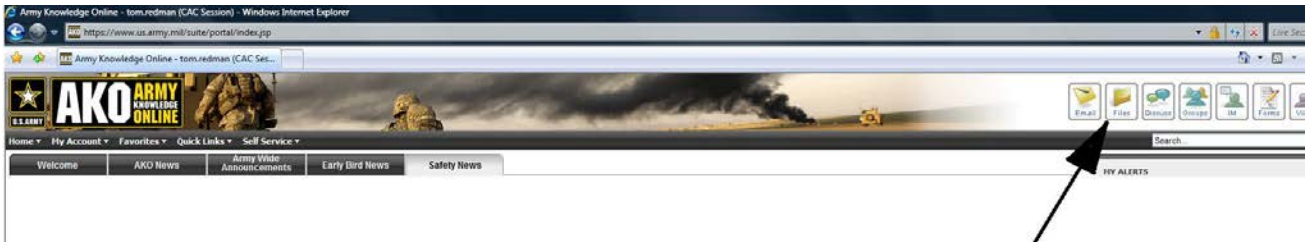
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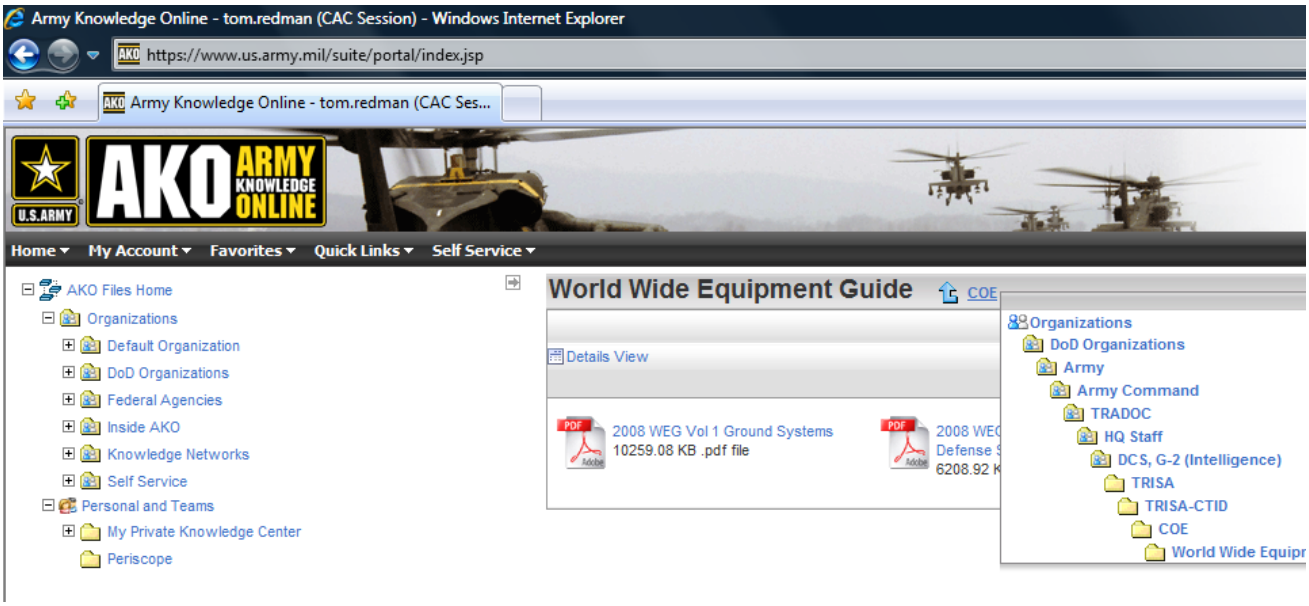
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Volume 3 Naval Littoral	https://www.us.army.mil/suite/doc/25963540



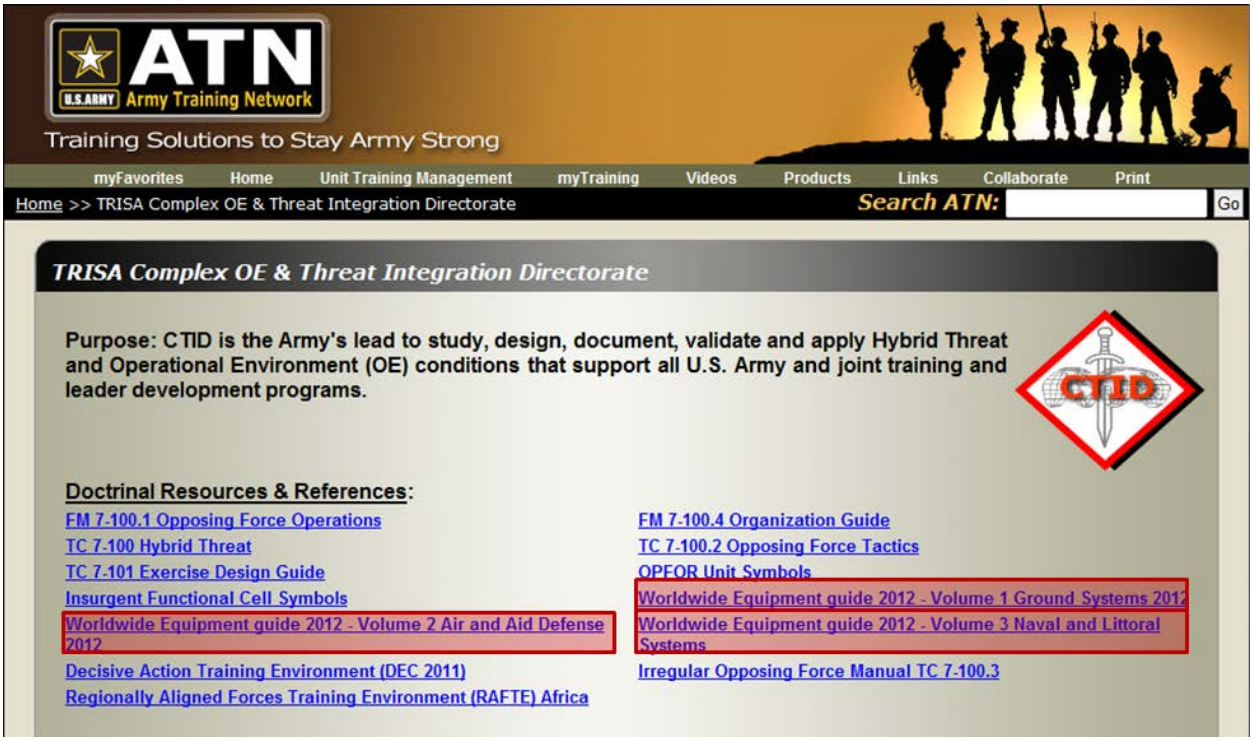
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To access WEG and other COE training products at our ATN go to the TRISA CTID page at the following link https://atn.army.mil/dsp_template.aspx?dpID=311.



Navigate to the appropriate WEG Volume and download the PDF.

Opposing Force:
Worldwide Equipment Guide
Chapters Volume I

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Units of Measure

The following example symbols and abbreviations are used in this guide.

Unit of Measure	Parameter
(°)	degrees (of slope/gradient, elevation, traverse, etc.)
GHz	gigahertz—frequency (GHz = 1 billion hertz)
hp	horsepower (kWx1.341 = hp)
Hz	hertz—unit of frequency
kg	kilogram(s) (2.2 lb.)
kg/cm^2	kg per square centimeter—pressure
km	kilometer(s)
km/h	km per hour
kt	knot—speed. 1 kt = 1 nautical mile (nm) per hr.
kW	kilowatt(s) (1 kW = 1,000 watts)
liters	liters—liquid measurement (1 gal. = 3.785 liters)
m	meter(s)—if over 1 meter use meters; if under use mm
m^3	cubic meter(s)
m^3/hr	cubic meters per hour—earth moving capacity
m/hr	meters per hour—operating speed (earth moving)
MHz	megahertz—frequency (MHz = 1 million hertz)
mach	mach + *(factor)* —aircraft velocity (average 1062 km/h)
mil	milliradian, radial measure (360° = 6400 mils, 6000 Russian)
min	minute(s)
mm	millimeter(s)
m/s	meters per second—velocity
mt	metric ton(s) (mt = 1,000 kg)
nm	nautical mile = 6076 ft (1.152 miles or 1.86 km)
rd/min	rounds per minute—rate of fire
RHAe	rolled homogeneous armor (equivalent)
shp	shaft horsepower—helicopter engines (kWx1.341 = shp)
μm	micron/micrometer—wavelength for lasers, etc.

OPFOR Ground Systems – Tier Tables

The OPFOR organization and equipment must support the entire spectrum of Contemporary Operational Environment in U.S. forces training. The COE OPFOR includes "hybrid threats", and represents rational and adaptive adversaries for use in training applications and scenarios. The COE time period reflects current training as well as training extending through the Near Term. This chapter deals with current time frame systems. Lists of equipment on these tables offer convenient baseline examples arranged in capability tiers for use in composing OPFOR equipment arrays for training scenarios. For guidance on systems technology capabilities and trends after 2014, the user might look to Chapter 10, Countermeasures, Upgrades, and Emerging Technology. Those tables offer capabilities tiers for Near and Mid-Term.

OPFOR equipment is broken into four "tiers" in order to portray systems for adversaries with differing levels of force capabilities for use as representative examples of a rational force developer's systems mix. Equipment is listed in convenient tier tables for use as a tool for trainers to reflect different levels of modernity. Each tier provides an equivalent level of capability for systems across different functional areas. The tier tables are also another tool to identify systems in simulations to reflect different levels of modernity. The key to using the tables is to know the tier capability of the initial organizations to be provided. Tier 2 (default OPFOR level) reflects modern competitive systems fielded in significant numbers for the last 10 to 20 years.

Systems reflect specific capability mixes, which require specific systems data for portrayal in U.S. training simulations (live, virtual, and constructive). The OPFOR force contains a mix of systems in each tier and functional area which realistically vary in fielded age and generation. The tiers are less about age of the system than realistically reflecting capabilities to be mirrored in training. Systems and functional areas are not modernized equally and simultaneously. Forces have systems and material varying 10 to 30 years in age in a functional area. Often military forces emphasize upgrades in one functional area while neglecting upgrades in other functional areas. Force designers may also draw systems from higher or lower echelons with different tiers to supplement organizational assets. Our functional area analysts have tempered depiction of new and expensive systems to a fraction of the OPFOR force. The more common modernization approach for higher tier systems is to upgrade existing systems.

Some systems are used in both lower and higher tiers. Older 4x4 tactical utility vehicles which are 30 to 40 years old still offer effective support capability, and may extend across three tiers. Common use of some OPFOR systems also reduces database maintenance requirements.

Tier 1 systems are new or upgraded robust state-of-the-art systems marketed for sale, with at least limited fielding, and with capabilities and vulnerabilities representative of trends to be addressed in training. But a major military force with state-of-the-art technology may still have a mix of systems across different functional areas at Tier 1 and lower tiers.

Tier 2 reflects modern competitive systems fielded in significant numbers for the last 10 to 20 years, with limitations or vulnerabilities being diminished by available upgrades. Although forces are equipped for operations in all terrains and can fight day and night, their capability in range and speed for several key systems may be somewhat inferior to U.S. capability.

Tier 3 systems date back generally 30 to 40 years. They have limitations in all three subsystems categories: mobility, survivability and lethality. Systems and force integration are inferior. However, guns,



missiles, and munitions can still challenge vulnerabilities of U.S. forces. Niche upgrades can provide synergistic and adaptive increases in force effectiveness.

Tier 4 systems reflect 40 to 50 year-old systems, some of which have been upgraded numerous times. These represent Third World or smaller developed countries' forces and irregular forces. Use of effective strategy, adaptive tactics, niche technologies, and terrain limitations can enable a Tier 4 OPFOR to challenge U.S. force effectiveness in achieving its goals. The tier includes militia, guerrillas, special police, and other forces.

Please note: ***No force in the world has all systems at the most modern tier.*** Even the best force in the world has a mix of state-of-the-art (Tier 1) systems, as well as mature (Tier 2), and somewhat dated (Tier 3) legacy systems. Many of the latter systems have been upgraded to some degree, but may exhibit limitations from their original state of technology. Even modern systems recently purchased may be considerably less than state-of-the-art, due to budget constraints and limited user training and maintenance capabilities. Thus, even new systems may not exhibit Tier 1 or Tier 2 capabilities. As later forces field systems with emerging technologies, legacy systems may be employed to be more suitable, may be upgraded, and continue to be competitive. ***Adversaries with lower tier systems can use adaptive technologies and tactics, or obtain niche technology systems to challenge advantages of a modern force.***

A major emphasis in an OPFOR is flexibility in use of forces and in doctrine. This also means OPFOR having flexibility, given rational and justifiable force development methodology, to adapt the systems mix to support doctrine and plans. The tiers provide the baseline list for determining the force mix, based on scenario criteria. The OPFOR compensates for capability limitations by using innovative and adaptive tactics, techniques, and procedures (TTP). Some of these limitations may be caused by the lack of sophisticated equipment or integration capability, or by insufficient numbers. Forces can be tailored in accordance with OPFOR guidance to form tactical groups.

An OPFOR force developer has the option to make selective adjustments such as use of niche technology upgrades such as in tanks, cruise missiles, or rotary-wing aircraft, to offset U.S. advantages. Forces may include systems from outside of the overall force capability level. A Tier 3 force might have a few systems from Tier 1 or 2. The authors will always be ready to assist a developer in selecting niche systems and upgrades for use in OPFOR portrayal. Scenario developers should be able to justify changes and systems selected. With savvy use of TTP and systems, all tiers may offer challenging OPFOR capabilities for training. The Equipment Substitution Matrices can help force designers find weapons to substitute, to reflect those best suited for specific training scenarios.

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Weapon System Tier Tables

	Tier 1	Tier 2	Tier 3	Tier 4
Dismounted Infantry				
Infantry Flame Launcher	(Shmel) RPO-M	RPO-A	RPO	LPO-50
Lt AT Disposable Launcher	Armbrust	Armbrust	Armbrust	RPG-18; M72 LAW
AT Disposable Launcher	RPG-30/32/28	RPG-27	RPG-26	RPG-22
AT Grenade Lcher (ATGL)	Panzerfaust 3-IT600	Panzerfaust 3 T-600; RPG-29	Carl Gustaf M3	RPG-7V
Long-Range ATGL	PF-98 Mounted/Tripod (@ Bn)	RPG-29/Mounted/Tripod	SPG-9M (Imp)	SPG-9
Heavy ATGM Man-Portable	Eryx SR-ATGM	Eryx SR-ATGM	M79/Type 65-1 Recoilless	M67 Recoilless Rifle
Light Auto Grenade Launcher	QLZ-87 (Light Configuration); QLZ-87B	W-87	W-87	W-87
Auto Grenade Launcher	CIS-40 w/Air-Burst Munitions/ AGS-30; QLZ-87 (Heavy Configuration)	AGS-17	AGS-17	AGS-17
Heavy Machine Gun	KORD	NSV	NSV	DShk; M2 Browning
General Purpose MG	PKM Pechneg	PKM	PKM	PKM
Anti-Materiel Rifle	M107A1(.50 Cal); 6S8 and 6S8-1 (12.7mm)	M82A1(.50 Cal); OSV-96 (12.7mm)	M82A1(.50 Cal)	M82A1(.50 Cal)
Sniper Rifle	SVD	SVD	SVD	Mosin-Nagant
Assault Rifle	AK-74M	AK-74M	AKM	AKM
Carbine	AKS-74U	AKS-74U	AK-47 Krinkov	AK-47 Krinkov
Company-Dismount ATGM	Spike-LR ATGM Launcher	Spike-MR ATGM Launcher	AT-13	AT-7
Battalion-Dismount ATGMs	Kornet-E Launcher (1 team) Starstreak-SL AD/AT (1 team)	Kornet-E ATGM Lchr	AT-5B	AT-5
Combat Vehicles				
Infantry Fighting Vehicle	BMP-2M Berezhok	BMP-2M	AMX-10P	BMP-1PG
Infantry IFSV for IFV	BMP-2M Berezhok	BMP-2M w/Kornet/SA-18	AMX-10 w/AT-5B/SA-16	BMP-1PG w/ AT-5/SA-16
Amphibious IFV	BMP-3UAE/AT-10B	BMP-3UAE/AT-10B	BMD-2/AT-5B	BMP-1PG/AT-5
Amphibious IFV IFSV	BMP-3UAE/AT-10B	BMP-3UAE/AT-10B	BMD-2/AT-5B	BMD-1PG w/AT-5/SA-16
Armored Personnel Carrier	BTR-3E1/AT-5B	BTR-80A	BTR-80	M113A1
Amphibious APC	BTR-90	BTR-80A	WZ-551	VTT-323
Amphibious APC IFSV	BTR-90/AT-5B/SA-24	BTR-80A w/Kornet-E/SA-18	WZ-551 w/AT-5B/SA-16	VTT-323 w/AT-3C/SA-14
Airborne IFV	BMD-3	BMD-3	BMD-2	BMD-1P
Airborne APC	BTR-D	BTR-D	BTR-D	BTR-D
Airborne APC IFSV	BTR-D w/Kornet-E, SA-24	BTR-D w/Kornet-E/SA-18	BTR-D w/AT-5B/SA-16	BTR-D w/AT-5, SA-14
Heavy IFV/Heavy IFSV	BMP-3M/w Kornet-E, SA-24	BMP-3UAE/Kornet-E, SA-18	Marder 1A1/MILAN 2, SA-16	BMP-1PG/w SA-14
Combat Recon Vehicle	BRM-3K/Kredo M1	BRM-3K	BRM-1K	EE-9

Abn/Amphib Recon CRV	BMD-3/Kredo M1	BMD-3K	BMD-1PK	BMD-1K
Armored Scout Car	BRDM-2M-98/Zbik-A	BRDM-2 M-97/Zbik-B	Fox	BRDM-2
Sensor Recon Vehicle	HJ-62C	HJ-62C	BRM-1K	BRM-1K
AT Recon Vehicle	PRP-4MU (w/Kredo-M1)	PRP-4M (w/PSNR-5M)	PRP-4 (w/PSNR-5K)	PRP-3 (w/SMALL FRED)
Armored Command Vehicle	BMP-1KshM	BMP-1KShM	BMP-1KSh	BMP-1KSh
Abn/Amphib ACV	BMD-1KShM	BMD-1KShM	BMD-1KShM	1KShM
Wheeled ACV	BTR-80/Kushetka-B	BTR-80/Kushetka-B	BTR-60PU/BTR-145BM	BTR-60PU/BTR-145BM
Combat Support Vehicles				
Motorcycle	Gear-Up (2-man)	Gear-Up (2-man)	Motorcycle (2-man)	Motorcycle (2-man)
Tactical Utility Vehicle	VBL MK2	VBL	UAZ-469	UAZ-469
Armored Multi-purpose	MT-LB6MB	MT-LB6MA	MT-LBu	MT-LB
All Terrain-Vehicle	Supacat	Supacat	LUAZ-967M	LUAZ-967M
Tanks and AT Vehicles				
Main Battle Tank	T-90A/AT-11 Refleks 5km	T-72BM / AT-11 Svir 4km	Type 59-11 105mm/AT-10	T-55AMV
Amphibious Tank	Type 63A 105mm/AT-10	Type 63A 105mm	M1985 85mm/AT-3	PT-76B
Tracked Heavy Armored CV	2S25	AMX-10 PAC 90	AMX-13	M41A3
Wheeled Heavy Armored CV	Carousel 120	AMX-10RC Desert Storm	AMX 10RC	EE-9
Div ATGM Launcher Vehicle	9P157-2/Krizantema-S	9P149 w/AT-9 Ataka	9P149 w/AT-6	9P148/AT-5
Bde ATGM Veh Tracked	9P162 w/Kornet	AMX-10 HOT 3	AMX-10 HOT 2	Type 85/Red Arrow-8A
Bde ATGM Veh Wheeled	BMD-3	VBL w/Kvartet, Kornet	9P148/AT-5B	Jeep/Red Arrow-8A
Abn ATGM Launcher Veh	VBL MK2 w/Kvartet, Kornet	VBL w/Kvartet, Kornet	BMD-2 with AT-5B	BMD-1P with AT-5
Hvy ATGM Launcher Veh	9P157/Mokopa	9P149 w/Ataka	9P149 w/AT-6	9P148/AT-5
NLOS ATGM Launcher Veh	AMX-13Nimrod-3	Type 92B/Nimrod	--	--
Div Towed AT Gun	2A45MR	2A45M	MT-12	MT-12
Bde Towed AT Gun	2A45MR	MT-12R	MT-12	M40A1
Artillery				
Mortar/Combo Gun Tracked	2S9-1	2S9-1	2S9-1	M106A2
Mortar/Combo Gun Wheeled	2S23	2S23	2S12	M-1943
Towed Mortar or Combo Gun	Type 86 or 2B16	Type 86 or 2B16	M75 or MO-120-RT	M-1943
82-mm Mortar	Type 84	Type 84	Type 69	M-1937
82-mm Auto Mortar	2B9	2B9	2B9	2B14-1
60-mm Mortar	Type 90	Type 90	Type 63-1	Type 63-1
Towed Light Howitzer	D-30	D-30	D-30	D-30
Towed Medium How/Gun	G5	2A65	2A36	D-20
Self-Propelled Howitzer	2S19M1-155, G6, AU-F1T	G6, 2S19M1	2S3M1	2S3M

Multiple Rocket Launcher	9A51/Prima	9A51/Prima	BM-21-1	BM-21
Light MRL/Vehicle Mount	Type 63-1	Type 63-1	Type 63-1	Type 63
Heavy MRL	9A52-2 and 9P140	9A52-2 and 9P140	9P140	Fadjr-3
1-Round Rocket Launcher	9P132	9P132	9P132	9P132
Amphibious SP How	2S1M	2S1M	2S1	2S1
Artillery Cmd Recon Veh	1V13M w/1D15, 1V119	1V13M w/1D15, 1V119	1V13, 1V119	1V18/19, 1V110
ACRV, Wheeled	1V152, 1V110	1V152, 1V119, 1V110	1V119, 1V110	1V18/19, 1V110
Mobile Recon Vehicle	PRP-4MU (w/Kredo-M1)	PRP-4M (w/PSNR-5M)	PRP-4 (w/PSNR-5K)	PRP-3 (w/SMALL FRED)
Arty Locating Radar	1L-259U, 1L-219	1L-220U, 1L-219	ARK-1M	Cymbeline
Sound Ranging System	SORAS 6	SORAS 6	AZK-7	AZK-5
Flame Weapon	TOS-1	TOS-1	Type 762 MRL	OT-55 Flame Tank
Reconnaissance				
Ground Surveillance Radar	Kredo-1E	Kredo-M1	PSNR-5M/Kredo-M	PSNR-5/TALL MIKE/Kredo
Man-portable Radar	FARA-1E	FARA-1E	N/A	N/A
Unattended Ground Sensors	BSA Digital Net	BSA Digital Net	N/A	N/A
Remote TV/IR Monitor	Sirene IR	Sosna	N/A	N/A
Thermal Night Viewer	Sophie LR	Sophie/NVG 2 Gen II	NVG 2 Gen II	NVG 1Gen II
Laser Target Designator	DHY-307	DHY-307	1D15	--
Laser Rangefinder/Gonio-meter Fire Control System	Vector/SG12 with Sophie-LR	Vector/SG12 with Sophie	PAB-2M	PAB-2
Communications				
Radio VHF, Hand-Held	Panther-P	TRC5102	ACH42	R31K
Radio, SPF	Scimitar-H	PRC138	PVS5300	PRC104
Radio VHF, Veh Medium Pwr	Panther	Jaguar-V	R163-50U	R173M
Radio HF/VHF, Veh Med Pwr	M3TR	RF5000	XK2000	R123M
Satellite Systems	Syracuse-III	Feng Huo-1	Mayak	Molinya 1
Global Navigation Sattellite	NAVSTAR	GLONASS	Beidou	Galileo
Operational Comms	RL402A	R423-1	KSR8	R161-5
Tac Wide Area Network	EriTac	RITA	N/A	N/A
IBMS Network	Pakistani IBMS	Pakistani IBMS	N/A	N/A
Electronic Warfare				
Ground-Based ESM	Meerkat-S	Weasel 2000	MCS90 Tamara	R-703/709
Ground-Based EA	CICADA-C	TRC 274	Pelena-6	R-330 T/B
TACSAT EA	CICADA-R	GSY 1800	Liman P2	R-934B
Radar EA	BOQ-X300	CBJ-40 Bome	Pelena-1	SPN-2/4
GPS EA	Aviaconversia TDS	Optima III	Aviaconversia	--
UAV-Based EA	Fox TX/Barrage	ASN-207/JN-1102	Yastreb-2MB/AJ-045A	Muecke/Hummel
Engineer Systems				
Wheeled Minelaying Systems	PMZ-4	PMR-3	Istrice VS-MTLU-1	--

Tracked Minelaying Systems	GMZ-3	GMZ-2	GMZ	--
Scatterable Mine Systems	PKM Man-Portable Minelayer	UMZ	Istrice VS-MTLU-1	--
Route Recon Systems	IPR	IRM	--	--
Route Clearing Systems	IMR-2M	IMR-2	BAT-2	BAT-M
Bridging Systems	TMM	PMP Pontoon Bridge	MT-55A	--

Systems Substitution Matrix - Volume 1

This table provides a list of Vol 1 systems for users to substitute other systems versus OPFOR systems listed in guidance documents. Systems in italics are Tier 2 baseline systems used in the OPFOR Organization Guide. Systems are listed by type in tier order, and can substitute to fit a scenario. Some systems span between the tiers (e.g., 3-4). Also, systems can be used at more than one tier (e.g., 3-4).

	Tier
1. RECONNAISSANCE	
Reconnaissance Vehicles	
BRM-3K Kredo-1E Combat Recon Veh	1
BRDM-2M-98, -97Armored Scout Cars	1-2
HJ-62C Sensor Recon Vehicle	1-2
VBL and VBL Mk2 Armored Scout Cars	1-2
BRM-3K Combat Recon Veh	2
BRM-1K Combat Recon Cmd Vehicle	3-4
Fox Armored Scout Car	3-4
BRDM-2 Armored Scout Car	4
Reconnaissance Systems	
Kredo-1E Grd Surveillance Radar	1-2
Fara-1E Man-portable GSR	1-2
PRP-4M Mobile Recon Vehicle	1-2
France RASIT GSR	2
Kredo-M1 Grd Surveillance Radar	2
Kredo-M Grd Surveillance Radar	3
Kredo/PSNR-5, -5K/TALL MIKE GSR	4
Sophie MF Forward Observer Sys	1
Sophie LR Thermal Binoculars/FO Sys	1
Sophie Thermal Binoculars/FO System	2
2. INFANTRY WEAPONS	
Small Arms	
6S8 and 6S8-1 (12.7mm) AM Rifle	1
M107-A1 Barrett AM Rifle	1
Pecheneg 7.62-mm GP MG	1
KORD Heavy MG	1
OSV-96 (12.7mm) AM Rifle	2
M82-A1 Barrett AM Rifle	2-4
SVD Sniper/Marksman Rifle	1-3
AK-74M Assault Rifle	1-2
RPK-74 Light Machinegun	2
NSV Heavy MG	1-3
PKM General Purpose MG	1-3
Lee-Enfield Rifle	3-4

Mosin-Nagant Sniper Rifle	4
RPK Light Machinegun	3-4
SKS Rifle	4
AK-47/AKM Assault Rifle	3-4
RPD Light Machinegun	4
DShK 38/46 Heavy MG	4
M2 BROWNING Heavy MG	4

Grenade Launchers

QLZ-87B Auto Grenade Launcher	1
AGS-30 Auto Grenade Launcher	1
GM-94 43-mm Magazine Grenade Lchr	1
QLZ-87 Auto Grenade Launcher	1
QLB-06 Auto Grenade Launcher	1
CIS-40 AGL w/Air Burst Munition	1
CIS-40 Auto Grenade Launcher	1-2
W-87 Auto Grenade Launcher	2-4
GP-30 Under-Barrel Grenade Lchr	3
AGS-17 Auto Grenade Launcher	3

Multi-purpose and Flame Launchers

Shmel-RPO-M Flame Weapon	1
RPO-A Flame Weapons	2
RPO Flame Weapon	3

Antitank Weapons

Panzerfaust 3-IT600 AT Grenade Lchr	1
PF-98and PF-98BN ATGL	1
RPG-32/Hashim ATGL	1
RPG-27 ATDL	1-3
RPG-29 ATGL	2
Panzerfaust-3T600 ATGL	2
Carl Gustaf M2 Recoilless Rifle	3
M67 Recoilless Gun	3-4
RPG-7V ATGL	4
RPG-28 AT Disposable Launcher	1
Armbrust ATDL	1-3
AT-4 ATDL	2-3
RPG-22 ATDL	4
RPG-30 ATGL	1

Obscurants and Flame

Shmel-M Flame Weapon	1
BMO-1 Flamethrower Operator Vehicle	1-2
TOS-1 Flamethrower Weapon	1-2
RPO-A Flame Weapons	2
AF-79 Smoke Generator Vehicle	2



3. INFANTRY VEHICLES

Armored Personnel Carriers

BTR-3E1	1-2
BTR-80A	2
BTR-80	3
Pandur	3
WZ 551A/Type 92	3
VTT-323	3-4
BTR-60PB	4
M113A1	3-4
YW 531H/Type 85	3-4
BOV-M	4
BTR-60PA	4
BTR-152 Armored Transporter	4
YW 531A/531C/Type 63-II	4

Infantry Fighting Vehicles

BMP-2M Berezhok	1
BMP-2M	2
Marder 1IFV	2-3
Warrior IFV	2-3
AMX-10P IFV	3
BMP-2 IFV	3
BMP-1P IFV	4
BMP-1 IFV	4

Specialized Carriers/Infantry Fire Spt Vehicles

BMP-3M Heavy IFV/Amp IFV	1
Kliver IFV Turret on BMP/BTR	1
BMP-3 UAE Amphibious IFV	1-2
BTR-90 Amphibious APC	1
BMD-3 Airborne IFV	1-2
BTR-D Airborne APC	1-4
BMD-1/BMD-1P Airborne	4
BTR-T Heavy APC	1-2

Combat Support Vehicles

Spider Light Strike Vehicle	1
Cobra Light Armored Vehicle	1-2
Supacat All-Terrain Vehicle	1-2
VBL and VBR Armored Carrier	1-3
UAZ-469 Tactical Utility Vehicle	2-4
Gear-up Motorcycle	2-4
V-150 Armored Vehicle	3-4
MT-LB Armored Tracked Carrier	

Series	1-4
S55 4 Personnel Carrier	1-4

4. TANKS

Challenger 2	1
Leopard 2A5, 2A6	1
T-90A	1
Type 99 and Type 99A2	1
Al Khalid	1-2
T-80U	1-2
Leopard 2A4	1-2
T-90S	2
T-72BM	2-3
Type 96G	2
Chieftain Mk 12	2 -3
T-64B	2-3
T-80B	2-3
Chieftain Mk 5	3
T-72A/T-72M1	3
T-72B and Other T-72 Upgrade Tanks	3
AMX-30	3-4
Leopard 1A1	3-4
M60A1/M60A3	3-4
T-55AMV	3-4
T-62M	3-4
Type 59-II	4
T-34	4

5. ANTITANK AND ANTI-ARMOR

Dismounted Infantry Crew-served Weapons

RPG-29 Mounted 105-mm ATGL	1-2
Eryx Man-portable ATGM Launcher	1-2
Starstreak Air Def/Anti-armor Missile	1-2
Spike BLOS ATGM Launcher	1-2
Milan/Milan 3/Milan ADT ATGM Lchr	1-3
AT-13 Man-portable ATGM Launcher	3
AT-7 Man-portable ATGM Launcher	4
AT-3/Malyutka-2 ATGM Launcher	4

Portable Mounted Crew-served Weapons

Kornet-E ATGM Launcher	1-2
9P135 Launcher and AT-4B/5B ATGMs	3-4
Red Arrow-8 ATGM Launcher	3-4
SPG-9/-9M 73-mm Recoilless Gun	3-4
M79 82-mm Recoilless Gun	3-4
Towed or Vehicle-Mounted Recoilless Guns	
B-10 82-mm Recoilless Gun	4

M60 82-mm Recoilless Gun	4
B-11 107-mm Recoilless Gun	4

Towed Antitank Guns

2A45MR/2A45M 125-mm Towed AT Gun	1-2
MT-12R/MT-12 100-mm Towed AT Gun	2-3
D-44/SD-44 85-mm Towed Gun	4
ZIS-3 76-mm Towed Antitank Gun	4

Heavy Armored Combat Vehicles

M40 Upgrade 106-mm Recoilless Rifle	2-4
2S25 Self-Propelled AT Gun	1-2
Type 63A Mod Amphibious Tank	1-2
AMX-10RC Armored Recon Veh	2-3
AMX-10 PAC 90 Fire Support Veh	3
EE-9 Armored Recon Veh	3-4
M1985/PT-85 Light Tank	3
AMX-13 Light Tank	3-4
Scorpion Trkd Combat Recon Veh	3-4
M36 SP AT Gun	4
M41A3 Walker Light Tank	4
PT-76B Amphibious Tank	4

ATGM Launcher Vehicles

Mokopa NLOS ATGM launcher System	1
9P157-2/Khrizantema-S ATGM Lchr Veh	1
VBL/Kvartet (Kornet) ATGM Lchr Veh	1
9P162/Kornet-LR ATGM Lchr Veh	1-2
Type 92B/RA-9 ATGM Lchr Vehicle	1-2
BRDM-2HOT-3 ATGM Lchr Veh	1-2
AMX-10 HOT ATGM Lchr Veh	2
9P149 (AT-6/9 Ataka) ATGM Lchr Veh	2-3
M901/ITOW ATGM Lchr Veh	2-3
9P148 (AT-4/5/4B/5B) ATGM Lchr Veh	3-4

6. ARTILLERY

Artillery Command and Recon Vehicles

1V13 Tracked	2-3
1V14/15 Tracked	2-3
1V16 Tracked	2-3
1V18/19 Wheeled	3
1V119 Airborne	3
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Artillery Reconnaissance

PRP-4MU Artillery Mobile Recon Veh	1
PRP-4M Artillery Mobile Recon Vehicle	2
PRP-3/4Artillery Mobile Recon Vehicles	3-4
IL-219 Artillery Locating Radar	1-3
IL-220U Artillery Locating Radar	1-2
SORAS 6 Sound Ranging System	1-2
SNAR 10 Battlefield Surveillance Radar	3-4
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BL-904 Artillery Locating Radar	2-3
Cymbeline Artillery Locating Radar	3-4

Towed Cannon

G-5 155-mm Towed Howitzer	1-2
GH N-45 155-mm Towed Gun-How	1-2
2A36 152-mm Towed Gun	3
D-30A 122-mm Towed Howitzer	3-4
M-46 130-mm Towed Gun	3-4
D-20 152-mm Towed Gun-Howitzer	3-4

Self-Propelled Cannon

2S19M1 152-mm SP Howitzer	1
AU-F1T 155-mm SP Howitzer	1
CAESAR 155-mm Truck Mtd Howitzer	1
G-6 155-mm SP Howitzer	1-2
2S1 122-mm SP Howitzer	1-3
AU-F1155-mm SP Howitzer	2
2S19 152-mm SP Howitzer	2
Type 83 152-mm SP Gun-Howitzer	3
2S3M1 152-mm SP Howitzer	3
2S5M 152-mm SP Gun	3
M1978/M1989 170-mm Koksan SP Gun	4

Multiple Rocket Launcher

Lynx MRL & Extra/Delilah Missile TEL	1-2
9A51/Prima 122-mm MRL	1-2
9A52-2 300-mm MRL	1-2
Astros-II 127/180/300-mm MRL	1-2
WM-80 273-mm MRL	1-2
BM-21 122-mm MRL	2-3
M77 128-mm MRL	2-3
9P140 220-mm MRL	2-3
Fadjr-3 240-mm MRL	2-3
9P132 122-mm Rocket Launcher	2-4
Type 63107-mm MRL	2-4

Mortars/Gun-Mortar Systems

2B16 120-mm Towed Combination Gun	1-2
2S9-1 120-mm SP Combination Gun	1-2
2S23 120-mm SP Combination Gun	1-2
MO-120-RT 120-mm Towed Mortar	2-3
2S12 120-mm SP Mortar	3-4

7. ENGINEER and CBRN

Mine/Countermine

Helkir Antihelicopter mine	1-2
PMZ-4 Towed Mechanical Minelayer	1-2
UMZ Scatterable Minelaying System	1-2
PKM Man-portable Minelaying System	1-2
TM-83 Side-attack mine	1-3 8-24
MTK-2 Tracked Mineclearing Vehicle	1-3
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GMZ-3 Tracked Minelaying Vehicle	2-3
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KMT-5 Tank-Mounted Roller-Plow Set	2-3
Istrice VS-MTLU-1Minelaying System	3
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General Engineer

IMR-2M Obstacle-Clearing Vehicle	1-3
BAT-2 Armored Route-Clearing Vehicle	2-3
MTU-72 Armored Veh-Launch Bridge	2-3
PMM-2 Self-Propelled Amphib Ferry	2-3
PMP Heavy Folding Pontoon Bridge	2-3
IRM Engineer Reconnaissance Vehicle	2-4
TMM Truck-Mounted Scissors Bridge	2-4
MT-55A Armored Veh-Launch Bridge	3-4
BAT-M Tracked Route-Clearing Vehicle	4

CBRN

Decontamination and Smoke Vehicles

TZ-74 Decon/Smoke Generator Vehicle	1-2
TMS-65M Decon/Smoke Generator Veh	3

8. LOGISTICS

Transportation

GAZ-66 2 mt Cargo Truck	2-4

Maintenance

BREM-1 Armored Recovery Vehicle	1-3
T-54-T Armored Recovery Vehicle	4

General Utility

KRAZ-255B 7.5 mt Cargo Truck	1-4
KamAZ 4310 6x6 General Utility Truck	1-2
Ural-375D 4.5 mt Cargo Truck	1-4

9. C2 and INFORMATION WARFARE

Eritac Tactical Comms System	1
Kushetka-B Command and Staff Vehicle	1-2
IBMS (Pk) Integrated Battle Mgmt Sys	2
BMP-1KSh Command and Staff Vehicle	2-3
142 NSA Command and Control Vehicle	1
Optima-3 GNSS Jamming Transmitter	1
ASN-207EW/ECM UAV	1
Cicada ES/EA Jamming Transmitter	1
1L245 Mobile Abn Rdr ECM Jammer	1-2
Weasel 2000 Mobile ESM/ELINT Sys	1-2
Aviaconversia Portable GNSS Jammer	1-2
Avtobaza Ground ELINT System	1-2
SPN-2/3/4 High-Power Radar Jammer	1-3
Infauna Airborne EA Jammer	1
Tigr-M REI PP Leer-2 EW System	1
German EULe ES/SIGINT System	1
Swedish SAB BOQ X-300 ECM/ECW Pod	1
Finish Elektrobit COMINT Sensor	1

10. COUNTERMEASURES, UPGRADES AND EMERGING TECHNOLOGY

No Substitution Platforms

11. INSURGENT AND GUERILLA FORCES

No Substitution Platforms

12. CHEMICAL SYSTEMS

No Substitution Platforms

Dec
2016

Worldwide Equipment Guide

Chapter 1: Reconnaissance



TRADOC G-2 ACE–Threats Integration
Ft. Leavenworth, KS

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Chapter 1: Reconnaissance

Reconnaissance represents all measures associated with organizing, collecting, and studying information on the enemy, terrain, and weather in the area of operation. Aggressive, continuous reconnaissance allows the timely accomplishment of combat missions with minimum losses. Poor reconnaissance can lead directly to failure.

The OPFOR term that addresses the totality of reconnaissance activities is RISTA (reconnaissance, intelligence, surveillance, and target acquisition). Therefore, RISTA **DOES NOT** equal the US term, C4ISR (command, control, communications, intelligence, surveillance, and reconnaissance). For information on OPFOR command and control (C2), see Chapter 9.

The OPFOR commits significant resources to reconnaissance. Prior to hostilities, the OPFOR will already have developed an intelligence picture and expected military courses of actions. While the OPFOR practices similar intelligence and reconnaissance disciplines (HUMINT, SIGNINT, IMINT, etc.) as the US, the OPFOR conducts RISTA with different assets, focuses, and methodologies. Reconnaissance platforms must be able to operate in all spheres: ground, surface, below surface, air, space, naval, and littoral areas. The OPFOR fields reconnaissance assets at all echelons and products derived from those assets are used for actions on the battlefield.

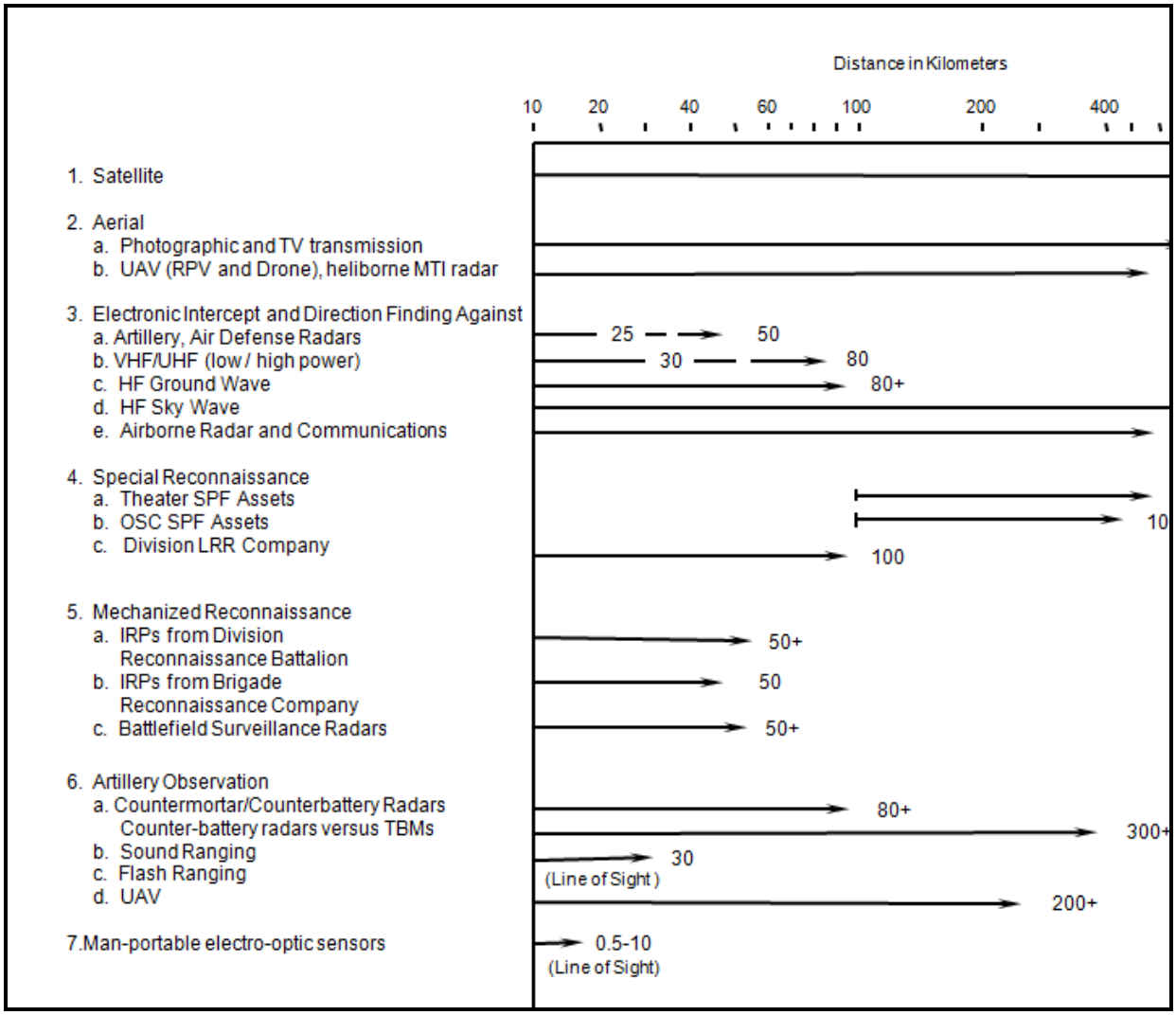
This chapter describes ground maneuver forces and specialized ground troops (special purpose forces-SPF) reconnaissance assets. The most basic sensors are lasers/optics/electro-optics used by infantry units (see Chapter 2). When linked with a radio, these basic sensors can be used for unit reporting and other HUMINT reports. There are also dedicated reconnaissance assets with data sheets in other chapters.

- Aerial reconnaissance (Rotary-Wing and Fixed Wing aviation chapters in Volume 2)
- Air defense reconnaissance, early warning, and target acquisition (Air Defense chapter in Volume 2)
- Artillery target acquisition (Artillery chapter)
- Engineer reconnaissance (Engineer chapter)
- NBC reconnaissance (Chemical chapter)
- Signals reconnaissance (Information Warfare chapter)
- Unmanned aerial vehicles (UAV chapter in Volume 2)

The reconnaissance effort depends upon sensor technologies for location, surveillance, and acquisition. Most units will employ a mix of older and newer systems, with recon vehicles, portable sensors, and man-portable sensors. The most prolific sensor on the battlefield is the human eye. Range is a critical factor. The table below gives general range capabilities.

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Effective Ranges of Selected Reconnaissance Assets



The most prolific reconnaissance discipline is HUMINT reports generated by ground units. Much of this reconnaissance effort consists of tactical recon missions executed by maneuver units in their operational area. Any unit can generate reconnaissance. The OPFOR will exploit civilian information and acquisition assets for reconnaissance purposes. While OPFOR units may operate reconnaissance vehicles, most will possess the ability to operate dismounted observation posts (OP). These dismounted OPs may possess similar capabilities as vehicle mounted patrol vehicles. The OPFOR will use many types of vehicles for reconnaissance including motorcycles, all-terrain vehicles, or civilian vehicles. The OPFOR will use equipment such as multi-spectral concealment materials, navigation equipment, light-weight laptop computers, and long-range communications/digital transmission systems while conducing reconnaissance.

Questions and comments on reconnaissance for specific equipment should be addressed to the respective chapter POC. Questions concerning this chapter should be addressed to:

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RISTA Key Technology Trends

Military forces continue to field new RISTA systems and upgrade old legacy systems. These systems can be found in both reconnaissance, tactical, and fir support units.

System Category	Technology Trend	System Example
Ubiquitous Handheld RISTA System	Remote electronic optics (EO)/3d generation thermal sight, 30x zoom precise location, video link, & graphic net	Sophie MF
	EO bionics with forward looking infrared (FLIR) camera, laser rangefinder (LRF), and goniometer for precise target location	ADAD
	LADAR optical augmentation scans & detects enemy weapon sights	Mirage 1200
	Robotic hand-thrown camera with PDA display, & robot/ball mount	Macroswiss
	Camera grenade (rifle, RPG, AGL) remotes in-flight image to display	SPARCS
RISTA Dismount Team Assets	Man-portable II camera net to display monitor & alert system	Nighthawk
	Site spy cameras with remote-display images on monitor	NG-30
	EO Laser target designator guides laser homing round to 10+ km	DHY-307
	Man-portable radar with 24 km range and LPI frequency	Squire
	Multi-sensor unattended ground sensors with remote monitor display	CLASSIC 2000
	Hand-launch UAVs/micro-UAVS for infantry, SPF, RISTA, AT, etc.	Zala 421-08
RISTA Vehicles	Masted 50+x EO, 3d generation thermal sights & other sensors for real-time nets	ATM
	Integrated weapons with sensor pods for combat reconnaissance vehicles	BRM-3K
	Mast-mounted motorized LPI radars & real-time digital transmission	HJ-62C
	Remote add-on turrets & radar modules for vehicle conversion	Stalker



Aerial RISTA Systems	Powered airship or aerostat with video camera or other sensor arrays	TAOS/Sky Media Pro
	Helicopter/weapon-launch UAV munitions for real time intel/targeting	R-90
	Helicopters & FW with real-time MTI; synthetic aperture radar	Horizon
Other RISTA Assets	INFOWAR, UAV, aerial & HUMINT assets tactically linked & fused	HJ-62C
	Handheld & embedded GNSS receivers for in-view displays	Magellan GPS
	EO laser RF weapon sights with 3d generation day & night capability	IS-2000
	Acoustic sensors quickly detect vehicles, weapons & aircraft	HALO
	Trip-wire charges, mines, or sensor-fused grenade launchers	AJAX
	Artillery/aerial-delivered & hand-emplaced UGS display in intelligence net	BSA
	Weapon launched sensor munitions for aircraft & artillery	R-90
	Laptop display data transmission systems, encryption, and satellite communication (SATCOM)	Kredo-M1



Reconnaissance Vehicles

The OPFOR conducts continuous and pervasive reconnaissance activity in all phases of military operations. To accomplish their reconnaissance, the OPFOR uses a variety of vehicles based on the enemy threat and the mobility desired. The spectrum of reconnaissance vehicles range from old systems ill-suited for modern requirements to mobile, lethal, and survivable systems equipped with complex sensor arrays and communication equipment. Some vehicles may work alone or as part of a patrol.

The vehicle most used for reconnaissance is an unarmored 4 X 4 wheeled rive *tactical utility vehicle* or TUV (see the Infantry chapter for examples). The US M151 or Jeep was originally designed as a reconnaissance vehicle and many countries still favor a similar system due to their small size, speed, and maneuverability in a variety of terrain. Some countries have upgraded their reconnaissance vehicles to something similar to the US HMMWV or British Land Rover.

Reconnaissance vehicles are designed or other vehicles are modified to fit the role desired, force requirements, and the terrain in which the vehicle needs to operate. The vehicles may be unarmed except for small arms carried by the personnel in the vehicle or other larger weapons such as a machine gun or automatic grenade launcher (AGL) may be mounted on the vehicle. Many TUV chassis are poorly suited to adding additional armor for protection of the crew. The additional weight compromises the other positive aspects of the vehicle.

The *armored scout car* is sometimes better suited for reconnaissance than the TUV. These wheeled vehicles offer good road mobility, and better all-terrain off-road mobility than other vehicle types. The vehicle can be based on a truck, armored personnel carrier, or indigenous chassis to handle the added armor requirements while maintaining good mobility. Many of these vehicles may resemble a TUV, but are designed from the ground up for reconnaissance missions. The armor is often light and the wheels are vulnerable to nearly all weapons. Other improvements may be amphibious capability such as with the French VBL and VBR and larger caliber weapons. Examples of these vehicles include the British Fox, Hungarian FUG-66, and Russian BRDM-2.

In heavy combat or when a larger number of soldiers is needed, the OPFOR will often use modified Infantry Fighting Vehicles (IFV) or Armored Personnel Carriers (APC) as a reconnaissance vehicle. Other countries have produced specialized combat reconnaissance vehicles (CRV) designed to operate ahead of the forward line of troops (FLOT), not to initiate combat, but survived if attacked. These CRVs often sacrifice space for soldiers to gain increased mobility, additional sensors, or increased C2 capacity. Many CRVs use tracks instead of wheels, but the wheeled vehicles have amphibious capabilities the tracked vehicles do not. Examples of CRVs include the Russian BRM-3K, the British Scimitar, and the Austrian Pandur RECCE vehicle.

A newer generation came about with the addition of mast mounts and multi-sensor suites to create a *sensor reconnaissance vehicle*. These vehicles are not designed to operate forward of the FLOT, but behind the lines using cover while providing continuous data to ground forces. These vehicles feature powerful multi-sensor arrays using masts from five to 10 meters high provide longer-range surveillance with less vulnerability to enemy fires. Most of these sensor vehicles are built on an IFV or APC chassis provides the space for three to five work stations. These vehicles can also serve as an intelligence coordination and analysis center. These vehicles are likely to move less often than a CRV. Examples of these sensor reconnaissance vehicles include the Czech Snezka and Chinese Type 85 with HJ-62C radar. There are also sensor vehicles available for specific branches such as the Russian PRP-3//PRP-4M for artillery units and the Russian Sborka for air defense units.

Many countries are not using their limited defense dollars not on producing new reconnaissance vehicles, but on improving the sensor suites and mounted them on other vehicles such as the Israeli Rafael Stalker or the French VBL. Some countries are going as far as putting sensors on motorcycles or all-terrain vehicles. See the Infantry chapter for various types of these vehicles are available.

Since reconnaissance forces often operate far away from other friendly units, they need to defend themselves. Some countries have developed vehicles for such purpose with enough firepower, but still can complete the reconnaissance requirements. Examples include the British Saladin Armored Car and the Austrian Pandur Fire Support Vehicle. The main guns on thse vehicles can range from 57 mm to 105 mm on the South African Rooikat. These vehicles are often modified versions of a basic IFV, APC, or other armored vehicle modified to make the vehicle most suitable for reconnaissance vehicles. Some of the more common reconnaissance vehicles are on the following data sheets.

RUSSIAN ARMORED SCOUT CAR BRDM-1



BRDM-1 converted to an ATGM platform

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	BTR-4OP (4 X 4)	Name:	DShKM
Date of introduction:	1959	Caliber/length (mm):	12.7
Proliferation: Vehicles: Countries	1943 17	Type:	Machine Gun
Description:	Light fully amphibious 4 X 4 wheel drive armor scout car with 2 firing ports on each side of the hull & 2 large hatches in the forward part of the roof; 2 belly wheels can be lowered to improve cross-country performance & cross ditches with space for 3 other soldiers besides the crew; personnel must enter & exit the vehicle from the hatches on top of the vehicle	Ammo (Rounds carried): In Box: Ready: Light Ball, Ball-T, API	1250 250 1000
Crew (driver & commander):	2	Max Effective Range (Day): Night: Anti-Aircraft (Est):	2000 INA 1500
Combat weight (mt):	6.2	Armor penetration (mm): At 500 m:	 8
Chassis length overall (m):	5.70	Muzzle velocity (m/s; Est):	800
Height overall (m):	1.91	Name:	SGMB (Rear roof)

Width overall (m):	2.25	Caliber/length (mm):	7.62
Ground pressure (kg/cm^2):	INA	Type:	Medium Machine Gun
Automotive performance:	GAZ 40P	Ammo (Rounds carried): In Box: Ready: Light Ball, Ball-T, API	1250 250 1000
Engine type:	Water-cooled, in-line, 6-cylinder gasoline	Max Effective Range: Day: Night: Anti-Aircraft (Est):	1000 INA 1000
Cruising range (km):	500	Armor penetration (mm): At 500 m:	 8
Speed (km/h):	Max road: 80 Max off-road: INA Average cross-country: INA Max Swim: 6	Muzzle velocity (m/s; Est):	800
Fording depths (m):	Amphibious	VARIANTS	SPECIFICATIONS
Radio:	INA	BRDM-1 Model 1957	Open-topped crew compartment
Protection:		BRDM-1 Model 1958	Closed-top crew compartment
Armor, turret front (mm):	10	BRDM-1 Model 1959	1 7.62-mm MG at front roof
Applique armor (mm):	No	BRDM-1 Model 1960	3 7.62-mm MGs at front & sides
Explosive reactive armor(mm):	No	BRDM-1U	Command vehicle with 4 antennas
Active Protection System:	INA	BRDM1-RKh	NBC reconnaissance vehicle with lane-marking equipment
Self-entrenching blade:	No	2P27 Tank Destroyer	2K16 launcher for 3 AT-1 Snapper ATGM missiles
NBC protection system:	Available	2P32 Tank Destroyer	2K8 launcher for 4 AT-2 Swatter ATGM missiles
Smoke equipment:	INA	2P110 Tank Destroyer	9K14M launcher for 6 AT-3 Sagger ATGM missiles
Survivability equipment:	INA	SPW-4OP (East Germany)	Unarmed BRDM-1
		SPW-40PA (East Germany)	Armed BRDM-1
		9P111 (East Germany)	9P110 Tank Destroyer
		FUG (Hungary)	Hungarian designation for BRDM-1

NOTES

SOURCES: 2014 WEG, MILITARY PERISCOPE, & MILITARY FACTORY. SOME MODELS SUBSTITUTE AN SGMB MACHINE GUN FOR THE DSHKM MACHINE GUN. MANY COUNTRIES OPERATE A COMBINATION OF BRDM-1S & BRDM-2S AND THEIR TOTAL INVENTORY IS BOTH TYPES TOGETHER.

RUSSIAN ARMORED SCOUT CAR BRDM-2



BRDM-2 used by the Polish Army

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	GAZ 41-08	Name:	KPVT
Date of introduction:	1966	Caliber/length (mm):	14.5
Proliferation: Vehicles: Countries:	4694+ 49	Type:	Heavy Machine Gun
Description:	4 X 4 improved BRDM-1, but only space for a total of 4 personnel; personnel must still load & unload from the top of the vehicle	Ammo (Rounds carried): API, API-T, I-T: HE-T:	500 160 340
Crew (driver, commander, gunner, & loader):	4	Max Effective Range: Day: Night:	2000 INA
Combat weight (mt):	7.0	Armor penetration (mm): CE at 1000 m: CE at 500 m:	 20 30
Chassis length overall (m):	5.75	Muzzle velocity (m/s):	1005
Height overall (m):	2.31	Name:	Coaxial
Width overall (m):	2.35	Caliber/length (mm):	7.62
Ground pressure (kg/cm^2):	INA	Type:	PKT machine gun
Automotive performance:	GAZ-41	Ammo (Rounds carried): Heavy ball, I-T, Light ball, Ball-T, API-T:	2000
Engine type:	Water-cooled, V-8 gasoline	Max Effective Range: Day: On the move: Night:	1000 400-500 INA

Cruising range (km):	750	Armor penetration:	INA
Speed (km/h): Max road: Max off-road: Average cross-country: Max swim:	 95 INA INA 10	Muzzle velocity (m/s):	825
Fording depths (m):	Amphibious		
Radio:	R-123	VARIANTS	SPECIFICATIONS
Protection:		BRDM-2K Command Vehicle	Telescopic antenna on right side & whip antenna on right side
Armor, turret front (mm):	10	BRDM-2U Command Vehicle	2 Antennas on each side
Applique armor (mm):	No	R-1A/R-5 Command Vehicles (Poland)	AT Command vehicle with 2 R-123Z radios & 1 R-107 radio
Explosive reactive armor(mm):	No	BRDM-2RKhA NBC Reconnaissance Vehicle	Carries lane markers & 14.5-mm KPVT heavy machine gun
Active Protection System:	INA	BRDM-2RKhB NBC Reconnaissance Vehicle	Carries lane markers & two 7.62-mm machine guns & better sensors
Self-entrenching blade:	No	9P122 Malyutka	Retractable launcher with 6 AT-3 Sagger ATGMS & 8 missiles in hull
NBC protection system:	Collective	9P124	Similar to the 9P122, but 4-launcher AT-2 ATGMS with 4 missiles in hull
Smoke equipment:	No	9P133	Retractable 6-rail AT-3C ATGM launcher
Survivability equipment:	Integrated winch system	9P137	Retractable 5-rail AT-5 ATGM launcher
		9P148	Retractable 5-rail launcher with AT-4 or AT-5 ATGM launcher
		BRDM-2 Konkurs with Spandrel ATGMs	Turretless with 5 AT-5 missiles ready to fire with 9 more missiles in hull
		BRDM-2 Strela 1	SA-9 Gaskin SAM system on a turretless hull with 4 missiles
		BRDM-2ZS	PSYOP vehicle with external speaker
		BRDM-2 Model 96i (Poland)	Auxiliary wheels removed, additional hull door, crew increased to 5, & larger storage capacity
		Russian Upgrades	BPU-1 turret & electronic upgrades

NOTES

SOURCES: 2014 WEG, MILITARY PERISCOPE, & MILITARY FACTORY. THE BRDM-2 HAS BEEN USED AS THE BASE CHASSIS FOR A VARIETY OF VEHICLES. MANY COUNTRIES OPERATE A COMBINATION OF BRDM-1S & BRDM-2S AND THEIR TOTAL INVENTORY IS BOTH TYPES TOGETHER.

POLISH ARMORED SCOUT CAR BRDM-2M-98 & BRDM-2M-97



BRDM-2M-97 Zbik-B

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	BRDM-2A, BRDM-2B M97, Zbik-A, Zbik-B	Name:	NSV-5
Date of introduction:	2004	Caliber/length (mm):	12.7
Proliferation: Vehicles: Countries (offered for export):	INA 1+	Type:	Heavy Machine Gun
Description:	Improved BRDM-2 with auxiliary wheels removed; other weapons available; 2 soldiers can dismount for OP for short periods of time	Ammo (Rounds carried; Est):	1000 API (B-32), API-T (BZT-44), HEI
Crew (driver, commander, gunner, & loader):	4	Max Effective Range: Day: Night: Anti-Aircraft:	2000 INA 1500
Combat weight (mt):	8.0	Armor penetration:	INA
Chassis length overall (m):	5.78	Muzzle velocity (m/s):	845
Height overall (m):	2.57	Name:	HOT-3
Width overall (m):	2.78	Caliber/length (mm):	150
Ground pressure (kg/cm²):	INA	Type:	ATGM
Automotive performance:		Ammo (Tandem charge-HEAT (Est):	4

Engine type:	Diesel	Max Effective Range (m): Minimum range:	4300 75
Cruising range (km):	500	Armor penetration (mm):	1250
Speed (km/h): Max road: Max off-road: Average cross-country: Max swim:	 100 INA INA 9-10	Muzzle velocity (m/s):	240
Fording depths (m):	Amphibious		
Radio:	INA	VARIANTS	SPECIFICATIONS
Protection:		BRDM-2-M98/Zbik-A/BRDM-2A	Upgraded turret, 12.7-mm machine gun, & battlefield surveillance system
Armor, turret front (mm):	14	BRDM-2-M97/Zbik-B/BRDM-2B	20 upgrades including larger turret, 12.7-mm MG, ATGM, night sensors, radar, & improved space design
Applique armor (mm):	INA	BRDM-2A (Russia)	Better engine & other upgrades
Explosive reactive armor(mm):	INA	BRDM-2SMD/BRDM-2D (Russia)	145-hp engine & other improvements
Active Protection System:	INA	BRDM-B (Czech Republic)	Overhead turret, 12.7-mm MG, TV/thermal sight, new engine, & space for 6 soldiers
Self-entrenching blade:	No		
NBC protection system:	Collective		
Smoke equipment:	INA		
Survivability equipment:	Internal fire suppression system		

NOTES

SOURCES: 2014 WEG & ARMY RECOGNITION. VARIANTS INCLUDE VERSIONS WITH OR WITHOUT RADAR. GUNS CAN RANGE FROM 7.62-MM MACHINE GUNS TO 20-MM CANNONS. TURRETS ARE AVAILABLE THAT CAN CONTAIN 30-MM AUTO-CANNONS OR AUTOMATIC GRENADE LAUNCHERS (AGL). THE ATM MASTED TURRET CAN BE FITTED TO A BRDM-2 SENSOR VEHICLE. BRDM-2M-97/98 CAN BE MODIFIED TO ACCEPT A VARIETY OF ATGM SYSTEMS.

BRITISH ARMORED SCOUT CAR FOX



FV721 Fox Armored Scout Car

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	FV721; FV722 (Vixen)	Name:	L21 Rarden
Date of introduction:	1973	Caliber/length (mm):	30
Proliferation: Vehicles: Countries:	70+ 3+	Type:	Automatic Cannon
Description:	4 X 4 replacement for the FV701 Ferret armored car series used for recon purposes or route protection	Ammo (Rounds carried): HEI-T (Est): APDS-T, APSE-T (Est)	99 Rounds: 66 33
Crew (driver, commander & gunner):	3	Max Effective Range (Day):	1100
Combat weight (mt):	6.12	Armor penetration:	INA
Chassis length overall (m):	4.17	Muzzle velocity (m/s):	INA
Height overall (m; with turret):	2.20	Name:	L37A2
Width overall (m):	2.13	Caliber/length (mm):	7.62
Ground pressure (kg/cm^2):	INA	Type:	Machine Gun

Automotive performance:	Jaguar XK	Ammo (Rounds Carried): Ball; Ball-T; API; API-T	2600
Engine type:	4.2 liter, liquid-cooled, in-line, 6-cylinder gasoline	Max Effective Range (m): Day: Night	800 INA
Cruising range (km):	434	Armor penetration:	INA
Speed (km/h): Max road: Max off-road: Average cross-country: Max swim:	104 INA INA 5.23	Muzzle velocity (m/s):	840
Fording depths (m; unprepared):	1.0		
Radio:	INA	VARIANTS	SPECIFICATIONS
Protection:		FV722 (Vixen)	Turretless FV721; only prototypes built
Armor, turret front (mm): Resistant to Heavy MG (NFI)	INA	Panga	FV721 with a Helio FVT 800 turret with a 12.7-mm heavy barreled MG & 1 L37A2 MG; never entered production
Applique armor (mm):	No	Fox with 25-mm Chain Gun	Variant with a 25-mm McDonnell Douglas chain gun & 1 7.62-mm MG; never produced
Explosive reactive armor(mm):	No	Fox/MILAN	Twin MILAN ATGM launcher & 1 7.62-mm McDonnell Douglas chain gun; no production models
Active Protection System:	No	Saber Armored Reconnaissance Vehicle (ARV)	All turrets from deactivated FV721s were combined with the hulls from Scorpions with a 76-mm gun to create a Scorpion ARV variant
Self-entrenching blade:	No		
NBC protection system:	No		
Smoke equipment (Smoke grenade launchers):	8		
Survivability equipment:	INA		

NOTES

SOURCES: 2014 WEG & MILITARY PERISCOPE. THIS VEHICLE HAS BEEN PHASED OUT OF THE BRITISH ARMY & IS ON THE WAY OUT IN MOST MILITARIES. THERE ARE SOME OF THESE VEHICLES FOUND IN SOME AFRICAN COUNTRIES.

BRAZILIAN ARMORED SCOUT CAR EE-9 CASCAVEL



EE-9 Cascavel (Rattlesnake) Armored Car

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	None	Name:	EC-90
Date of introduction:	1973	Caliber/length (mm):	90
Proliferation: Vehicles: Countries:	1432+ 23	Type:	Rifled Gun
Description:	6 X 6 ARV developed in conjunction with the EE-11 Urutu APC as both share many of the same components; vehicle is for recon & route protection as no dismounted soldiers are available	Ammo (Rounds carried): In turret: In hull: APDS, HE Frag	44 12 32
Crew (driver, commander, & gunner):	3	Max Effective Range (m): APDS: HE:	 1200 2000

Combat weight (mt):	13.7	Armor penetration:	INA
Chassis length overall (m):	5.20	Muzzle velocity (m/s): APDS: HE:	1250 1050
Height overall (m):	2.60 (cupola top)	Name:	INA
Width overall (m):	2.64	Caliber/length (mm):	7.62
Ground pressure (kg/cm^2):	INA	Type:	Coaxial Machine Gun
Automotive performance:	Detroit 6V-53N	Ammo (Rounds carried): Ball-T, Match, API, API-T (Est)	2000
Engine type:	Liquid-cooled, 6-cylinder diesel	Max Effective Range (m): Day: Night:	 1500 INA
Cruising range (km):	550 (880 on roads)	Armor penetration:	INA
Speed (km/h): Max road: Max off-road: Average cross-country: Max swim:	 100 80 INA N/A	Muzzle velocity (m/s):	840
Fording depths (m):	1.0	Name:	M2HB
Radio:	Varies by customer	Caliber/length (mm):	12.7
Protection:		Type:	Anti-Aircraft Machine Gun
Armor, turret front (mm):	16	Ammo (Rounds carried): Ball, Tracer, AP, API, API-T, AP Hardcore, Multipurpose, SLAP, SLAPT	800
Applique armor (mm):	No	Max Effective Range (m): Against High Hard Armor (HHA)	1500
Explosive reactive armor(mm):	No	Armor penetration (mm): SLAP at 500 m	 34
Active Protection System:	INA	Muzzle velocity (m/s): M33 Ball: SLAPT:	 890 1215
Self-entrenching blade:	No	**VARIANTS**	**SPECIFICATIONS**
NBC protection system:	Available	Mark 2/Cascavel I/Cascavel Magro (Thin Rattlesnake)	1st model with 37-mm gun removed from obsolete M3 Stuart tanks
Smoke equipment (Up to 3 smoke dischargers on either side):	6	Mark 3/Cascavel II/Cascavel Gordo (Fat Rattlesnake)	1st export model with Mercedes diesel engine, turret ring widen for Giat 90-mm gun, & 2 smoke dischargers
Survivability equipment:	Welded multi-layer armor	Mark 4/Cascavel III	Engesa EC-90 90-mm gun, 7.62-mm coaxial MG, anti-aircraft MG (12.7-mm or 7.62-mm) on commanders cupola
		Mark 5/Cascavel IV	Mark 4 with central tire pressure regulation system, Mercedes OM352 diesel engine & disk brakes
		Mark 6	Mark 5 with a Mercedes OM352A engine
NOTES **SOURCES: 2014 WEG, MILITARY PERISCOPE, ENEMY FORCES, & NAVY WEAPONS.**			

SPANISH HIGH-MOBILITY TACTICAL VEHICLE VAMTAC



VAMTAC as an ATGM Platform



VAMTAC with Machine Gun Mounted

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	*Vehiculo de Alta Movilidad Tactico (VAMTAC)*	Name:	AA-52
Date of introduction:	1998	Caliber/length (mm):	7.62
Proliferation: Vehicles: Countries:	3567+ 10+	Type:	Machine Gun
Description:	4 X 4 HMMWV like vehicle with 2-door or 4-door modesl available; used in a variety of configurations including recon; normal passenger capacity is 3	Ammo (Rounds carried; Est): Ball, Tracer; Other: INA	1250
Crew (driver):	1	Max Effective Range (m):	3000
Combat weight (mt):	7.7	Armor penetration:	INA
Chassis length overall (m): Some variants up to:	4.85 5.55	Muzzle velocity (m/s):	830
Height overall (m; roof top):	1.90	VARIANTS	SPECIFICATIONS
Width overall (m):	2.18	VAMTAC I3	166-hp Steyr diesel engine
Ground pressure (kg/cm^2):	INA	VAMTAC S3	188-hp Steyr diesel engine, reinforced suspension with greater payload capacity
Automotive performance:	Steyr	FAMTAC BN3	Up-armored version with 220-hp Steyer M16TCA-3 6-cylinder engine with a top speed of 135 k/hr
Engine type:	Turbo-charged 4-cylinder or 6–cylinder diesel	Ambulance	2 stretcher or 4 seated patients in rear compartment
Cruising range (km):	> 600	ATGM Carrier	For GBM-71 TOW or MILAN ATGM systems
Speed (km/h): Max road: (6 cylinder) Max off-road: Average cross-country:	 126 135 INA INA	Anti-Aircraft Vehicle	Mistral Surface-to-air missiles

Max swim:	N/A		
Fording depths (m): Without preparation: With preparation:	 .75 1.50	Command & Control Vehicle	Separate rear compartment for communications gear
Radio:	Customer dependent	PYSOP Vehicle	Equipped with loudspeaker
Protection:			
Armor, turret front (mm):	STANAG 4569 Level 2 mine protection, Level 3 against bullets, & Level 4 against 155-mm artillery fragments (BN3 variant)		
Applique armor (mm):	No		
Explosive reactive armor(mm):	No		
Active Protection System:	INA		
Self-entrenching blade:	No		
NBC protection system:	Available		
Smoke equipment:	INA		
Survivability equipment:	Net armor to protect against RPG-7 rockets is available; fire-suppression system; remotely operated weapons station available		

NOTES
SOURCES: 2014 WEG & MILITARY TODAY. VEHICLE CAN BE ARMED WITH A WIDE VARIETY OF WEAPONS INCLUDING MACHINE GUNS, AUTOMATIC GRENADE LAUNCHERS (AGL), ANTI-TANK MISSILES, ANTI-AIRCRAFT MISSILES, OR 81-MM MORTARS.

RUSSIAN COMBAT RECONNAISSANCE VEHICLE BRM-1K



BRM-1K

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	BMP M1976/2	Name:	2A28 /Grom
Date of introduction:	1976	Caliber/length (mm):	73
Proliferation: Vehicles: Countries (BMP-1/2/3s are in at least 44 countries):	INA 3+	Type:	Smoothbore Gun with automatic loader
Description:	BMP-1 modified for recon with space for 2 passengers (see Chapter 3)	Ammo (Rounds carried): HEAT-FS (Est): HE (Est):	 20 10 10
Crew (driver, commander, gunner, & navigator):	4	Max Effective Range (m): HEAT-FS/HE Day: HEAT-FS/HE On the move: HEAT-FS/HE Night:	 1300 600 800-1000
Combat weight (mt):	13.3	Armor penetration (mm): HEAT-FS (PG-15VNT): HEAT-FS (PG-15): HE (OGBG1): Damage/defeat APC HE (OG-15VM): Damage/defeat APC	 550-700 335 INA INA
Chassis length overall (m):	6.74	Muzzle velocity (m/s):	700
Height overall (m):	2.15	Name:	Coaxial
Width overall (m):	2.94	Caliber/length (mm):	7.62
Ground pressure (kg/cm^2):	0.57	Type:	PKT machine gun

Automotive performance:	**UTD20**	**Ammo (Rounds carried): Ball, Tracer**	**2000**
Engine type:	**300-hp, Water-cooled, V-6 diesel**	**Max Effective Range (m)** **Day:** **On the move:** **Night:**	 **1300** **400-500** **800**
Cruising range (km):	**600**	**Armor penetration (mm):**	**INA**
Speed (km/h): **Max road:** **Max off-road:** **Average cross-country:** **Max swim:**	 **65** **40-45** **INA** **7**	**Muzzle velocity (m/s):**	**825**
Fording depths (m):	**Amphibious**		
Radio:	**R-173, R-130, 2x R-148 man-portable, R-014D telegraph**	**VARIANTS**	**SPECIFICATIONS**
Protection:		**BRM-1**	**Baseline ARV (BMP M1976/1)**
Armor, turret front (mm):	**19-23**	**BRM-1K**	**Smoke grenade launchers, additional communications (R-130, R-014D telegraph), PSNR-K Radar**
Applique armor (mm):	**Available**		
Explosive reactive armor(mm):	**Available**		
Active Protection System:	**No**		
Self-entrenching blade:	**No**		
NBC protection system:	**Automatic overpressure system**		
Smoke equipment:	**VEESS; Smoke grenade launchers available**		
Survivability equipment:	**INA**		

NOTES

SOURCES: 2014 WEG, MILITARY PERISCOPE. 1G25 GYROCOMPASS; 1G13 GYRO COURSE INDICATOR; 1PN22M2 FIRE SIGHT; 1D8 LASER RANGEFINDER; PSNR-5M BATTLEFIELD SURVEILLANCE RADAR. PASSENGERS MAY DISMOUNT & FORM AN ALTERNATE RECONNAISSANCE POST. ALMOST ALL BRM-1S WERE UPGRADED TO THE BRM-1K STANDARD WITH PSNR-5M RADAR.

RUSSIAN COMBAT RECONNAISSANCE VEHICLE BRM-3K



BRM-3K

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	Rys (Lynx), Model 501	Name:	2A72
Date of introduction:	1990	Caliber/length (mm):	30
Proliferation: Vehicles: Countries (BMP-1/2/3s are in at least 44 countries):	INA 1+	Type:	Automatic Gun
Description:	BMP-1 modified for recon with space for 3 passengers (see Chapter 3)	Ammo (Rounds carried): HEI-T, Frag-HE: APDS, APFSDS-T:	500 340 160
Crew (driver, commander, & gunner):	3	Max Effective Range (m): Frag-HE Day: Frag-HE Night passive sight: Frag-HE Night active sight: Frag-HE Anti-aircraft: APDS Day: APDS Night passive sight: APDS Night active sight: APDS Anti-aircraft: APFSDS-T M929 Day:	 4000 1200-1500 3000+ 4000 2500 1200-1500 2500 4000 2500+ 1200-1500

		APFSDS-T Night passive sight: APFSDS-T Night active sight: APFSDS-T Anti-Aircraft:	2500+ 4000
Combat weight (mt):	19.6	Armor penetration (mm): Frag-HE: APDS (RHA at 1500 at 60˚): APFSDS-T RHA at 1000 m: APFSDS-T RHA at 2000 m:	 INA 25 55 45
Chassis length overall (m):	6.10	Muzzle velocity (m/s; Est):	960
Height overall (m):	2.65	Name:	Coaxial
Width overall (m):	3.15	Caliber/length:	7.62-mm
Ground pressure (kg/cm^2):	0.62	Type:	PKT machine gun
Automotive performance:	UTD29M	Ammo (Rounds carried): Ball, Tracer	2000
Engine type:	450-HOP, 10-cylinder, V-shaped, water-cooled diesel	Max Effective Range (m): Day: Night passive sight: Night active sight:	 2000 1200-1500 2000
Cruising range (km):	600 (highway)	Armor penetration:	INA
Speed (km/h): Max road: Max off-road: Average cross-country: Max swim:	 70 45 35 10	Muzzle velocity (m/s):	825
Fording depths (m):	Amphibious		
Radio:	R-163-50U UHF, R-163-50K HF, R-163-10U (dismounts)	**VARIANTS**	**SPECIFICATIONS**
Protection:		BRM-3K	Base version is a BMP-3 variant with a steel hull
Armor, turret front (mm; front glacis):	30-35	BRM-3K/Kredo 1	BRM-3K CRV with a 2-3 m mast with a Kredo-1 radar system. Catherine 2d generation thermal sight night range to 5-7 km. 1D22 LTD ranges to 7 km.
Applique armor (on turret):	Yes		
Explosive reactive armor(mm):	Available		
Active Protection System:	No		
Self-entrenching blade:	No		
NBC protection system:	Automatic overpressure system		
Smoke equipment (Smoke grenade launchers; VEESS):	6		
Survivability equipment:	INA		

NOTES
SOURCES: 2014 WEG, MILITARY PERISCOPE & DEAGEL. RADIO TRANSMISSION RANGE IS 100 KM MOVING & 350 KM STATIONARY. 1D14 LASER RANGEFINDER CAN DETECT OBJECTS AT 10 KM. ACQUISITION FOR GUN SIGHTS IS ESTIMATED AT 4000 METERS. NIGHT SIGHT RECOGNITION IS AT 5000 METERS.

BRITISH COMBAT RECONAISSANCE VEHICLE SCORPION



FV101 Scorpion

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	FV101 (See variants)	Name:	L23
Date of introduction:	1972	Caliber/length (mm):	76
Proliferation: Vehicles: Countries:	1173+ 18+	Type:	Semi-automatic rifled gun
Description:	Initially a light tank, it took on another of roles; passengers depends on the variant; specifications are for the Scorpion	Ammo (Rounds carried):	40
Crew (driver, commander & gunner):	3	Maximum Effective Range:	INA
Combat weight (mt):	8.07	Armor penetration:	INA
Chassis length overall (m):	4.79	Muzzle velocity (m/s):	INA
Height overall (m):	2.10	Name:	L43A1 (or L8A1)
Width overall (m):	1.71	Caliber/length (mm):	7.62
Ground pressure (kg/cm^2):	0.36	Type:	Coaxial Ranging Machine Gun

Automotive performance:	Jaguar J60	Ammo (Rounds carried): Ball; Ball-T; API; API-T	3000 -
Engine type:	No 1 Mk 100B 190-hp liquid-cooled, in-line, 6-cylinder gasoline	Max Effective Range (m): Day (Est): Night:	800 INA
Cruising range (km):	644	Armor penetration:	INA
Speed (km/h): Max road: Max off-road: Average cross-country: Max swim:	80 Ina Ina 9.7	Muzzle velocity (m/s; Est):	838
Fording depths (m):	Amphibious		
Radio:	INA	VARIANTS	SPECIFICATIONS
Protection:		Scorpion (FV101)	Original variant with 3-man crew
Armor, turret front (mm; against 14.5-mm rounds; remainder of vehicle against 7.62-mm rounds)):	INA	Spartan (FV103)	Artillery & engineer vehicle with 3-man crew & 4 dismountable troops; 80 k/hr; 483 km range; 1 7.62-mm MG
Applique armor (mm):	INA	Striker (FV102)	AT vehicle with 5 Swingfire CLOS ATGMS (5 reloads) & 1 7.62-mm L37A1 MG
Explosive reactive armor(mm):	INA	Scorpion 90	3-man crew; 73 k/hr; Cockerill Mk IIIK 90-mm gun & 1 7.62-mm MG
Active Protection System:	INA	Samaritan (FV104)	Ambulance for 4 litter patients, 5 seated patients, or 2 litter/3 seated patients; 2-man crew; 483 km range
Self-entrenching blade:	No	Sultan (FV105)	Command vehicle with at least 2 radios; total 5-6 personnel; 483 km range
NBC protection system:	Yes	Samson (FV106)	483 km range, ARV with internal main winch, tow bars, & tow cables
Smoke equipment (Smoke dischargers):	8	Scimitar (FV107)	Scorpion with 1 30-mm Rarden L21 rifled gun (165 rounds) & 1 7.62-mm coax MG; 80 k/hr; 644 km range;
Survivability equipment:	Enhanced mine protection available	Scorpion 2	Description of late production Scorpions with Perkins engine & other upgrades with 2-man turret with 30-mm, 76-mm, or 90-mm main armament options
		Saber	Reconditioned recon vehicle with 30-mm Rarden cannon & Hughes 7.62-mm co-axial chain gun
VARIANTS	SPECIFICATIONS	Scorpion (Jordan)	Upgraded original Scorpion with Perkins engine & other upgrades
Scorpion 90 (Venzeula)	Scorpion 90 with Belgain CMI Defence 90-mm Mk II gun & Perkins engine	Spartan with MILAN ATGM	2-round turret must be reloaded from outside the vehicle (11 reloads)
Sturgeon	OPFOR vehicle used in Suffield, Canada based on the Spartan	Omani Scorpion	Increased protection package & some received a Cummins diesel engine

Salamander	OPFOR vehicle used in Suffield, Canada based on the 76-mm Scorpion	Scorpion vehicle-mounted automatic mortar FCS	Fires Denel's 60-mm or BAE Systems' 81-mm L16 mortars
Scorpion (Malaysia)	Scorpion 90 with 76-mm AGL & Perkins engine	CVR(T) Life-Extension Program (LEP)	LEP with diesel engine, better optics & communication

NOTES
SOURCES: MILITARY PERISCOPE. ALL BRITISH SCORPION FAMILY VEHICLES RECEIVED ENHANCED MINE PROTECTION AS RESULT OF OPERATIONS IN THE BALKANS & IRAQ.

CHINESE SENSOR RECONNAISSANCE VEHICLE HJ-62C



HJ-62C with Mast in Raised Position

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	Type 89 Reconnaissance Vehicle	Name:	Type 54 (DShKM copy) available
Date of introduction:	1990	Caliber/length (mm):	12.7
Proliferation: Vehicles: Countries (can represent Czech Snezka, Canadian LAV-RECCE, Russian Credo-S, & other recon vehicles with elevated sensor pods):	INA 1+	Type:	Machine Gun
Description:	Sensor vehicle with 4-man crew (estimated) based on a Chinese Type 89 APC (Data based on this vehicle)	Ammo (Rounds carried): APDS, API, API-T: HE-T, HEI:	1120 500 620
Crew (driver, commander, & 2 crew):	4	Max Effective Range (m): APDS Day: Night: Anti-aircraft:	 1500 INA 1600
Combat weight (mt):	13.60	Armor penetration (mm): API at 500 m RHA: API at 1000 m RHA:	 21 13
Chassis length overall (m):	6.13	Muzzle velocity (m/s):	850
Height overall (m; not counting sensor):	2.59	Sensors	Represent capabilities of state-of-the-art specialized elevated sensor pod systems
Width overall (m):	3.06		
Ground pressure (kg/cm^2):	INA	Radar	Qcquisiton & tracking radar similar to current Western radars (such as

			the Dutch Signal GB-Scout or the Israeli EL/M-2140) with an 8-12 km for personnel, 17-25 km for LAVs, or 25-30 for tanks/helicopters
Automotive performance:		EO Sensors	2-32 X with optical & digital zoom (estimated) with TV range of 5 km or 12 km detection with digital zoom (Day) or 5 km recognition range/7 km detection range (estimated) for 1st generation FLIR
Engine type:	320-hp diesel	Other ISR	7 km LTD designation range; 15-20 km LRF range; digital data transmission with multi-color graphic displays (includes GPS) on digital terrain map overlay. Links available to UAVs, UGS, & other remote sensors for integration & common picture transmission
Cruising range (km):	500		
Speed (km/h): Max road: Max off-road: Average cross-country: Max swim:	 66 40 INA 6.0		
Fording depths (m):	Amphibious		
Radio:	HF/VHF, digital, SATCOM, encryption (estimated)		
Protection:			
Armor, turret front (mm; front glacis):	14		
Applique armor (mm):	INA		
Explosive reactive armor(mm):	INA		
Active Protection System:	INA		
Self-entrenching blade:	No		
NBC protection system:	Yes		
Smoke equipment (Tubes available (2 X 4)):	8		
Survivability equipment:	INA		

NOTES

SOURCES: 2014 WEG. AN UPGRADE CAPABILITY CURRENTLY AVAILABLE FOR SELECTED RECONNAISSANCE VEHICLES IS AN AUTO-TRACKER FOR THE EO SYSTEM. EXAMPLES OF AUTO-TRACKERS ARE IN THE CROTALE, RUSSIAN SOSNA, STALKER, & BMP-3M IFV, JAPANESE TYPE 90 TANK, & THE ISRAELI MERKAVA 4 TANK. (PHOTO FROM 2014 WEG)

Sensor Technologies for Tactical Ground Forces

Reconnaissance units use a mixture of high and low technologies. As noted in TC 7-100.2, Opposing Force Tactics, forces may perform tactical reconnaissance using designated reconnaissance units/soldiers or maneuver unit soldiers. Sensors span an increasing wider segments of the electromagnetic spectrum while integration C2, navigation systems, data processing, and fusing technologies. Developers offer more compact packages, platforms, sensor integration, and mobility systems for greater situational awareness, better operational security, and shorter response time than ever before.

Reconnaissance starts with *location* and *navigation*. Instruments include survey instruments (i.e, Bulgarian PAB-2A theodolite), aiming circles or goniometers, GPS receivers, maps, compasses, terrain data, and inertial guidance systems. Commercial equipment such as the Magellan handheld GPS units are sufficient for most forces. Other more advance equipment such as navigation data for laser rangefinders (LRF) and improved communications with digital interface ensure precise navigation.



Magellan Blazer 12 Commercial Handheld GPS Device

The primary battlefield sensor is still the human eye, but human vision receives much help. Weapons sights are often used. See the Infantry chapter for day and night weapon sights. Almost all reconnaissance forces use optics such as sights, binoculars, or telescopes to increase viewing capacity. Most of these sights operate in the visual light (0.4-0.75 µm) electro-magnetic (EM) spectrum. Binoculars can vary in features and magnifications and usually zoom from 7-12 (x) power. For longer-range day acquisition, the OPFOR uses spotting telescopes (Celestron and Swarovski models) with 60 x zoom capability. Other features could include anti-fogging lens coatings, camouflage netting, tripods for better stability or binocular periscopes (German RWDL) for covert viewing.

Night-time observation systems which operate in the visual band spectrum are all daylight observation systems similar to the human eye and therefore require visual light illumination to see. The Infantry chapter discusses the capability of using starlight, moonlight, or street lights to enable the average soldier to see greater distances. Illumination support equipment includes spotlights, flashlights, or pyrotechnics (grenades, illumination rounds) to bring light to dark spaces. Specialized devices are available, such as the Universal Tactical Light, which can be mounted on weapons and is located near the weapon's trigger. Fires or other improvised lighting offer illumination support. To ensure operational security, the OPFOR will usually not use artificial illumination until the fire fight is underway.



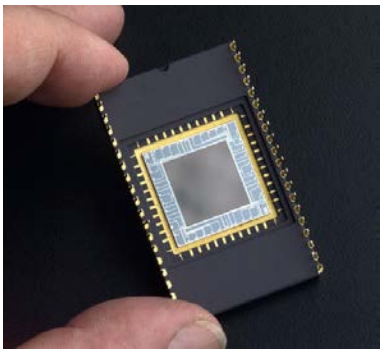
Universal Tactical Light mounted on a pistol

Reconnaissance personnel on today's battlefields have increased their use electro-optical (EO) systems to convert an image into a digital electronic signal that is sent to a display circuit (i.e., photocathode tube or micro-channel plate) for viewing. While optical zoom lens are still critical, EO cameras require almost no focal length or mirrors reducing their size and bulk. Polymers and composite material produce ergonomic devices that are easier to hold with image processing/transmission capabilities for rapid exploitation and dissemination. Zoom capacity can reach 84 x or more allows rapid detection at 10 km or more in distance for selected targets. Day and night EO technologies include TV cameras can convert video imagery into an RF signal

to transmit it to a receiver/display unit. Tripod-mounted or aircraft sensor pods can acquire targets at 10-30+ km in distance. Larger systems allows vehicles and aircraft to mount sensors with even longer ranges, better resolutions, and longer transmission ranges.

ELECTRO-MAGNETIC SPECTRUM AND SENSOR TECHNOLOGIES			
Light Band	**Alternate Name**	**Microns**	**Technologies**
Ultraviolet	UV/Black Light	0.01 – 0.40	Mercury Arc
Visible Light	Daylight	0.40 – 0.75	Eye, Optics, TV, Charged-Coupled Device (CCD)
Near Infrared	NIR	0.75 – 1.30	CCD, Image Intensifiers (II), Active IR
	Shore-Wavelength IR	1.30 – 3.00	Active IR
Mid-Infrared	Mid-Wavelength IR	3.00 – 6.00	Thermal
Far Infrared	Long-Wavelength IR	6.00 – 15.00	Thermal/Forward Looking Infrared (FLIR)

All night-time observation systems that operate outside of the visual spectrum are EO systems. CCD offers some capability during dawn and dusk and periods of adverse weather that create low light levels. Sub-component improvements offer night vision devices that are clearer, more compact, more resistant to glare, require less power, more time between service, with new features including laser pointers, better zoom, greater magnification, or electronic zoom capability. Commercial grade viewers offer affordable alternatives to military systems. *Electronic zoom* (EZ) can expand images to multiply the optical zoom by a factor of 3-8 x resulting in magnification of 60-100+ x in affordable systems. This doubles or triples the acquisition range, but could reduce image clarity in the highest EZ modes.



Charged-Coupled Device (CCD)

One inexpensive digital technology is the charged-coupled device (CCD) used in many video camcorders and some cameras operate in the near IR (0.75 – 1.3 µm) band. These CCDs generally lack ability to see in absolute darkness, but most (Bushnell Night-Hawk) offer superior day vision, video capability, and can be used in “low-light-level” (LLL) conditions. There are some 20-80 x CCD binoculars claim a day acquisition range of 10 km (8 km for man-sized targets).

The following table notes the evolution and variety of viewing sensors meld EO with other technologies used by reconnaissance as well as other ground force units.

EVOLUTION OF OPTICS AND EO SENSORS: GROUND FORCES APPLICATIONS		
Surveillance and Observation	**Added Technology**	**Weapons Target Acquisition**
Binoculars Theodolites Telescopes	Optics (Lenses and Reticles)	Day Sights (Telescopes & Collimators)
Day/Night Viewers Digital Cameras Video Recorders	Electro-Optics	Day Sights Night Sights
Laser Rangefinders (LRF) Laser Illuminators "Radars"	Laser Technology	Laser Aiming Sights & Pointers FCS Optical Augmentation
Digital Survey Sets	Navigation/Unit Location (GPS, Computer, LRF, Goniometer)	LRF Fire Control Systems
UAV Drone Remotely Piloted Vehicle (RPV)	Rocket Motor/Airframe	Fiber-Optic Guided Missiles Attack UAVs Laser-Homing Missiles
Micro-UAV; Canister Launch UAV Artillery/Rocket Launch UAV TV Recon Grenades, Projectiles, or Rounds	Artillery/Grenade/Canister Launcher	Attack UAVs Laser-Homing Munitions, Rockets Laser Target Designators
Unattended Ground Sensors (Cameras) Multi-Sensor Pods (Vehicles/UGS) Passive IR (Autotracker) Alerters	Remote Cameras/Acoustics (Motor Drive Actuator/Controls)	Side-Attack Mine Sensor Units Unattended Anti-Tank Grenade Launchers (ATGL) Sensors
Unmanned Ground Vehicles (UGVs)	Robotic Cameras (Robotic Chassis)	UGVs with guns, ATGLs, or ATGMs Robotic Mines

Night *Infrared Viewers* operate in the 0.75 – 2.00 µm band employ active light sources such as IR spotlights and this technology is easily detectible by adversaries with night vision systems. Therefore, the use of this technology has declined as the passive mode range is limited creating limited practical value. Passive night technology such as II can be found in the Infantry chapter. This technology is now in its 3rd generation, but some companies are claiming a 4th generation technology. This technology continues to expand due to requirements from hunters, police, and the military. Night vision goggles (NVGs), such as the Malaysian NG-30, allows for hands-free operations such as for driving with many affordable ($200+) for the Nighthawk. The cheaper NVGs, however, may not offer as many features as those designed specifically for the military. Some cameras fuse II and CCD together for effective and affordable day/night use. Many night scopes, night views, and NVGs are not weapon's sights, but can be used to improve accurate firing. These devices can be used to detect targets or queue new targets for weapons. An assistant with an NVG could use a visual light pointer to designate targets for the weapons operator to engage.



Night Vision Goggles

A newer night vision technology called *thermal imagery* (TI) is now challenging II in popularity as it surpasses the former in range and resolution. TI can "see" any object with temperature different than the background objects so TI can operate in absolute darkness. TI, however, does possess some limitations.

- Shapes are sometimes converted into images not readily recognized based on the human's visual frame of reference.
- At certain times of the day, the temperature changes may alter shapes or render objects invisible.
- Lack of heat from selected targets means the TI may not see objects in the foreground or background, which helps to provide contrast and context to the observer.
- Generally TI are bulkier than II and require bulky and noisy coolant bottles or power supplies.
- TI sensors are usually more expensive than II sensors.

TI does offer several significant advantages as TI is particularly sensitive to temperatures of warm-blooded animals, vehicle engines, solar-heated metal surfaces, and running gear from moving vehicles. Even after a vehicle stops, the residual engine heat renders a clear TI image for an hour or more. Second, TI usually provides faster and easier detection than II. Many TI systems use cameras operating in the mid-IR band (3.00 – 6.00 µm) with ranges up to 2 to 3 km. FLIR, operating in the far-IR (6.00 – 15.00 µm) band, offers superior clarity and range (3-4 km) for most applications making it the preferred technology. Due to increased production and competition, the cost has declined so TI is affordable for priority weapons such as ATGM launchers, tanks, and IFV. In Tier 1 and Tier 2 forces, TI is commonly used in reconnaissance vehicles.



Handheld Thermal Imager

Over the years, TI has improved so it can be categorized by generation like II. The current proliferation of mercury-cadmium-telluride and SPRITE detector staring arrays increased ranges to 5+ km while improving the discrimination of the images. A recent development is the uncooled TI that eliminates the bulky coolant bottle. An even more recent 3rd generation system combines II and FLIR to fuse them into one clear image. Reduction in the size of parts including microcircuits and imagers have produced portable TI viewing systems. In Tier 1 and 2 reconnaissance units and selected other units, key sensors and dismounted personnel will possess Sophie thermal binoculars with the II/FLIR upgrade. Some reconnaissance units may employ ATGM thermal sights for battlefield surveillance. The larger the system, the longer range and better clarity of most IR systems.



Shakhin Thermal Imaging Scope

The miniaturization of camera technologies through CMOS (complementary metal-oxide semi-conductor) transistors and the spread of commercial products offer fertile ground for new military reconnaissance applications. EO systems, such as the Bushnell Nighthawk CCD Viewer and Digital Imaging System 22 x 60 spotter scope offers video output could be transmitted to computers or goniometer systems. These cameras allow remote viewing options. “Nanny-cams” such as the XCam2 or British Spy Vision can monitor close-in areas such as urban streets and then transmit the images. Tactical applications could include hand-thrown cameras such as the Macroswiss. Other off-the-shelf technology such as digital cameras, camera cell phones, and binocular CCD imagers possess military applications.

Lasers are important for measurement, location, and target acquisition. The most important of these is the *laser rangefinder* or LRF. The LRF is used to measure distances to targets, surveying, or self-location—all important in firing both direct and indirect fire weapons. Many fire control systems on crew-served weapons or on combat vehicles include an in-viewer LRF that provides data into the FCS computer for target acquisition. Dismounted soldiers can used a hand-held LRF as as the Leica Vector or Aselan LH-7800 binoculars can precisely measure ranges out to 10 km. Some binocular LRFs, such as the Eloptro LH-40C and Russian 1D18, can range targets to 20 km limited only by line-of-sight and the subject’s size. Some of these hand-held systems such as the Bushnell Lytespeed with a 1 km range cost less than $300.



Leica Vector Laser Rangefinder (LRF)

One of the biggest benefits of lasers integrated into EO systems is increased responsiveness as the optics, EO, acoustics, radars, and other sensors can provide accurate location without the need for a second azimuth to solve an intersection problem. The time required to obtain the second azimuth could allow the target to escape if they are moving. Targets can be precisely located and engaged with only one azimuth, a laser snap, and a simple ballistic computer.

The *goniometer* uses LRF technology and is similar to the old aiming circles used in artillery and mortar units to fire indirect fire. The goniometer surveys itself into position on a tripod base with an azimuth viewer. Most goniometers are illuminated for night-time use, carry a GPS mount, and a simple computer (or programmable calculator) to determine self-location, directions, and elevations/deflections. Some goniometers are linked to a

digital transmission system or have one built right into the system. A binocular LRF could be mounted on top to sight and range objects, targets, and registration points. Night sights can be added for 24-hour operations. The system can be referred to as a goniometer system, a fire control system (Vetronix Mortar FCS-MORFIRE), a forward observer system or FOS (OIP Delft), an observation station (Leica Digital), a targeting system (Sure Strike), or other names. The modern goniometer-based LRF FOS for the OPFOR is the SG12 with GPS, Leica 21 LRF with 12 km range, thermal night sight, computer interface, and digital data transfer. The entire time to emplace the system is under two minutes.

An *aiming circle* can be used for similar purposes with the same accuracy, but only when all of the separate components (LRF, GPS, computer, digital transmission system) are present. Often, a goniometer-based system can be more responsive, move more quickly, and produce greater accuracy than an aiming circle. Any OPFOR aiming circle should be regarded as the base for an observation system. Most dismounted forces worldwide will use an aiming circle or goniometer-based system. Due to its size and ability to be broken down, the goniometer system is portable and easily carried almost anywhere on the battlefield. In the past, 100 meters was considered accurate. With the new systems, accuracy is now one to five meters creating the ability to call in precise fire against a target.



Aiming Circle

Multi-sensor suites fuse together a variety of recent technologies to create sensors that integrate day/night detection, location, and target acquisition. Most suites are found on vehicles, but suites can be created by dismounted personnel in observation posts (OP) linking the various systems together. The Eloptro LH-40C LRF can link GPS with a computer link for the viewer image to determine range, bearing, and elevation before sending the data through a digital transmission. The LH-40C does not need a goniometer base for precise target location.

The *laser target designator* (LTD) is the next step in laser evolution. The LTD can guide semi-active homing bombs, artillery, naval gun rounds, mortar projectiles, rockets, and ATGMs directly onto their target. The seeker on the munitions directs the round onto the "laser splash" aimed on the target. Some LTDs, such as the Russian 1D26, can be carried by a single operator. Most LTDs include a tripod mount with other sub-assemblies such as a built-in LRF or night sight, for easy carrying by a team of two to three soldiers. It is likely that as technology increases, lighter materials will be used to create LTDs making them lighter weight and more easily carried for use by dismounted units. There have even been laser-homing grenades developed for squad ATGLs for well over a decade.



French DHY-307 Laser Target Designator (LTD)

In some LTD-based FCS such as the French DHY-307, the LTD replaces the goniometer for an OP. The LTD FCS may contain such features as an encoded beam to ensure only one hit per target, counter-measures against the enemy looking for lasers, GPS, night sights, and the other sub-components found in a goniometer-based FCS. Most laser munitions can be used with most LTDs. Tier 1 and 2 OPFOR observers will operate the DHY-307 with a designation range of 10 km instead of goniometer-based system. OPFOR recon and AT observers possess the ability to

call in laser rounds through man-portable LTDs with a night range out to 5 km with an accuracy of 1 m.

The *laser aimer* as discussed in the Infantry chapter or *laser pointer* are used by ground units to shoot direct fire weapons or point out targets to other personnel. The pointers, however, emit light and offer a risk of exposure to a prepared adversary. Thus, the pointers are only used when the fire fight begins when the using unit possesses fire superiority.



PEQ-15 Laser Aimer

A recent laser technology is the laser locator (also known as the "laser radar" or LADAR or when linked into a weapons fire control system as "optical augmentation") that uses light detection and ranging (LIDAR) to detect and measure ranges. LIDAR can operate in the active or passive mode. In the active mode, it employs a laser to scan in the observed sector, scanning in a band pattern similar to radar. The aligned IR viewer then looks for IR light generated by laser light reflected by optics and sights. Although the LADAR operating in an active mode creates a narrow laser beam, it limits the beam spread beyond the scanned target. Passive use of LADAR is more difficult because it depends on the use of light close to or behind the viewer in the right frequency with sufficient brightness and the right angularity for the viewer to detect down-range reflections. An example of LADAR is the Mirage 1200 hand-held "lens detector" with a range up to 1200 m. Laser filters on optics can reduce the effectiveness of detection by LADAR. Reconnaissance vehicles and aircraft employ LADARs for day and night imagery.



Leica HDS-3000 LIDAR



Ground Vehicular Laser Locator Designator

For many years, reconnaissance units have detected the enemy through the process of "triangulation." When 2 or more azimuths are obtained from known locations of a particular target, the target's location can be determined by drawing the lines on the map to determine where the lines intersect. This intersection is the target's location. The system previously had some limitations as the time delay from receiving the two locations with azimuths could provide faulty information, especially if the target was on the move. Recent technology can exploit this old methodology. Precise self-location with GPS, computers, digital map displays, and digital data links from different sensors can provide the two locations with the azimuths in a matter of seconds, providing both sensors are aimed at the same target.

Acoustic sensors are also found on the battlefield including multi-directional microphones, directional microphones, sound-ranging arrays, vehicle arrays, which intersect azimuths to locate sound sources including guns, helicopters, and combat vehicles. Artillery sound-ranging systems include the Russian AZK-5 and AZK-7, Swedish Soras 6, and the British HALO all use microphones digitally linked to automated processors for rapid calculation of enemy firing locations. Sensitive microphones on various Israeli Helispot systems, including autonomous acoustic vehicles, enable them to detect and locate enemy helicopters in flight. Man-portable Air Defense Systems (MANPADS) units also use acoustic sensors to determine target locations.

The military continues to find new applications for *radar* systems, whether they are battlefield surveillance systems mounted on tripods, carriages, weapons, vehicles, aerial platforms, or even trees. New technologies such as miniaturization, millimeter-wave (MMW), improved power supplies, links to laptop computers offer other new applications. Compact radars such as the Fara-1 offer man-portable carrying capability and attachment to weapons, such as automatic grenade launchers (AGL) for fire direction. Slightly larger systems include the Thales Squire two-man radar system with a 24 km operating range that is portable in packs. Tripod-mounted radars such as the Credo-1E can link to digital nets with the ability for easy emplacement or displacement.

The major disadvantage of radar is the system actively emits a signal the enemy can locate through Electronic Warfare (EW) or other systems making the radar vulnerable to attack. Squire is a low probability of intercept (LPI) radar due to its extremely low peak power. Other LPI features include phased array with lower power levels for detectors, reduced side lobes, and operating frequencies outside of most radar intercept system bandwidths. The most common frequency bands for land radar systems have been the I and J bands. In recent years, new radar technologies have been fielded to add LPI features to reduce intercept vulnerability. Airborne radar such as Horizon use moving target indicator (MTI) and synthetic aperture radar (SAR), and Doppler processing with secure stand-off for missions. MMW radars (30+ GHz) offer precise acquisition and fire control, compact size antennas, and lower signal detectability.

Two other technology trends are on the rise—*remote sensors* and *robotic sensors*. Remote sensors are generally immobile, although they may be able to change their field of view in order to see as required. A simple remote sensor is a side-attack mine, such as an anti-tank disposable grenade launcher placed along an expected advance for vehicles and linked to an autonomous acoustic sensor unit, such as AJAC. As the enemy approaches, usually along a road, the device will launch a grenade, thus audibly signaling the vehicle's approach. Robotic sensors can relocate to perform their mission. Civilian applications have led to a wide variety of remote cameras, remote actuators on robotic systems, and the use with unattended ground sensors including acoustic, IR, seismic, tripwire-electronic, and magnetic. Key technology constraints include detectability shortfalls, power supply and battery limitations, and signal transmission inadequacies, but the issues are in the process of being resolved. Use of fused sensors means more accurate, timely, and complete reports. Rechargeable batteries, acoustic.IR wake-up, miniaturization, and increased sensor sensitivity all make the use of remote sensors and sensor suites practical as well as marketable.

The British Radamec 1000L system is an example of a *remote camera* with limited operator presence to detect targets. Other applications include cameras tethered from concealed vehicles and operated through the vehicle power system. New technologies include passive IR scanning cameras with auto-track and alert algorithms such as the French Sirene or British ADAD IR units emplaced on the battlefield to link into sensor nets and monitor sensitive avenues of approach and unit flanks. Early systems include air defense sensors such as ADA, Sirene, or the hand-held Swedish IRS-700. A tethered *aerostat balloon* can hold a remote camera platform to increase surveillance beyond the line-of-sight. The Israeli TAOS system uses a gimbaled, stabilized, multi-sensor platform with a CCD and thermal camera for day or night use. Radar and laser illuminator applications are optional with the ground station mounted on a trailer. Ground forces are also adapting commercial camera network technologies to create a *surveillance camera network* that can monitor wide areas on the battlefield. These systems include the CELTICS, TACS, and Gamma 2000—all produced by Israel.

The use of an *unattended ground sensor* (UGS) by the US dates back to the Vietnam War where the UGS units were placed to detect enemy presence and movement. Some of these sensors were "break-wire" that generated a signal when broken. While the most common UGS is acoustic, other UGS units can monitor seismic, magnetic,

infrared, or RF activity. Some UGS units can sleep to save energy and the size can vary from a few centimeters to a few inches in size. Relay systems may be required to forward the signal to the monitoring station. By analyzing the location and pattern of signals, the operator is cued to initiate additional battlefield surveillance activities in selected areas. Examples of UGS units include the Thales Miniature Intrusion Sensor (MIS) and Rafael. Current technology reduces false alarms such as from animals wandering in the area. Emplacement is important as if placed in too open of an area, the UGS can be seen. If placed in an urban or defilade position, the signal may not reach the monitoring station. Larger UGS units may be placed at road junctions, river crossing sites, and other important locations. Examples of the larger UGS units include the ATE UGS, Steel Eagle, Gateway, and Boden-Sensor-Ausstattung (BSA). The Thales CLASSIC 200 has been sold to over 39 countries for military, border control, police, and commercial purposes with a complete network with monitor, acoustic, cameras, and other sensors. Possible roles for the UGS include perimeter protection, route monitoring, and point surveillance. Emerging UGS technologies include linking to other sensors, mine activation, remote weapons system operation, and autonomous cueing to conduct precision targeting. A subset of the UGS is the *remotely-delivered sensor* that delivers reconnaissance rounds through a weapons system such as artillery or mortars. These rounds, once fired and activated, can provide target location, acquisition, and post-mission battle damage assessment. Cameras provide a low-cost method to obtain immediate view beyond the line-of-sight, over the hill, or behind the foliage, with a reduced risk of being seen. The Israeli IMI recently debuted a Refaim rifle grenade containing a camera that can transmit pictures back to the launching unit as the round descended on its target. A 40-mm under-barrel rifle grenade launcher can fire the Israeli Firefly that transmits video and sound back to a digital radio and laptop computer. In addition to their anti-tank role, fiber-optic ATGMs can use their camera to provide video footage for analysis by reconnaissance units.



Robot with Camera

Robotic sensors consist of single or multiple sensors mounted on robots or unmanned ground vehicle (UGV) chassis. Previous applications include the exploration of the ocean floor, other planets, and inaccessible areas such as caves or volcanoes. The police often uses a robotic sensor for surveillance in hostile situations as well as examining contamination areas such as the Chernobyl nuclear plant. A military version is the tracked Matilda with a day TV camera used in Afghan caves, clearing minefields, and checking for potential IEDs. The OPFOR can use robotic sensors for surveillance and patrols in urban or open terrain to reduce troop vulnerability. A simple application is to use robots controlled from reconnaissance vehicles or nearby personnel. A robotic chassis features EO viewers for guidance and surveillance, such as a TV camera with an RF or cable link; GPS in-view readouts; a thermal or II night channel; and LRF. A robot can carry other sensors including acoustic microphones, NBC samples, radar, or weapons. Other robotic examples include the British tracked Wheelbarrow mine detection system or the Giant Viper wheeled line charge launcher vehicle that tows its own charge trailer. The German company, Telerob, produces tracked robots for industrial, police, and military applications. The Russian SPC robot can employ a number of sensors.

The earliest robotic sensors on the modern battlefield were unmanned aerial vehicles (UAV). See Volume 2 for additional information on UAVs. UAVs can perform pre-programmed (drone) or operator control (remotely piloted vehicle—RPV) missions. The on-board TV camera and its ability to transmit the images to a ground station are the core of the UAV mission. In the last few years, unmanned combat aerial vehicles (UCAV) have appeared

to attack located targets. A UAV ground station can consist of only a notebook computer or PDA as a terminal. Due to the high cost of airplanes and the training required to become a proficient pilot, UAVs are an excellent way to work through budget constraints and lack of an efficient manned air force. Recent or expanded technology for UAVs include the following:

- *Man-portable UAVs* are light weight and can be carried in a backpack and launched by hand such as the German Carolo, Russian Pustelga, or French K100.
- *Micro-aerial Vehicles* (MAV) use radio-control (RC) model plane technology where some of these are not larger than a man's hand.
- *Improvised UAVs* using RC aircraft.
- *Vehicle/robotic launch UAVs* including canister launchers such as the Israeli Skylite UAV or the UAV the French are looking for their next LeClerc tank upgrade.
- *Weapons-launched UAVs* such as the Russian R-90 300-mm launched by the 9A152-2 MRL can loiter for 30 minutes while transmitting imagery to an artillery command and reconnaissance vehicle (ACRV).
- LTD UAV where the UAV substitutes as the laser designated in lieu of a soldier or vehicle.



American RQ-11 Man-Portable UAV

Battlefield monitoring systems require the use of cable links or RF data transmission equipment, and display arrays such as those found in vehicles modified into ground stations. These systems can fuse various technologies, including commercial equipment, together to obtain the best situational awareness possible for the user.

Technology limitations will continue to challenge reconnaissance operations, but solutions will be found. Commercial applications will continue to cross over into the military as forces with limited budgets will continue to use off-the-shelf technology for military purposes. The OPFOR will supplement new technology with low technology to conduct their reconnaissance operations. Innovative military forces can use niche technologies and aggressive manned reconnaissance units to conduct battlefield surveillance operations. The battlefield surveillance networks will consist of personnel, organic sensors, vehicles, UGS, remote sensors, UAVs and any other reconnaissance assets available. Effective equipment, sound organization and planning, commitment to the OE variables, and effective reconnaissance tactics can enable the OFPRO to gain greater situational awareness within their operational area, and to challenge enemy capabilities to achieve tactical surprise.

FRENCH GROUND SURVEILLANCE RADAR RASIT/RASIT-E



RASIT Ground Surveillance Radar (GSR) Mounted on Vehicle

SYSTEM	SPECIFICATIONS	EQUIPMENT	SPECIFICATIONS
Alternative designations:	RASIT 3190B; RACIT E; DRPT-5; Basir 110D (Iran)	Name:	Radar Acquisition de Surveillance Intermediare (RASIT)
Date of introduction:	1970s; 1990s (RASIT-E)	Console:	Digitally operated including display
Proliferation: Vehicles Countries:	INA 22+	Radar:	Motor-driven for azimuth adjustment with remote control
Description:	Ground Surveillance Radar (GSR) can be operated by a crew of 1 or 2; entire system breaks down to 3 90-kg sections; vehicle or tripod-mounted	Azimuth coverage (°):	Operator section: 10 to 240 (200 to 4300 mils)
Crew (Operate & Assistant Operator, but more for vehicle):	2	Antenna type:	Flat array type; slotted waveguide antenna; cable link
Combat weight (kg):	90.0	Performance:	
Chassis length overall (m):	Varies by vehicle	Surveillance range (km):	20-23 (Personnel); 32-40 (Vehicles); 20-40 (Aircraft)
Height overall (m):	Varies by vehicle	Tracking speed:	00 – 103 km/hr

Width overall (m):	Varies by vehicle	Resolution:	+/- 10 m range; +/- 0.6° in azimuth
Ground pressure (kg/cm²):	Varies by vehicle	Countermeasure resistance:	ECCM & LPI capable
Automotive performance:	Varies by vehicle	Transceiver specifications:	
Engine type:	Varies by vehicle	Signal:	I-Band (8.00 – 10.00 GHz)
Cruising range (km):	Varies by vehicle	Power (W):	3000 (consumption); 150 (Output)
Speed (km/h):	Varies by vehicle	Width of radiation pattern lobe (°):	-11 to 240
Fording depths (m):	Varies by vehicle		
Radio:	INA	Accuracy:	90% probability of detection
Protection:	N/A	Polarization:	Linear & circular
Armor, turret front (mm):	N/A	Compatibility:	With IFF systems & ECCM capabilities
Applique armor (mm):	N/A	Remote Operation:	Console 300 m from dish
Explosive reactive armor(mm):	N/A	Target acquisition:	Automatically detects, tracks, & identifies all targets
Active Protection System:	N/A	TV Monitor:	Polar & Universal Transverse Mercator (UTM) coordinates
Self-entrenching blade:	N/A	Display:	Plotting table or mapping computer
NBC protection system:	N/A	Tone Signal:	Available
Smoke equipment:	N/A	Remote user transmission:	Standard interface; RASIT E can be integrated with battle management system using TCP/IP interface
Survivability equipment:	N/A	Alternative modes of operation:	
		Magnified mode:	2.5 km x up to 40 km; widths in 10° intervals up to 240°; registers only movement within designated zone
		FDC mode:	Weapon aiming radar to correct artillery fire; GSR still operational
		Air Defense (AD) mode:	RASIT E only; used to locate nap-of-the-earth flying helicopters up to 30 km; low flying aircraft to 40 km; sends coordinates to AD units
		Early Warning mode:	Vehicle mounted version with antenna not in stowed position
		GPS mode:	Compatible with GPS navigation systems to transmit relative coordinates using digital interface to battlefield management systems

NOTES
SOURCES: 2014 WEG.

RUSSIAN GROUND SURVEILLANCE RADAR KREDO-1E



Kredo-1E Ground Mount



Kredo-1S Ground Surveillance Vehicle



SNAR-10M Artillery Reconnaissance Vehicle

SYSTEM	SPECIFICATIONS	EQUIPMENT	SPECIFICATIONS
Alternative designations:	RP-200, IRL-133-3, Kredo-1, Credo-1, Credo-1E, & PSNR-8	Name:	Kredo-1E
Date of introduction:	1990s	Console:	INA
Proliferation: Vehicles Countries:	N/A 1+	Radar:	Motor-driven for azimuth adjustment
Description:	Ground Surveillance Radar (GSR) can be operated by a crew of 2 or 3; vehicle pintle or mast-mounted or tripod-mounted	Azimuth coverage (°): In scan sector: Elevation:	360 180 18
Crew (operator; assistants; more for vehicle):	2-3	Antenna type:	Slotted wave guide
Combat weight (kg): With battery & display:	48 97	Performance:	
Chassis length overall (m):	Varies by vehicle	Surveillance range (km): Detection: Tracking: Tanks: Light vehicles & trucks: Helicopters: Large aircraft: Ships: Personnel: Shell burst-155-mm: Minimum distance:	 40 30 40 20-40 35 30 12 15 15 0.2
Height overall (m):	Varies by vehicle	Tracking speed (km/hr):	3-72
Width overall (m):	Varies by vehicle	Resolution: Range (m): Azimuth (°):	50 1.8
Ground pressure (kg/cm²):	Varies by vehicle	Countermeasure resistance:	INA
Automotive performance:		Transceiver specifications:	Multi-mode master oscillator & klystron
Engine type:	Varies by vehicle	Signal:	Coherent pulse Doppler J-band (10.00 -19.00 GHz, US Ku band)

Cruising range (km):	Varies by vehicle	Power (W):	250 (Consumption)
Speed (km/h):	Varies by vehicle	Mode:	Mono-pulse digital processing
Fording depths (m):	Varies by vehicle	Width of radiation pattern lobe (°):	INA
Radio:	INA	Accuracy (range in m): Azimuth (˚):	10 0.12
Protection:	N/A	Emplacement time (minutes):	5
Armor, turret front (mm):	N/A	Polarization:	INA
Applique armor (mm):	N/A	Compatibility:	Can be used as the base for an integrated digital sensor suite or fused to process data from other sensors
Explosive reactive armor(mm):	N/A	Remote Operation (m): Min: Max:	25 200
Active Protection System:	N/A	Target acquisition:	Automatically detects, tracks, & identifies targets & reads coordinates
Self-entrenching blade:	N/A	TV Monitor:	INA
NBC protection system:	N/A	Display:	Displays acquisitions on digital map display with various display colors
Smoke equipment:	N/A	Tone Signal:	INA
Survivability equipment:	INA	Remote user transmission:	Transmit data digitally over network via standard interface
		VARIANTS	SPECIFICATIONS
		Kredo-1S	Ground recon vehicle with Kredo-1E radar/EO sensor pod on telescoping arm on amphibious BAZ-5921 chassis
		TBD	Same telescoping arm as the Kredo-1S, but on the BTR-based UNSh/K1Sh1 chassis
		SNAR-10M	Russian upgrade for the SNAR-10 artillery battlefield surveillance radar vehicle (replaces BIG FRED radar with the Kredo-1E)

NOTES
SOURCES: 2014 WEG. WITH THE PINTLE MOUNT, THIS RADAR CAN BE MOUNTED ON ALMOST ANY VEHICLE TO MODIFY IT INTO A RECONNAISSANCE VEHICLE. (PHOTOS FROM 2014 WEG)

RUSSIAN/BULGARIAN GSR PSNR-5/5M & KREDO-M1



PSNR-5 Ground Surveillance Radar (GSR) Portable Dish



PSNR-5 GSR Portable Viewer

SYSTEM	SPECIFICATIONS	EQUIPMENT	SPECIFICATIONS
Alternative designations:	TALL MIKE (NATO); PSNR-5/IRL133 (Ground); PSNR-5K/1RL133-1 (Vehicle); IRL 133M (Kredo M-1 ground); 1RL 133M1 (PSNR-8 vehicle)	Name:	PSNR-1 Kredo-M1 (both C & K used in translations);
Date of introduction:	1974 (PSNR-5)	Console:	INA
Proliferation:	11+ countries	Radar:	Motor-driven for azimuth adjustment with remote control
Description:	Ground Surveillance Radar (GSR) can be operated by 1 or 2 soldiers; 3 soldiers required for dismounted carry	Azimuth coverage (°): In surveillance sector (˚): +/- (˚) Tripod can be adjusted for more vertical coverage.	360 180 18
Crew:	1 (Vehicle); 2 (Dismounted)	Antenna type:	Parabolic dish with cable link
Combat weight (kg):	56.0; 50 (including 2 batteries for Kredo-M1)	Performance:	
Chassis length overall (m):	Varies by vehicle	Surveillance range (km): PSNR-5/5M Personnel: Vehicles: Minimum distance: (Range reduced 50% at wind speeds >5 m/second)	 3-5 10-15 0.2
Height overall (m):	Varies by vehicle	Tracking speed:	2-60 km/hr (more for some targets)
Width overall (m):	Varies by vehicle	Resolution:	100 m in range; 50 mils in azimuth; 25 m for range & 50 mils for azimuth for Kredo-M1
Ground pressure (kg/cm^2):	Varies by vehicle	Countermeasure resistance:	INA
Automotive performance:	Varies by vehicle	Transceiver specifications:	Coherent pulse Doppler with magnetron (With klystron for Kredo-M1)
Engine type:	Varies by vehicle	Signal:	I-band (9.00 GHz); J-band (10.00-19.00 GHz or US Ku band for Kredo-M1)
Cruising range (km):	Varies by vehicle	Power (W):	90 (Consumption); 12 (Output); 110 (consumption for Kredo-M1)

Speed (km/h):	**Varies by vehicle**	**Width of radiation pattern lobe (°):**	**INA**
Fording depths (m):	**Varies by vehicle**	**Emplacement time:**	**5 minutes (vehicle mast mounted)**
Radio:	**INA**	**Accuracy:**	**INA**
Protection:	**N/A**	**Polarization:**	**INA**
Armor, turret front (mm):	**N/A**	**Compatibility:**	**Operate using analog or digital processing match user interface.**
Applique armor (mm):	**N/A**	**Remote Operation:**	**25 m away for concealed operators**
Explosive reactive armor(mm):	**N/A**	**Target acquisition:**	**INA**
Active Protection System:	**N/A**	**TV Monitor:**	**INA**
Self-entrenching blade:	**N/A**	**Display:**	**Monochrome digital readouts; color on Baget-14 notebook computer for Kredo-M1**
NBC protection system:	**N/A**	**Tone Signal:**	**INA**
Smoke equipment:	**N/A**	**Remote user transmission:**	**INA**
Survivability equipment:	**N/A**	**VARIANTS**	**SPECIFICATIONS**
		PSNR-5	**Tripod mounted**
		PSNR-5K	**Mount mast for vehicles (i.e. Russian BRM-1K)**
		PSNR-5M/Kredo-M	**Updated PSNR-5K on vehicles with a notebook computer to display, process, transmit; with GPS**
		Monitor-M	**Links up to 4 PSNR-5M radars to provide 360°**
		Kredo-M1/PSNR-5M Modernized	**PSNR-5M with additional upgrades with range of 5 – 8.5 km (personnel); 20 km (tanks); 32 km (trucks); with 12 km (tracking)**
		Strazh-ST	**Vehicle sensor pod with Kredo-M1 & EO cameras (PRP-4M uses the PSNR-5M system; the PRP-4MU has an option for the Kredo-M1)**

NOTES
SOURCES: 2014 WEG.

RUSSIAN/BULGARIAN MAN-PORTABLE GSR FARA-1E



Fara-1E GSR Set Up in the Field



Fara-1E GSR Components

SYSTEM	SPECIFICATIONS	EQUIPMENT	SPECIFICATIONS
Alternative designations:	Fara; Fara-3; RP-100; 1RL-136; SBR-3 (Russia); SSBR-3 (Bulgaria)	Name:	Fara-1E
Date of introduction:	1990s	Console:	INA
Proliferation:	2+ countries	Radar:	Motor-driven for azimuth adjustment with remote control
Description:	Man-portable Ground Surveillance Radar (GSR) can be mounted on a vehicle	Azimuth coverage (°):	360; 180 in surveillance sector;
Crew:	1 or 2 (system can be carried by 1 soldier)	Antenna type:	Flat array type slotted waveguide antenna with cable link
Combat weight (kg):	14 (total system); 18.3 (with tripod); 6 (patrol version)	Performance:	
Chassis length overall (m):	Varies by vehicle	Surveillance range (km):	5 (vehicles); 2.5 (personnel)
Height overall (m):	Varies by vehicle	Tracking speed:	2 – 50 km/hr
Width overall (m):	Varies by vehicle	Resolution:	20 m (range); 0.9° (azimuth)
Ground pressure (kg/cm^2):	Varies by vehicle	Countermeasure resistance:	God jam resistance with phase-coded modulation
Automotive performance:	Varies by vehicle	Transceiver specifications:	Coherent pulse Doppler with continuous-wave kylstron
Engine type:	Varies by vehicle	Signal:	J-band (10.00 -19.00 GHz, US Ku band)
Cruising range (km):	Varies by vehicle	Power (W):	7 (consumption); 0.50 (output)
Speed (km/h):	Varies by vehicle	Width of radiation pattern lobe (°):	4 (azimuth); 10.5 (elevation)
Fording depths (m):	Varies by vehicle	Gain (dB):	27
Radio:	INA	Sideload in azimuth (dB):	16
Protection:	N/A	Emplacement time:	INA
Armor, turret front (mm):	N/A	Accuracy:	INA
Applique armor (mm):	N/A	Polarization:	INA

Explosive reactive armor(mm):	N/A	Compatibility:	Can be fused with data from other sensor systems for target location by azimuth intersction
Active Protection System:	N/A	Remote Operation:	Console can be set up 15 m away from dish
Self-entrenching blade:	N/A	Target acquisition:	Automatically detects, tracks, & identifies all targets
NBC protection system:	N/A	TV Monitor:	
Smoke equipment:	N/A	Display:	
Survivability equipment:	N/A	Tone Signal:	Earphones & sound signal alert the user & classifies targets.
		Remote user transmission:	Data can be transmitted to remote users via standard interface.
		Alternative modes of operation:	
		Individual Weapons Target Acquisition:	Mounted on the NNP-23 infrared night sight for fusing data to that device
		Crew-served Weapons Target Acquisition:	Elbow flange to mount on machine guns, AGS-17 AGL (Fara-2) to deliver precision fires up to 4 km (day/night) while still serving as a GSR
		Hand-held LRF & GPS:	Fuse azimuth directional data, current location, & range data for precise day/night target location.
		Fara-1:	Used by AD units to locate nap-of-the-earth flying helicopters & use flange elbow mount to direct machine guns or send data through link to AD units.
		Vehicle Mount Version:	Early warning of enemy personnel when mounted on motorcycles or TUVs.
		Remote Surveillance:	Link with unattended ground sensors to conduct wide area battlefield surveillance.

NOTES

SOURCES: 2014 WEG; SYRACUSE RESEARCH CORPORATION TECHNICAL REPORT-GROUND SURVEILLANCE RADARS AND MILITARY INTELLIGENCE, 30 DECEMBER 2002. USE OF A LAPTOP COMPUTER INSTEAD OF THE BACKPACK UNIT DECREASES SYSTEM'S WEIGHT. COMPACT MODULAR SYSTEM IS IDEAL FOR USE ON SMALL VESSELS. (PHOTOS FROM 2014 WEG)

FRENCH THERMAL BINOCULARS/FORWARD OBSERVER SYSTEM
SOPHIE LR



Sophie Binoculars Using the Daytime CCD Camera Mode

SYSTEM	SPECIFICATIONS	PERFORMANCE	SPECIFICATIONS
Alternative designations:	See variants	Field of View (FOV) (°):	12.4 x 6.2 (wide view); 6.2 x 3.1 (narrow view); Other versions have different FOVs
Date of introduction:	1996 (original)	Night Range (km):	Standard (without EZ)
Proliferation:	45+ countries (Sophie & Sophie LR)	Fixed-wing Aircraft:	Detection: 22 (15) Recognition: 10 (6.4)
Description:	Binoculars with additional features	Helicopters:	Detection: 16 (11) Recognition: 7 (4.5)
Crew:	1	Vehicles:	Detection: 13 (8.7) Recognition (3.3)
Combat weight (kg):	3.3 (Sophie LR with 2 X electronic zoom (EZ)); 2.4 (original)	Personnel:	Detection: 9 (4.4) Recognition: 3 (1.6)
Components:		Day Range:	Similar to night ranges
Configuration:	Hand-held binocular device	VARIANTS	SPECIFICATIONS
Power Supply:	Internal rechargeable lithium battery & DC adaptor	Original Sophie	Day/night binoculars that can be fitted to a goniometer to serve as a base sight for

			dismounted forward observation (FO) & fire control system
Detector:	SOFRADIR 288 X 4 element CdHgTe (Mercury Cadmium Telluride) detector	Sophie LR (Long Range):	Improved version with increased range, 2 x EZ, & image stabilization
Frequency:	8 – 12 microns	Sophie UF2:	Compact redesigned hand-held viewer that weighs 2.4 kg, but meets the Sophie LR upgraded standards
Thermal Technology:	Second generation	Sophie MF (Multi-function):	Integrated goniometer FO System (FOS) with all LR features, laser rangefinder 9LRF), laser pointing system, internal GPS, & internal color camera. FOs can adjust indirect fires 13 km, 6 km with recognition; direct fire precision ranges are 6 km+ dependent upon targets & ammunition; range against helicopters is 7 km with EZ
Optional additions:	Tripod mount; RS 422 remote control box for remote viewing (see variants for other applications)	Sophie XR (Extended Range):	All Sophie MF features as well as the new SOFRADIR Scorpio detector with increased ranges.
Operation:			
Battery Time (hrs):	Thermal: 4+; Day use: 6+ (Lithium batteries) Thermal: 4+; Day/night use: <12 (rechargeable batteries)		
Cooling Bottle:	None (uncooled FLIR)		
Detectability while surveilling:	None (passive both day & night)		
Data transmission:	CCIR or RS-170 link for digital downlink to computer/net for TV display		

NOTES

SOURCES: 2014 WEG. THE SOPHIE-LR IS USED AS LIGHTWEIGHT CAMERAS WITHIN SURVEILLANCE SYSTEMS AND INDIRECT WEAPON FIRE CONTROL SYSTEMS. SOPHIE-LR IS CONFIGURED AS A REMOTE SENSOR POD FOR VEHICLE OR SITEMOUNTED, WITH DIGITAL FEED TO A REMOTE DISPLAY. A CURRENT SOPHIE-BASED RISTA SYSTEM IS DEPICED AT THE THALES WEBSITE FOR USE BY THE F2000 UAV & IS MOUNTED ON ATGM LAUNCHERS, HELICOPTERS, & A VARIETY OF OTHER VEHICLES. THE SOPHIE-LR CAN BE MOUNTED ON A TELESCOPING MAST WITH AN RS 422 REMOTE CONTROL BOX FOR AZIMUTH ROTATION, & A VERTICALLY SWIVELING PINTLE FOR PRECISION ELEVATION. THE SENSOR POD USES A DC POWER SUPPLY & A DIGITAL DATE CABLE LINKED TO A REMOTE VIEWER OR RF VIDEO TRANSMISSION SYSTEM (UAV).

Dec
2016

Worldwide Equipment Guide

Chapter 2: Infantry Weapons





TRADOC G-2 ACE–Threats Integration
Ft. Leavenworth, KS

Distribution Statement: Approved for public release; distribution is unlimited.

Chapter 2: Infantry Weapons

Chapter 2 provides the basic characteristics of selected infantry weapons either in use or readily available to the OPFOR and therefore likely to be encountered by US forces in varying levels of conflict.

The chapter is divided into two categories—***small arms*** and ***recoilless weapons***. ***Small arms*** covers, in order, assault and battle rifles, sniper/anti-material rifles, automatic grenade launchers, under-barrel and hand held grenade launchers, light machineguns, general-purpose machineguns, and heavy machineguns. The second category, ***recoilless weapons***, contains the most proliferated disposable launcher rocket propelled grenades and reloadable launcher RPGs and recoilless rifles. While originally limited to shoulder-fired unguided antitank weapons such as the Russian 40-mm Antitank Grenade Launcher RPG-7V, the utility of shoulder-fired weapons has expanded to include multi-purpose systems such as the Swedish 84-mm Recoilless Rifle Carl Gustaf M2, and many other systems. This field of weapons is often labeled "antitank" and also includes "bunker-buster" warheads, and weapons which can be fired from within confined spaces such as the German 67-mm Disposable Antitank Grenade Launcher (Armbrust) due to no or minimal back blasts. New, disposable launcher Tier 1 anti-armor systems such as the RPG-28, 32 and 30 have also been added. The RPG-30, in particular, is designed to defeat both Explosive Reactive Armor (ERA) and Active Protective Systems (APS) via a sub-caliber device that upon firing reaches the target milli-seconds before the main 105mm HEAT tandem warhead rocket. The RPG 28 is a heavy, 125mm tandem warhead weapon that will penetrate in excess of 1000mm of rolled, homogenous armor (RHG), after defeating ERA. Both are formidable anti-armor systems, which can be easily employed by the individual Soldier or insurgent.

An enduring battle-tested, lethal, shoulder-fired weapon is the Russian Infantry Rocket Flame Weapon RPO-A Series (RPO-A/D/Z) capable of firing either a smoke, incendiary, or a thermobaric warhead to 600 meters. At 200 meters it is accurate to 0.5 m^2. The thermobaric warhead has a blast effect corresponding to a round of 122 mm HE artillery. Due to the relative low cost, availability, versatility, transportability, trainability, and lethality of this category of infantry weapons, trainers should expect to encounter these systems in larger numbers with increasing levels of lethality, penetration, and utility.

Following several deletions and additions in last year's WEG update, there are no deletions or additions for this 2016 update.

Crew-served infantry weapons which require a vehicle, or which limit mobility, have been moved to the Antitank and Anti-Armor chapter (6). Questions and comments on data listed in this chapter should be addressed to:

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BELGIAN FABRIQUE NATIONALE 7.62X51 MM NATO MAIN BATTLE RIFLE, FAL



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: None. Date of Introduction: 1954 Proliferation: Widespread; like the Hk G3, it has been used by 70+ nations, worldwide, at some time or another, and is still found in many Third World militaries/security services.	Weight: FAL 50.00: 4.3 kg (9.48 lb) FAL 50.61: 3.90 kg (8.6 lb) FAL 50.63: 3.79 kg (8.4 lb) FAL 50.41: 5.95 kg (13.1 lb) Length: FAL 50.00 (fixed stock): 1,090 mm (43 in) FAL 50.61 (stock extended): 1,095 mm (43.1 in) FAL 50.61 (stock folded): 845 mm (33.3 in) FAL 50.63 (stock extended): 998 mm (39.3 in) FAL 50.63 (stock folded): 748 mm (29.4 in) FAL 50.41 (fixed stock): 1,125 mm (44.3 in) Barrel length: FAL 50.00: 533 mm (21.0 in) FAL 50.61: 533 mm (21.0 in) FAL 50.63: 436 mm (17.2 in) FAL 50.41: 533 mm (21.0 in)	7.62x51 mm NATO; ball, tracer, armor piercing. All known variants.	Action: Gas-operated, tilting breechblock Rate of fire: 650–700 rds/min Muzzle velocity: FAL 50.00: 840 m/s (2,756 ft/s) FAL 50.61: 840 m/s (2,755.9 ft/s) FAL 50.63: 810 m/s (2,657.5 ft/s) FAL 50.41: 840 m/s (2,755.9 ft/s) Effective firing range: 400–600 m sight adjustments Feed system: 20 or 30 round detachable box magazine. 50-round drum magazines are also available. Sights : Aperture rear sight, post front sight; Sight radius: FAL 50.00, FAL 50.41: 553 mm (21.8 in) FAL 50.61, FAL 50.63: 549 mm (21.6 in)

			Various telescopic and night visions sights are available for mounting on the FN FAL series of rifles.
		VARIANTS	
		Numerous, particularly among those manufactured under license from FN in other nations. Most common variants are the standard FN infantry weapon with a fixed stock. Also the para models with a 17.2 inch barrel and folding stocks.	

NOTES
LIKE THE HK G3, ONE OF THE MOST PROLIFIC MAIN BATTLE RIFLES EVER PRODUCED; CAN BE FOUND VIRTUALLY AROUND THE WORLD, STILL IN SERVICE WITH SOME THIRD WORLD MILITARIES AND SECURITY ORGANIZATIONS.

GERMAN HECKLER & KOCH 7.62X51 MM NATO MAIN BATTLE RIFLE G3



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: None Date of Introduction: 1959 Proliferation: Widespread; 70+ nations worldwide, with many variants produced under license within the using nation.	Weight 4.1 kg (9.04 lb) (G3A3) 4.7 kg (10 lb) (G3A4) 5.54 kg (12.2 lb) with optic (G3SG/1) 4.1 kg (9.0 lb) (G3K) Length 1,025 mm (40.4 in) (G3A3) 1,025 mm (40.4 in) stock extended / 840 mm (33.1 in) stock collapsed (G3A4) 1,025 mm (40.4 in) (G3SG/1) 895 mm (35.2 in) stock extended / 711 mm (28.0 in) stock collapsed (G3K) Barrel length 450 mm (17.7 in) 315 mm (12.4 in) (G3K)	7.62×51 mm NATO; the G3 will fire all known types of 7.62x51 mm NATO ammunition from standard ball to tracer, AP or other types.	Action: Roller-delayed blowback Rate of fire: 500–600 rds/min Muzzle velocity: 800 m/s (2,625 ft/s) Effective firing range: 400 m (440 yd), 100–400 m sight adjustments Feed system: 20 rd detachable box and 50 rd drum magazine Sights: Rear, rotary diopter; front, hooded post There are numerous telescopic and night sights that have been manufactured for use on the G3, by various user nations.
		VARIANTS	
		Many variants made around the world; most common are those with telescoping stocks (G3A4) or with short barrels (G3K). The original G3, introduced in 1959, had a wooden stock and handguards.	

NOTES
UNQUESTIONABLY ONE OF THE MOST PROLIFICALLY DISTRIBUTED MAIN BATTLE RIFLES IN THE WORLD, AND ONE OF THE BEST, MOST RELIABLE DESIGNS.

RUSSIAN 7.62X39 MM SEMIAUTOMATIC RIFLE, SKS



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: Simonov Semiautomatic Carbine Date of Introduction: 1946 Proliferation: Widespread	Weight (kg): Empty: 3.85 Length (mm): Overall: 1,020 Barrel: 520 Rate of Fire (rd/min): 35-40 Operation: Gas Magazine: Integral box magazine Magazine capacity: 10 rounds Fire Mode: Semiautomatic	Name: M1943 (57N231S) Caliber/length: 7.62x39 mm Type: Ball, steel core Range (m): Effective: 350 Maximum: 800 Armor Penetration: 6 mm mild steel plate at 300 m Steel helmet at 1,000 m Flak vest at 60 m Muzzle Velocity (m/s): 718 Name: M1943 (T-45 or 57N231P) Caliber/length: 7.62x39 mm Type: Ball-Tracer Range Effective: 350 Maximum: 800 Trace (m): 800 Muzzle Velocity (m/s): 718	SIGHTS: Tangent leaf, graduated from 100 to 1,000 meters Night sights are available for the SKS
		VARIANTS	
		Karabiner-S: East German Manufacture Chinese Type 56: copy North Korea Type 63: copy Yugoslavian M59/66: copy, w/permanent grenade launcher	

NOTES

THE SKS IS THE PREDECESSOR TO THE RUSSIAN AK-47. THIS RELIABLE RIFLE IS STILL FOUND IN LARGE NUMBERS THROUGHOUT THE WORLD. IT IS THE MAINSTAY OF THE PRC “PEOPLES MILITIA”

RUSSIAN 7.62X39 MM ASSAULT RIFLE, AK-47/AKM



SYSTEM	SPECIFICATIONS	AMMUNITION	VARIANTS
Alternative Designations: AK, Kalashnikov Date of Introduction: 1949 (AK) 1961(AKM) Proliferation: Widespread (over 50 million) Feed: 30-round curved box magazine Fire Mode: Selective, automatic or semi-automatic Operation: Gas SIGHTS: Type: Fore, pillar; Rear, U-notch Magnification: None Night Sights Available: Yes	Description: Weight (kg): Loaded (with magazine): 3.8 Empty (w/o magazine): 4.3/3.14 Length (mm): 870/880 Rate of Fire (rd/min): Cyclic: 600 Practical: Automatic: 100 Semiautomatic: 40	M1943 (57N231S) Caliber/length: 7.62x39 mm Type: Ball, steel core Range (m): Effective: 300 Maximum: 800 Armor Penetration: 6 mm mild steel plate at 300 m Steel helmet at 1,000 m Flak vest at 60 m Muzzle Velocity (m/s): 718 M1943 (T-45 or 57N231P) Caliber/length: 7.62x39 mm Type: Ball-Tracer Range Effective: 300 Maximum: 800 Trace (m): 800 Muzzle Velocity (m/s): 718	Numerous. Many countries manufacture clones of the AK-47 or weapons using the basic AK action. Some of these are made in different calibers. AKS: Folding stock AK-47. AKM: Improved AK-47, sights, magazine, and stock. AKMS: Folding stock variant of AKM.

NOTES

PHOTO IS OF AN AKM. ALL 7.62X39 MM KALASHNIKOV ASSAULT RIFLES ARE VERY DEPENDABLE WEAPONS. THEY PRODUCE A HIGH VOLUME OF FIRE AND ARE SIMPLE TO MAINTAIN AND PRODUCE. THE PRIMARY DIFFERENCE BETWEEN THE AK-47 AND THE IMPROVED AKM IS THE RECEIVER. THE RECEIVER OF THE AK-47 IS FORGED AND MACHINED WHILE THE RECEIVER OF THE AKM IS STAMPED METAL FACILITATING EASIER AND LESS COSTLY MANUFACTURING. BOTH THE AK-47 AND THE AKM CAN MOUNT A 40 MM UNDER-BARREL GRENADE LAUNCHER. THE AK-47 AND AKM HAVE BEEN REPLACED IN MANY ARMIES BY THE NEWER AK-74. THE AK-74 IS BASICALLY AN AKM RE-CHAMBERED TO FIRE A 5.45X39 MM CARTRIDGE. THE 7.62X39 MM RPK LIGHT MACHINEGUN IS BASED ON THE AK/AKM DESIGN WHILE THE RPK-74 IS A LIGHT MACHINEGUN VERSION OF THE AK-74. BOTH ARE INFANTRY SQUAD LEVEL SUPPORT WEAPONS.

RUSSIAN 5.45X39 MM ASSAULT RIFLE, AK-74/AK-74M



SYSTEM	SPECIFICATIONS	AMMUNITION	VARIANTS
Alternative Designation: AK, Kalashnikov Date of Introduction: 1974/91 Proliferation: In approximately 21 different nations, primarily in Eastern Europe, and in Asia. Fire Mode: Selective, automatic or semi-automatic Feed: 30-rd detachable box magazine (40-rd used by RPK-74 LMG is interchangeable) SIGHTS: Name: INA Type: Fore, pillar; rear, U-notch Magnification: None Night Sights Available: Yes. AK-74M N3 mounts an NSPU-3	Description: Weight (kg): Loaded (with magazine): 3.95 Empty (w/o magazine): 3.4 Length (mm): Overall: 880 (937 including muzzle brake) Barrel: 415 Rate of Fire (rd/min): Cyclic: 600 Practical: Automatic: 100 Semiautomatic: 40 Operation: Gas	Name: 7N6 Caliber/length: 5.45x39 mm Type: Ball Range (m): Effective: 500 Maximum: 800 Armor Penetration: 6 mm mild steel at 300 m, flak vest at 80 m Muzzle Velocity (m/s): 880 Name: 7N10 (Enhanced Penetration) Caliber/length: 5.45x39 mm Type: Armor piercing Range (m): Effective: 500 Maximum: 800 Armor Penetration (mm): 16 mild steel at 300 m 5 armor plate at 150 m Flak vest 200 m Muzzle Velocity (m/s): 880 Name: 7T3M Caliber/length: 5.45x39 mm Type: Tracer Range (m): Effective: 500 Maximum: 800 Trace: 850 Armor Penetration: INA Muzzle Velocity (m/s): 880	AKS-74: Folding-stock version with a Y-shaped, tubular stock. AK-74M: Improves the basic AK-74 design by adding a folding plastic stock, an improved mount for night vision or other sights. AKS-74U: modified version with a much shorter barrel (207 mm) and a conical flash suppressor instead of a muzzle break. Its overall length is 492 with stock folded. AK-101: 5.56x45 mm (NATO) variant of the AK-74M. AK-102: 5.56x45 mm (NATO) short-barrel (314 mm) variant of the AK-74M. AK-103: 7.62x39 mm variant of the AK-74M. AK-104: 7.62x39 mm short-barrel (314 mm) variant of the AK-74M. AK-105: 5.45x39 mm short-barrel (314 mm) variant of the AK-74M.

NOTES
WEAPON PICTURED IS AN AK-74M. THE AK-74 IS BASICALLY AN AKM RECHAMBERED AND RE-BARRELED TO FIRE A 5.45X39 MM CARTRIDGE. THE AK-74 CAN MOUNT A 40 MM UNDER-BARREL GRENADE LAUNCHER AND A PASSIVE IMAGE INTENSIFIER NIGHT SIGHT. THE AK-74 IS ALSO THE BASIS FOR OTHER 5.45X39 MM INFANTRY WEAPONS INCLUDING THE RPK-74 LIGHT MACHINEGUN.

CHINESE 5.8X42 MM BULLPUP ASSAULT RIFLE, QBZ-95



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: Unk. Date of Introduction: 1997 Proliferation: China, and 6 other countries.	Weight: 2.9 kg (6.4 lb) (QBZ-95B Carbine) 3.25 kg (7.2 lb) (QBZ-95 Rifle) 3.35 kg (7.4 lb) (QBZ-97 Export) 3.9 kg (8.6 lb) (QBB-95 LSW) Length: 609 mm (24.0 in) (QBZ-95B Carbine) 745 mm (29.3 in) (QBZ-95 Rifle) 758 mm (29.8 in) (QBZ-97 and QBZ-97A) 840 mm (33.1 in) (QBB-95 LSW) Barrel length: 369 mm (14.5 in) (QBZ-95B Carbine) 463 mm (18.2 in) (QBZ-95 Rifle) 490 mm (19.3 in) (QBZ-97 and QBZ-97A) 600 mm (23.6 in) (QBB-95 LSW)	5.8×42 mm DBP-87 5.8×42 mm DBP-95 5.8×42 mm DBP-88 heavy round (for use in the LSW and QBU-88 DSM rifle) 5.8×42 mm DBP-10 (new all-purpose round that is designed to replace all of the previous rounds above)	Action: Gas-Operated, Rotating bolt Rate of fire: ~650 rounds/min (QBZ-95) ~800 rounds/min (QBZ-95B Carbine) Muzzle velocity: QBZ-95 – 930 m/s (3,050 ft/s), QBB-95 – 970 m/s (3181 ft/s), QBZ-95B – 790 m/s (2581 ft/s) Effective firing range: Rifle – 400 m point target, 600 m area target LSW – 600 m point target, 800 m area target Carbine – 300 m point target, 500 m area target Feed system: 30-round detachable box magazine 80-round detachable drum for LSW. Sights: Hooded post front sight and aperture rear sight, optional Y/MA 95-002 telescopic sigh
		VARIANTS	
		QBZ-95B Carbine QBZ-95 Rifle QBB-95 LSW (Light Support Weapon) QBU-88 DSM Rifle	

NOTES
CHINA'S PROPRIETARY 5.8×42 MM IS INTENDED TO PROVIDE GREATER PERFORMANCE AGAINST BODY ARMOR AND HELMETS THAN RUSSIAN 5.45X39 MM AND NATO 5.56X45 MM AMMUNITION AT ALL RANGES. THE DIFFERENCES BETWEEN THE VARIOUS 5.8X42 MM ROUNDS IS IN TYPES OF PROPELLANT, DIMENSIONS OF THE STEEL CASES, AND BULLET WEIGHTS. HOWEVER THE NEW DBP-10 ROUND WILL REPLACE ALL THREE OF THE EARLIER VARIANT ROUNDS IN ALL OF THE QBZ/QBB/QBU SYSTEMS. ADDITIONALLY, THE WEAPON IS ALSO BEING PRODUCED FOR EXPORT, CHAMBERED IN 5.56X45 MM NATO, AND HAS BEEN PURCHASED BY SEVERAL OTHER SE ASIAN AND SOUTH CENTRAL ASIAN NATIONS, PRIMARILY FOR USE BY PRESIDENTIAL GUARD AND SPECIAL FORCES UNITS.

RUSSIAN 7.62X54R MM SNIPER/MARKSMAN RIFLE, SVD



SYSTEM	SPECIFICATIONS	AMMUNITION	VARIANTS
Alternative Designation: SVD, Dragunov Date of Introduction: 1963 Proliferation: Widespread Fire Mode: Semi-automatic only SIGHTS: Name: PSO-1 Type: Infrared detection capability for night firing Magnification: 4x Field of View (°): 6 Sighting Range (m): 1,300 Night Sights Available: Yes. NSPU-3. The NSPU-3 increases accuracy to 1,000 m at night or during poor visibility.	Description: Weight (kg): Loaded (with magazine): 4.5 Empty (w/o magazine): 4.3 Length (mm): Overall: 1,230 With Bayonet: 1,370 Barrel: 620 Rate of Fire (rd/min): 30 Operation: Gas Feed: 10-rd detachable box magazine (15-rd available for the SVD-S)	Name: 57-N-323S Caliber and Length: 7.62x54 mm rimmed Type: Ball, standard steel-core Range (m): Effective: 600 Effective Night: 300 sight INA Armor Penetration (mm): Steel plate: 6 @ 520 m Flak vest: Yes @ 110 m Muzzle Velocity (m/s): 828 Name: Sniper (7N1) Caliber/length: 7.62x54R mm Type: Steel core Range (m): Effective With Scope: 1,000 Effective W/O Scope: 800 Armor Penetration: INA Muzzle Velocity (m/s): 823 Name: 7N13 Caliber/length: 7.62x54R mm rimmed Type: Enhanced penetration (steel core) Range (m): Effective With Scope: 1,000 Effective W/O Scope: 800 Armor Penetration (mm): Steel Plate: 6 @ 660 m Flak Vest: 800 m Muzzle Velocity (m/s): 828 Name: 7B2-3 Bullet: B-32	SVD-S: Folding stock, 15-rd magazine. SVU: Bullpup (trigger forward of magazine). OTs-03AS: SVU w/PSO-1 sight. 6V1: SVD with PSO-1 sight. 6V1-N3: SVD with NSPU-3 night sight.

		Caliber/length: 7.62x54R mm rimmed Type: AP-I Range (m): Effective With Scope: 1,000 Effective W/O Scope: 800 Armor Penetration: 10-mm armor plate @ 200 m Muzzle Velocity (m/s): 808 Name: 7T2m Bullet: T-46 Caliber/length: 7.62x54R mm rimmed Type: Tracer Range Range (m): Effective With Scope: 1,000 Effective W/O Scope: 800 Trace (m): 1,200 Time of Trace (sec): 3 Muzzle Velocity (m/s): 798	

NOTES

THE BOLT MECHANISM AND GAS RECOVERY SYSTEM OF THE SVD ARE SIMILAR TO THOSE OF THE AK AND AKM. THE 7.62X54 MM RIMMED CARTRIDGE OF THE SVD IS NOT INTERCHANGEABLE WITH THE 7.62X39 MM RIMLESS ROUND OF THE AK-47/AKM. THE SVD PERFORMS BEST WHEN USING TARGET GRADE AMMUNITION, HOWEVER STANDARD (PKM/PKT) 7.62X54 MM RIMMED ROUNDS MAY ALSO BE FIRED. EVERY OPFOR INFANTRY SQUAD HAS AN SVD EQUIPPED DESIGNATED MARKSMAN (DM).

RUSSIAN 7.62X54R MM/7.62X51 MM NATO SNIPER RIFLE, SV-98



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: Date of Introduction: 2003 Proliferation: Russian and Armenia (current information)	Weight: 5.8 kg (12.8 lb) w/o optical sight and suppressor 7.8 kg (17.2 lb) with optical sight and suppressor Length: 1,200 mm (47.24 in) 1,375 mm (54.13 in) with suppressor Barrel length: 650 mm (25.59 in) (4 grooves, right-hand twist) Cartridge/Caliber: 7.62×54mmR or 7.62×51mm NATO Action: Bolt Muzzle velocity: 820 m/s (2,690 ft/s) Effective range: 600 m (656 yd) iron sights 1,000 m (1,094 yd) optical sight	7.62x54R mm: 7.62x54R mm 7N1 standard sniper; 7N14 enhanced penetration sniper; "Extra" match grade sports cartridges. 7.62x51 mm NATO and .338 Lapua Magnum This rifle is capable of firing standard issue ball ammo in either caliber, but the trained DSMs or Snipers that the rifle will be issued to will also have access to target quality ammunition in order to take advantage of the superb, intrinsic accuracy offered by this sniper system.	Feed system: 10-round detachable magazine Sights: Telescopic sight and iron sights Trigger is fully adjustable for weight of pull.
		VARIANTS	
		A newer variant with a modular, fully adjustable (for length of pull and comb height) aluminum alloy stock has been produced. SV-98s chambered for the .338 Lapua Magnum cartridge, have heavier actions and barrels to handle the stresses associated with that particular cartridge.	

NOTES
THE SV-98 IS USED BY RUSSIAN POLICE SNIPERS ASSIGNED TO SPECIAL PURPOSE UNITS/TEAMS, AND SOME COUNTER-TERRORIST FORCES ORGANIC TO THE FSB, MOI AND OTHER INTERNAL SECURITY AGENCIES, AND BY SPECIAL PURPOSE AND CONVENTIONAL SNIPER UNITS OF THE RUSSIAN ARMED FORCES. IT IS REPORTED TO BE THE ISSUE SNIPER RIFLE OF THE RUSSIAN AIRBORNE TROOPS (VDV). IT HAS BEEN SPECIFICALLY DESIGNED AND BUILT TO ALLOW SUCCESSFUL SNIPER ENGAGEMENTS OUT TO 1000M, WITH OPTICAL SIGHTS.

RUSSIAN 12.7X108 MM ANTI-MATERIAL RIFLE, 6S8-1



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: KSKV Date of Introduction: 2013 Proliferation: Russian Army	Weight (kg): Empty (w/o magazine or optical sight): 12.5 Length (mm): Overall: 1,420 Barrel: 1,000 Rate of Fire (rd/min): 10 Operation: Bolt action, bull pup design Feed: 5-rd detachable box magazine Max Eff Range (m): 1,500 w/optical sight; 1,000 w/iron sights. Muzzle velocity (m/s): 770-860	7N34 Sniper BZ (API) BZT (API-T Typical Combat Load: 30 est.	SIGHTS Type: Optical: Orsis T-5000 or night vision scope mounted on integral Picatinny rail. Magnification: specifics unknown, but a variable power scope Night Sights Available: yes
		VARIANTS	
		None.	

NOTES
THE LATEST IN BULL PUP DESIGN FOR A HEAVY CALIBER, ANTI-MATERIAL RIFLE.

RUSSIAN 12.7X108 MM ANTI-MATERIAL RIFLE OSV-96



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: KSVK Date of Introduction: 2013 Proliferation: Russia, Belarus, India, Syria (SA and various FSA factions, and it would be reasonable to assume, ISIL as well). Note that in Russia, this system is primarily used by Federal Security Service (FSB) and Ministry of Internal Affairs SPETSNAZ units.	Weight (kg): Empty (w/o magazine or optical sight): 12.9 Length (mm): Overall: 1,746 Barrel: 1,000 Rate of Fire (rd/min): limited to shooter's ability to acquire and engage targets and reload. 20 SPM would be a practical maximum. Operation: Semi-automatic, gas operated, rotating bolt. Feed: 5-rd detachable box magazine Muzzle velocity (m/s): 770-860 Max Eff Range (m): 2,000	7N34 Sniper BZ (API) BZT (API-T) Typical Combat Load: 30 est.	SIGHTS Type: Optical: POS 13x60 or night vision scope mounted on integral Picatinny rail. Magnification: 13x Night Sights Available: yes

NOTES

THE OSV-96 IS SOMEWHAT UNIQUE IN THAT IT CAN BE BROKEN DOWN AND FOLDED IN HALF AT THE POINT WHERE THE BARREL JOINS THE RECEIVER. THIS FACILITATES TRANSPORT OF AN OTHERWISE VERY UNWIELDY WEAPONS SYSTEM.

UNITED STATES .50-CAL ANTI-MATERIEL RIFLE, M82A1A



SYSTEM	SPECIFICATIONS	AMMUNITION	AMMUNITION
Alternative Designation: None Date of Introduction: 1984 Proliferation: Widespread (45+ nations) SIGHTS Name: Unertl Type: Optical (matches trajectory of .50-cal Raufoss Grade A) Magnification: 10x Name: Swarovski Type: Optical (with ranging reticle) Magnification: 10x42 Night Sights Available: yes Magnification: 10x42 Name: Barrett Optical Ranging System (BORS) Type: Ballistic Computer. This add-on device couples to the telescope, in place of the rear scope ring. It can then adjust for range, air temperature, round used, and other factors. A commonly associated scope is the Leupold Mark 4; but it can also work with other scopes. Night Sights Available: yes	Weight (kg): Empty (w/o magazine): 14.75 Length (mm): Overall: 1,448 Barrel: 736 Rate of Fire (rd/min): 20 Operation: Recoil Feed: 10-rd detachable box magazine Fire Mode: Semi-automatic only Typical Combat Load: 30 rounds Ammunition Types: (.50-cal cartridge) Raufoss Grade A Ball (M2/M33) AP (M2) AP-I (M8) API-T (M20) Tracer (M10/21) SLAP (M903) MP (MK211 Mod 0)	Name: Raufoss Grade A (match)(DODIC A606) (USMC) Caliber/length: .50-cal BMG/12.7x 99 mm (NATO) Type: Standard operating round Range (m) (equipment-size targets): Maximum (w/scope): 1,800 Muzzle Velocity (m/s): 854 Name: MP NM140 (Nammo) MK211 Mod 0 Caliber/length: .50-cal BMG/12.7x99 mm (NATO) Range (m) (equipment-size targets): Maximum (w/scope): 1,800 Armor Penetration: 11 mm @45° @1,000 m Fragmentation: 20 fragments after hitting 2 mm steel Incendiary Effect: Ignition of JP4 and JP8 Accuracy: <15 cm @ 550 m Muzzle Velocity (m/s): 915	Name: AP-S NM173 (Nammo) Caliber/length: .50-cal BMG/12.7x99 mm (NATO) Type: Armor piercing Range (m) (equipment-size targets): Maximum (w/scope): 1,800 Armor Penetration: 11 mm @30° @1,500 m Accuracy: <15 cm @ 550 m Muzzle Velocity (m/s): 915 Name: M903 (Olin) Caliber/length: .50 cal BMG/12.7x 99 mm (NATO) Type: Saboted Light Armor Penetrator (SLAP) (actual bullet is tungsten .30 inch penetrator wrapped in a .50-cal plastic sabot) Range (m) (equipment-size targets): Maximum (w/scope): 1,500 Armor Penetration: 19 mm (.75 in) @1,500 m Accuracy: INA Muzzle Velocity (m/s): 1,014 Name: M8 Caliber/length: .50-cal BMG/12.7x99 mm (NATO) Type: Armor piercing incendiary Range (m) (equipment-size targets):

			Maximum (w/scope): 1,800 Armor Penetration: 20 mm @ 100 m Accuracy: <25 cm @ 550 m Muzzle Velocity (m/s): 881 Name: M20 Caliber/length: .50-cal BMG/12.7x99 mm (NATO) Type: Armor piercing incendiary-Tracer Trace (m): 91 to 1,463 Armor Penetration: 20 mm @ 100 m Accuracy: <25 cm @ 550 m Muzzle Velocity (m/s): 887
		VARIANTS	
		M107-A1 is a product improvement of the M82A1A. Improvements include: reduction in weight by 5 pounds; cylindrical titanium muzzle brake; titanium barrel key/recoil buffer system in order to operate with a Barrett suppressor; functional modifications to increase durability and ease of operation. Barrett introduced this variant in 2013.	

NOTES

THE M82A1A PROVIDES MANEUVER COMMANDERS WITH THE TACTICAL OPTION OF EMPLOYING SNIPERS WITH AN ANTI-MATERIEL WEAPON TO AUGMENT PRESENT 7.62x51 MM, .300 WINCHESTER MAGNUM AND .338 LAPUA MAGNUM ANTI-PERSONNEL SNIPER RIFLES. RECOIL EQUALS 7.62X51 MM LEVELS. THE USMC USES RAUFOSS GRADE A AMMUNITION, BUT THE RIFLE IS CAPABLE OF FIRING ANY STANDARD 12.7X99 MM BROWNING MACHINEGUN AMMUNITION.

RUSSIAN 30 MM AUTOMATIC GRENADE LAUNCHER AGS-17 and AGS-30





SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: Plamya (Flame) Date of Introduction: 1974 (AGS-17); 1995 (AGS-30) Proliferation: 25 (AGS-17); 5 (AGS-30)	Crew: 3 (gunner and two riflemen-assistant gunners). For ground transport the AGS-17 breaks down into four parts: launcher, sight, tripod, and magazine. When dismounted the gunner carries the sight and launcher, the first assistant carries the tripod and a magazine, and the second assistant carries two additional magazines. An additional ammunition bearer may be used. Weight (kg): Empty (without magazine): 30.71 Loaded (with magazine): 45.05 Launcher: 17.86 Sight: .99 Tripod: 11.86 Magazine (loaded): 14.34 Length (m): 1.28 Height (m): INA Width (m): INA Tripod Name: SAG-17 Mounts: Tripod, vehicle, or helicopter Traverse (°): 30 total	Types: 30 mm grenade, Frag-HE Typical Combat Load: Dismounted 87 Name: VOG-17A, VOG-17M (self-destruct) Caliber/length: 30x132.8 mm Type: Frag-HE, with a steel wire coil and aluminum nose fuze Range (m): Direct Fire Range (m): 700 Effective (m): 1,200 Min Range (m): 50 Max Indirect Range (m): 1,730 Armor Penetration: Lightly armored vehicles. Accuracy @ 400 m (m): 4.3 distance, 0.2 deflection It is very accurate in the semiautomatic mode and is quite effective in area coverage in the automatic mode. The 50-meter increments in the range table atop the receiver indicate accuracy against point targets.	SIGHTS: Name: PAG-17 Type: Illuminated day optical sight Sighting Range (m): 1,700 Magnification: 2.7x Location: Left rear of launcher Night Sights Available: Yes. The AGS-17 is capable of mounting night vision sights, with a range of 1,500+ m. VARIANTS: AG-17: Helicopter and vehicle mount AGL with electric trigger and remote sight. The AG-17A has a water cooled quick-change barrel and rate of fire to 420-480 rd/min, with a 300 rd belt. AGS-17M: Recent version for light vehicles with pintle or ring mounts. It has a ballistic LRF sight for a range of l,730 m.

	Elevation (°): +7 to +87 Service Life of Barrel (rds): 6,000 Barrel Change Time: Quick disconnect Rate of Fire (rd/min): Practical: 60-100 Cyclic: 100-400 Adjustable with a thumb safety. May be fired single shot or in short (≤ 5 rds) or long (6-10 rds) bursts. Operation: Blowback Feed: Drum magazine containing 29 round belt. Fire Mode: Selective, automatic and semi-automatic Loader Type: Manual	Casualty Radius (m): 15 (90% at 7 m) Complete Round Weight (grams): 350 Grenade Weight (grams): 280 Warhead Explosive Weight (grams): 36 Muzzle Velocity (m/s): 185 Fuze Type: Impact, activates after 25 spins. Self-destruct time (sec): 27 Other Ammunition: Name: VOG-30 Frag-HE with grooved body for controlled fragmentation, and increased HE fill (40 g). Lethal radius is 6 m at (90%) against personnel, with increased personnel injury effects at 10m and increased anti-material effects. Name: VUS-17 smoke grenade with a red phosphorus fill. Name: GPD-30 Frag-HE grenade. It features an effects radius of 20 m. When used with the AGS-30, range is 2,100 m.	The Adunok remote operated weapon station is a light mount for use on tactical utility vehicles, trucks, etc., with the AGS-17M. It could also be secondary RWS for IFVs/APCs. AGS-30/TKB-722K AGL: Lighter version and follow-on to the AGS-17, fires the same ammunition as the AGS-17, with a max range of 2,100 m. The AGL can use the 1PN102-1 day/night sight with 3rd gen II night range of 1,500+ m (est). The AG-30 version can be heli/vehicle mounted for remote operation to 2,100 m. Arbalet: Shoulder-fired semi-auto grenade launcher. It has a 5 or 10-rd magazine, 1,000-m aimed range, and a weight of 10 kg.

NOTES

THE AGS-17 PROVIDES INFANTRY AN AREA SUPPRESSIVE CAPABILITY. ALTHOUGH PRIMARILY FOR USE AGAINST PERSONNEL, IT HAS A LIMITED CAPABILITY AGAINST LIGHT ARMORED VEHICLES. THE AGS-17 IS NORMALLY ORGANIZED IN A PLATOON CONSISTING OF 6 LAUNCHERS, CARRIED IN PAIRS IN THREE ARMORED VEHICLES (THEY CAN ALSO BE CARRIED IN TRUCKS OR BY TEAMS ON FOOT). ONE AGL CAN CREATE A DAMAGE ZONE 15 METERS WIDE. A PLATOON WITH 6 AGS-17S CAN COVER A SECTOR 90 M ACROSS.

SINGAPOREAN 40 MM AUTOMATIC GRENADE LAUNCHER CIS-40/AIR BURSTING MUNITION SYSTEM (ABM)



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: Unk. Date of Introduction: 1991 Proliferation: 18+ nations (pre ABM model)	Crew: 3- gunner, assistant gunner, ammo bearer Weight (kg): Empty (without magazine): 33 On soft mount: 52 Magazine: Metal box Capacity (rds): CIS-32 rds, US M548-48 rds Weight (M548) (loaded) (kg): 28 Weight (CIS-32 rds) (kg): 18 Barrel Length (m): .350 Length (m): .966 Length (on soft mount) (m): 1.025 Height (on soft mount) (m): .389 Width (m): .375 Width (on soft mount) (m): .47 Tripod Name: M3 Tripod Weight M3 (kg): 20 Lightweight Tripod Avail: Yes	HE DP, Self-Destruct: HE-M384/CIS S412 HE Optional: Buckshot (US) Air Bursting Munitions (See next page) Typical Combat Load: 32 rds dismounted (1 CIS can) 48 rds dismounted (1 US M548 can) 400 rds in vehicle mount S411, CIS HEDP self-destruct (data based on M430) Caliber/Length: 40x53 mm high-velocity, standard for most Western AGLs Type: HE Dual Purpose (standard round for US MK 19) Range (m): Effective: 1,500 Minimum: Arms (M430) 18 to 30 meters Maximum: 2,200 Sighting Range: 1,500 Armor Penetration (mm): 60 Kill Radius (m): 5 (M430)	Reflex sight is standard. Day optical sights and computerized laser rangefinder optical sights available. Night Sights Available: AN/PAS-13-type Thermal sight (higher tier units), or US AN/TVS-5-type II Night Vision Sight (6.5x, lower tier units)

	Mounts: Tripod, vehicle, pedestal, or turret Rate of Fire (rd/min): Rapid: 60 Sustained: 40 Cyclic: 375 Operation: Air cooled, Direct blowback with advanced primer ignition Feed: Disintegrating metal link belt (M16A2), left to right Fire Mode: Selective, automatic and semi-automatic, turret mounts (CIS 40/50) can be fired remotely Loader Type: Manual	Casualty (wound) Radius (m): 15 Complete Round Weight (grams): 340 Muzzle Velocity (m/s): 240 Fuse Type: Point Initiating Base Detonating Self-Destruct: Yes Other Ammunition Types: HEDP-M430/CIS S411 Dual Purpose, US HE M384/CIS S412, M385/CIS S416A Practice, US Buckshot, other compatible 40 mm AGL cartridges	

NOTES

ORIGINALLY DEVELOPED BY SINGAPORE CIS FOR INFANTRY SUPPORT MOUNTED ON A TRIPOD THE CIS 40AGL IS NOW AVAILABLE FOR MOUNTING ON VEHICLES AND IN TURRETS. THE CIS 40/50 IS A 40 MM AGL AND .50 CAL HMG TOGETHER IN A ONE-MAN CUPOLA AVAILABLE ON M113 SERIES OF VEHICLES. THE CIS 40AGL IS DESIGNED TO FIRE ALL US 40 MM MK 19 MOD 3 AMMUNITION. ALL CIS 40 MM AMMUNITION IS DESIGNED TO US MILITARY SPECIFICATION. WEAPONS SYSTEMS SIMILAR TO THE CIS 40AGL (LESS THE ABMS) ARE MANUFACTURED ALL OVER THE WORLD. CIS LICENSED INDONESIAN PRODUCTION AS WELL.

SINGAPOREAN AIR BURSTING MUNITION (ABM) SYSTEM



AIR BURSTING MUNTION SYSTEM (ABMS)
The ABMS consists of the Air Bursting Munition, Fire Control System (FCS), and ammunition. The system is a kit (see photo below) which fit a variety of launchers which use NATO standard 40 mm AGL ammunition. Specific systems noted include: CIS40AGL, MK19 MOD 3, ST Kinetics Super Light Weight AGL (LWAGL) and other 40 mm AGLs to fire ABM.

A similar ABMS is used in the US version of the CG-40 40 mm AGL, called M47/STRIKER. This technology is comparable to that in US OICW and OCSW programs.

Fire Control System
Name: ABMS
The ballistic FCS consists of an electronic induction ammunition programmer, laser rangefinder, optical targeting module and ballistic computer. The gunner selects a target, and the FCS programs proper detonation data into the 40 mm ABM. This detonates the ABM at the intended point. ABM is extremely effective against concealed and defilade targets. The higher probability of hits requires fewer rounds.

Day Sight: 6x
Night Sight: Integrated Gen II & Gen II+
Laser Rangefinder: Yes, integrated into the computerized FCS
Weight (kg): <5 w/bat

Air-Bursting Ammunition
Name: ABM
Caliber/Length: 40x112 mm
Type: Frag-HE
Range (m)
Effective: 1,500
Maximum: 2,200
Sighting Range: 1,500
Casualty Radius (m): INA

Complete Round Weight (grams): 340
Muzzle Velocity (m/s): 240
Fuze Type: Programmable
Arming Time: Electronic & Mechanical

Other Ammunition Types: The automatic grenade launcher with ABMS can also fire conventional 40 mm AGL grenades as noted on the previous page.

OTHER USING SYSTEMS:
LWAGL (lightweight Automatic Grenade Launcher): Singaporean 40 mm AGL with capability for firing all types of NATO-compatible grenades, as well as programming ABM grenades. The AGL, without mount and ammo, weighs 19.5 kg. With all attachments as shown below, it weighs about 64 kg.

An improved lighter design employs its own ABM system with a simpler sight system, lighter tripod, and the programmer stalk next to the muzzle, rather than on the muzzle. A smaller magazine can be used for lightweight carry.

Initial version of the LWAGL, with ABMS

CHINESE 35 MM AUTOMATIC GRENADE LAUNCHER W-87, QLZ-87, and QLB-06



QLZ-87



QLB-06

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: Unk. Date of Introduction: WLZ-87 prior to 1988 (limited production); QLZ-87 fielded in 2007 Proliferation: Several other countries have purchased this AGL, from SE Asia to South America (Bolivia).	Weight (kg): Empty (without magazine): 12 Tripod: 8 Mounts: Bipod (attached) or Tripod Operation: Blowback Feed: 6, 9-rd box, 12-rd drum, 15-rd drum Fire Mode: Semi or Automatic Loader Type: Manual Range (m): Effective, 600 Max Range, 1,500 Rate of Fire (rd/min): 400 Muzzle Velocity (m/s): 170	35 mm grenades: Frag-HE: Caliber/length: 35x32 mm Type: Frag-HE Grenade Fill: HE and 400 3 mm steel balls Armor Penetration: Penetrates body armor Lethal Radius (m): 11 Complete Round Weight (grams): 270 Muzzle Velocity (m/s): 170 HEAT-MP: "HEAT" Caliber/length: 35x32 mm Type: HEAT-multipurpose (with anti-armor HEAT warhead and anti-personnel/anti-materiel HE blast effects) Armor Penetration: 80 mm @ 600 m Lethal Radius (m): 5 for HE effects Complete Projectile Weight (grams): 270 Muzzle Velocity (m/s): 170	Typical Combat Load: Crew load of 36 rds., in drums of 6, 9, 12, or 15 rds.

		VARIANTS
		WLZ-87: Early prototype, found in few units. **QLZ-87: Updated lighter variant of the W-87, adopted for PLA forces. It comes in standard and heavy configurations. The standard version, with a bipod and telescope, weighs 12 kg, and has an anti-armor range of 600m. Range with the Frag-HE grenade is 1,000-1,750 m. The heavy version is more suitable for vehicle pintle mount or dismounted tripod. It is scoped, weighs 20 kg, and ranges to 1,750 m.** **QLB-06/87B: Recent lightweight shoulder version (9.1 kg), which also fires HEAT-MP grenades to 600 m, Frag-HE to 1,000 m, and has a rate of fire of 500 rds/min. The launcher has a 3x day telescope, EO night sight, bipod, and uses 6 or 15 rd grenade drums.**

NOTES
THE W-87 IS SIGNIFICANT IN THAT IT WEIGHS A LITTLE MORE THAN A MEDIUM 7.62X54R/7.62X51 MM GP MG (PKM 18.5 LBS/U.S. M60 MG 32 LBS). IT IS SMALLER AND LIGHTER THAN THE AGS-17 BUT STILL PROVIDES THE INFANTRYMAN WITH THE ABILITY TO DESTROY LIGHTLY ARMORED VEHICLES AT 2 TO 3 TIMES THE RANGE OF THE MAJORITY OF INFANTRY LIGHT AT SYSTEMS. TEN 35-MM W-87 ROUNDS WEIGH LESS THAN 100 LINKED 7.62 ROUNDS. THE 35 MM ROUNDS ARE PROBABLY MORE EFFECTIVE AGAINST POINT TARGETS AT MEDIUM TO LONG RANGES THAN BALL 7.62 MM. OTHER UNIT MEMBERS CAN CARRY ADDITIONAL AMMUNITION AS NEEDED, AND CAN BREAK DOWN LOAD INTO SMALLER INCREMENTS FOR EASIER CARRY.

RUSSIAN 43 MM GRENADE LAUNCHER GM-94





SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: Some sources state that the GM-94 is the same weapon as Infantry Flamethrower LPO-97; but KBP, the manufacturer, lists them separately. Date of Introduction: 2007 Proliferation: Russian Ministry of Internal Affairs, and Russian military Special Purpose Forces.	Weight (kg): Empty: 4.8 Length (mm): With stock folded: 540 With stock extended: 810 Width (mm): 80 Height (mm): 320 with folded stock Rate of Fire (rd/min): 12 (salvo of 4 in 8seconds, 4 reloads, est) Operation: Pump action Feed: Over-barrel magazine Fire Mode: Semi-automatic	Ammunition Types, 43 mm grenade HE Thermobaric Non Lethal: Shock effect Smoke Tear gas Name: VGM-93.100 Caliber/length: 43 mm Type: HE thermobaric, with impact fuze. The round has a plastic nose with the explosive fill. It deforms and detonates against hard and soft targets. Weight (kg): INA Range (m): Maximum: 600 Maximum Sighted: 300 Casualty Radius (m): 3 With no metal fragments, the round can be used for room-to-room clearance of buildings (3-m lethal radius), with minimum damage to nearby personnel (5-m safe distance). Concussive effect from the blast will debilitate or shock personnel over a wider area than with the Shock Effects grenade noted below. Armor Penetration (mm): 8. The deforming round permits armor penetration against light armor, such as that found on tactical utility vehicles, trucks, etc. The round can destroy materiel targets.	SIGHTS: Type: Front post and rear open U-notched, 2 blades Location: Top of magazine Sighting Range (m): 300 TYPICAL COMBAT LOAD: For dismounts 16 From vehicles <48 Single Load 4 (1 in chamber, 3 in magazine)

		Muzzle Velocity (m/s): 85+ **Other Ammunition Types: Non-lethal grenades: Smoke, shock effect, and tear gas.** **The Shock Effect grenade is a "flash-bang" non-lethal grenade for temporarily pacifying persons in a target area, aiding discrimination of targets from neutral personnel in the area.** **Tear gas grenade effectiveness area is 100 m^2 against personnel in the open or 300 m^2 against personnel in enclosed areas.**	

NOTES
THERE ARE REPORTS OF FRAG-HE GRENADES FOR THIS WEAPON (VGM-93.900). AS MILITARY FORCES APPLICATIONS WILL CERTAINLY REQUIRE FRAG-HE GRENADES, THIS MAKES PERFECT SENSE AND IS IN NO WAY A TECHNICAL CHALLENGE TO PRODUCE FOR USE IN THIS PARTICULAR GL.

RUSSIAN 30 MM UNDER BARREL GRENADE LAUNCHER GP-30



SYSTEM	SPECIFICATIONS	AMMUNITION	VARIANTS
Alternative Designation: BG-15 Mukha; GP-25 Koster, GP-30 Obuvka Date of Introduction: 1980 Proliferation: Widespread SIGHTS: Type: Front post and rear open U-notched Location: Left side of mounting bracket Sighting Range (m): Graduated out to 400	Weight (kg): Loaded: 1.79 Empty: 1.5 Length (mm): Overall: 323 Barrel: 205 Rate of Fire (rd/min): 4-5 Operation: N/A Feed: Muzzle-loaded Fire Mode: Single-shot Accuracy @ 400 m: Distance: 6.7 m Deflection: 3 m Components: Barrel (w/ mounting bracket and sight), trigger assembly	40 mm caseless grenade: Frag-HE (impact) Frag-HE (bounding) Smoke Tear gas Combat Load: 10 rounds Name: VOG-25 Caliber/length: 40x102 mm Type: Frag-HE with impact fuze Weight (kg): Round: .250 Explosive: .048 Range (m): Maximum: 400 Minimum: 10–40 (arms itself) Casualty Radius (m): 6; (90% @ 10) Self-destruct Time (sec): 14–19 Muzzle Velocity (m/s): 76 Name: VOG-25P Caliber/length: 40x122 mm Type: Bounding Frag-HE, explodes .5 to 1.5 m from impact Weight (kg): Round: .278	BG-15, GP-25: (see NOTES)

		Explosive: .037 Range (m): Maximum: 400 Minimum: 10 – 40 (arms itself) Casualty Radius (m): 6; 90% @ 10 Self-destruct Time (sec): 14 – 19 Muzzle Velocity (m/s): 75 Name: GRD-40 Caliber/length: 40x150 mm Type: Smoke Effective Against: Visual and infrared Weight (g): 260 Smoke Screening Range (m): 50, 100, 200 Smoke Screen Dispersion (m): 1 sec 10x10x10 2 sec 20x20x20 3 sec 25x25x25 Smoke Screen Duration @ wind speed of 3-5 m/s: At least 60 sec Muzzle Velocity (m/s): 70-75 Other Grenades: Gvozd ("Nail") tear gas grenade	

NOTES

THE GP-30 OBUVKA IS A WIDELY PROLIFERATED, MUZZLE-LOADED, SINGLE-SHOT, DETACHABLE, UNDER-BARREL GRENADE LAUNCHER. THE BG-15, GP-25 AND THE GP-30 ARE ALL BASICALLY THE SAME WEAPON. VARIANTS CAN BE MOUNTED ON ALL MODELS OF KALASHNIKOV ASSAULT RIFLES. THE RIFLEMAN CAN FIRE THE LAUNCHER ONLY WHEN THE COMPLETE WEAPON IS ATTACHED TO THE ASSAULT RIFLE.

RUSSIAN REVOLVING 40 MM GRENADE LAUNCHER RG-6



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: 6G30 Date of Introduction: 1994 Proliferation: Russian Army and MVD (Internal Security Forces).	Hand-held 40 mm grenade launcher with 6-shot revolver Type cylinder. The launcher is 690 mm long (520 with buttstock retracted) and weighs 6.2 kg unloaded. With swing-out cylinder for fast loading and double action trigger, it can deliver a high volume of precision fire (16 rd/min) to 350 m.	The RG-6 fires the same 40 mm caseless grenades listed for the GP 30 under barrel GL.	

NOTES
AN INTERESTING GL THAT IS VERY MUCH A COPY OF VARIOUS HAND HELD CYLINDER FED GLS MADE IN OTHER COUNTRIES.

RUSSIAN 7.62X39 MM LIGHT MACHINEGUN RPD



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designations: Degtyarev Date of Introduction: 1944 Proliferation: Widespread	Weight (kg): Empty (w/o magazine) (kg): 7 Loaded (with magazine): 13 Mount: Bipod Length (mm): Overall: 1,037 Barrel: 520 Quick Change Barrel: No Rate of Fire (rd/min): Cyclic: 600 Practical: 150 Fire Mode: Automatic Operation: Gas Feed: Metallic-link belt, 100-rd drum (containing belt). The Chinese copies may use 200-rd drums.	Name: M1943 (57N231S) Caliber/length: 7.62x39 mm Type: Ball, steel core Range (m): Effective: 800 Maximum: 800 Armor Penetration: 6 mm mild steel plate at 300 m Steel helmet at 1,000 m Flak vest at 60 m Muzzle Velocity (m/s): 718 Name: M1943 (T-45 or 57N231P) Caliber/length: 7.62x39 mm Type: Ball-Tracer Range Effective: 800 Maximum: 800 Trace (m): 800 Muzzle Velocity (m/s): 718 Name: M1943 Caliber/length: 7.62x39 mm Type: API Armor Penetration (mm @ 0° obliquity @ 500m): 8 Muzzle Velocity (m/s): N/A	Sights: Type: Leaf sights Sighting range (m): 900 in 100 meter increments. Magnification: None Night Sights Available: Yes
		VARIANTS	
		Type 56 & 56-1: Chinese Type 62 Light MG: North Korean M52: Czech	

NOTES
THE RPD CAN BE USED AS AN ASSAULT RIFLE. THE USE OF THE DRUMS FOR AMMO CAN MAKE CARRYING THE AMMUNITION EARLIER THAN CARRYING LARGE AMMUNITION BOXES. IT WAS REPLACED BY THE RPK (WHICH WAS IN-TURN REPLACED BY THE RPK-74) BY SEVERAL ARMIES. THIS RELIABLE LIGHT MACHINEGUN IS STILL FOUND IN LARGE NUMBERS THROUGHOUT THE WORLD. IT IS THE MAINSTAY OF MANY MILITIAS. THESE WEAPONS ARE NUMEROUS, EASY TO ACQUIRE, RELIABLE, LETHAL, AND CHEAP.

RUSSIAN 7.62X39 MM LIGHT MACHINE GUN RPK



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: None Date of Introduction: 1964 Proliferation: Widespread	Weight (kg): Empty (w/o magazine) (kg): 4.9 Loaded (with magazine): 5.67 w/40-rd mag Mount: Bipod Length (mm): Overall: 1,035 Barrel: 591 Quick Change Barrel: No Rate of Fire (rd/min): Cyclic: 650 Practical (auto): 150 (80 sustained, see note) Practical (semi): 50 Fire Mode: Selective Operation: Gas Feed: 40 round-curved box or 75-rd drum magazine. Can also use the 30-round curved box magazine used by the AKM.	M1943 (57N231S) Caliber/length: 7.62x39 mm Type: Ball, steel core Range (m): Effective: 800 Maximum: 800 Armor Penetration: 6 mm mild steel plate at 300 m Steel helmet at 1,000 m Flak vest at 60 m Muzzle Velocity (m/s): 718 M1943 (T-45 or 57N231P) Caliber/length: 7.62x39 mm Type: Ball-Tracer Range Effective: 800 Maximum: 800 Trace (m): 800 Muzzle Velocity (m/s): 718 M1943 Caliber/length: 7.62x39 mm Type: API Armor Penetration (mm @ 0° obliquity @ 500m): 8 Muzzle Velocity (m/s): N/A	SIGHTS Name: N/A Type: Leaf sights Magnification: None Night Sights Available: yes, (luminous front/rear)
		VARIANTS	
		RPKS: Folded stock version (820 mm in length)	

NOTES
THE RPK IS THE LIGHT MACHINEGUN VARIANT OF THE AKM AND AS SUCH IS AN EXTENDED VERSION OF THE AKM. IT HAS A LONGER, HEAVER BARREL THAN THE AKM (591 MM VS 414 MM). MOST MOVING PARTS ARE INTERCHANGEABLE WITH THE AK-47 OR AKM ASSAULT RIFLES. THE SUSTAINED RATE OF FIRE CANNOT EXCEED 80 RDS PER MINUTE DUE TO "COOK OFF". IT HAS BEEN REPLACED BY THE 5.45 MM RPK-74 IN MANY ARMIES. THE RPK FILLS THE ROLE OF A SQUAD LEVEL SUPPORT WEAPON.

RUSSIAN 5.45X39 MM LIGHT MACHINE GUN RPK-74



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: Unk. Date of Introduction: Late 70s. Proliferation: Widespread.	Weight (kg): Loaded (with magazine): 5.0 Empty (w/o magazine): 4.6 Length (mm): Overall: 1.07 m Barrel: 590 mm (including flash suppresser) Rate of Fire (rd/min): Cyclic: 600 Practical: Automatic: 150 Semiautomatic: 50 Operation: Gas Feed: 40-rd detachable box magazine (30-rd used by AK-74 is interchangeable) Fire Mode: Selective, automatic or semi-automatic	7N6 Caliber/length: 5.45x39 mm Type: Ball Range (m): Effective: 800 Maximum: 1,000 Armor Penetration: 6 mild steel at 300 m, flak vest at 80 m Muzzle Velocity (m/s): 960 7N10 (Enhanced Penetration) Caliber/length: 5.45x39 mm Type: AP Range (m): Effective: 1,000 Maximum: 1,000 Armor Penetration (mm): 16 mild steel at 300 m 5 armor plate at 150 m Flak vest 200 m Muzzle Velocity (m/s): 960 7T3M Caliber/length: 5.45x39 mm Type: Ball-Tracer Range (m): Effective: 800 Maximum: 1,000 Trace: 850 Armor Penetration: INA Muzzle Velocity (m/s): 960	SIGHTS Name: INA Type: Fore, cylindrical post; rear, tangent leaf with U-notch; adjustable to 1,000 m Magnification: None Night Sights Available: Yes. 1LH51 night sight

NOTES

THE RPK-74 IS THE MACHINEGUN (SQUAD LEVEL SUPPORT) VERSION OF THE AK-74, FIRING THE SAME AMMUNITION. INSTEAD OF THE PROMINENT MUZZLE BRAKE USED ON THE AK-74, THE MACHINEGUN IS LONGER THAN THAT

NORMALLY USED WITH THE AK-74, BUT THE MAGAZINES ARE INTERCHANGEABLE. THE RPK-74 HAS A BIPOD AND IS COMPATIBLE WITH THE FRONT FIRING PORTS OF BMPS.

RUSSIAN 7.62X54R MM GENERAL PURPOSE MACHINE GUN PKM AND PECHENEG (PKP)



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: See Variants. Date of Introduction: (PKM/PKT/PKP): 1971/1968/2001 Proliferation: Widespread (PKM/PKT) NOTE: Picture, above, is of a PKP (Pecheneg).	Crew: 2 Weight (kg): Empty (w/o magazine) (PKM/PKT) (kg): 8.4/10.66 Loaded (with magazine): Varies with magazine Ammo box (only) with 100/200-rd belt (kg): 3.9/8.0 Tripod (lightweight) (kg): 4.75 Length (mm): Overall (PKM/PKT): 1,160/1,080 On tripod (PKS): 1,267 Barrel: 658 Barrel Change: Yes Mount Type: Pintle, coaxial, bipod or tripod (Stepanov) Mounted On: (see VARIANTS) Rate of Fire (rd/min): Cyclic: 650 Practical: 250 (PKM) Up to 600 for Pecheneg/PKP Fire Mode: Automatic Operation: Gas Feed: Belt, 100-rd belt carried in a box fastened to the right side of the receiver. 25-rd belts can be joined in several combination lengths (100/200/250)	57-N-323S Caliber and Length: 7.62x54R mm Type: Ball Max Range (PKM/PKT) (m): 3,800/4,000 Practical Range (PKM/PKT) (m): Day: 1,000/2,000 Night: 300/INA Armor Penetration @ 0° obliquity, and 500 range (mm): 8 steel plate @ 520 m (mm): 6 Flak vest: 110 m Muzzle Velocity (PKM/PKT) (m/s): 825/855 7BZ-3 Caliber and Length: 7.62x54R mm Type: Armor piercing incendiary Max Range (PKM/PKT) (m): 3,800/4,000 Practical Range (PKM/PKT) (m): Day: 1,000/2,000 Night: 300/INA Armor Penetration @ 200 range (mm): 10 Muzzle Velocity (PKM/PKT) (m/s): 808	Type: Open iron sights Sighting range (PKM/PKT) (m): 1,500/2,000 Magnification: None Night Sights Available: Yes

		VARIANTS
		PKM: Squad machinegun PKT: Vehicle mounted MG with solenoid electric trigger, remote sight, and a longer heavier barrel. It lacks a stock and, bipod. Some are coaxial to a main gun and use its sights. Others operate separately. They generally do not dismount for ground use. PKS: Lightweight tripod-mounted infantry weapon PKMS: Lightweight tripod-mounted variant of the PKS PKB (PKBM): Pintle-mounted on APCs, SP guns, BRDM, BTRs, has butterfly trigger rather than solenoid, double spade grips, and front and rear sights

NOTES
THE 7.62X54R MM GENERAL-PURPOSE MACHINEGUN (PKM) IS A GAS-OPERATED, BELT-FED, SUSTAINED-FIRE WEAPON. THE BASIC PKM IS BIPOD-MOUNTED BUT CAN ALSO FIT IN VEHICLE FIRING PORTS. IT IS CONSTRUCTED PARTLY OF STAMPED METAL AND PARTLY OF FORGED STEEL. THE NEWER VARIANT PKP (PECHENEG) FEATURES IMPROVED COOLING SYSTEM, AND A HEAVY, FIXED BARREL THAT DOES NOT REQUIRE CHANGING NOR CAN IT BE CHANGED BY THE CREW. IT IS DESIGNED TO FILL THE ROLE OF A TRUE, SQUAD LEVEL GPMG FOR SUPPORT IN RUSSIAN INFANTRY AND SPETSNAZ UNITS.

RUSSIAN 12.7X108 MM HEAVY MACHINE GUN DSHK 38/46



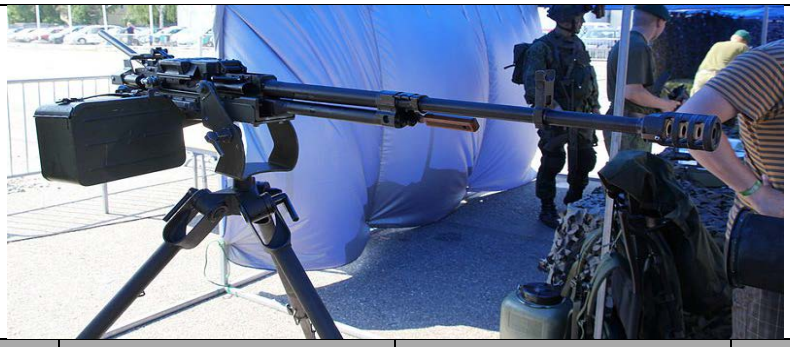
SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: DShKM, Degtyarev, DShK 38 Date of Introduction: 1946 Proliferation: Widespread	Weight (kg): Empty (gun only): 36.6 w/Mount: 158 Length (mm): Overall: 1,588 Quick-change Barrel: Yes Barrel Length (mm): 1,070 Mount Type: Vehicle, wheels, or tripod (M1938) Traverse (°): 90, free on tripod Elevation (°): -10 to +80, free on tripod Rate of Fire (rd/min): Cyclic: 540-600 Practical: 80-100 Fire Mode: Automatic only Operation: Gas, fires from open bolt Feed: 50 round non-disintegrating metallic belt (feed from both sides)	Ball API (B-32) API-T (BZT-44) HEI Combat load: 750 Name: B-32 Caliber and Length: 12.7x108 mm Type: Armor Piercing Incendiary Max Range (ground) (m): 7,850 Effective Range (m): AA: 1,000 Ground: 2,000 Armor: 800 Night (w/1PN52-1): 1,000 Armor Penetration @ 0° obliquity @ 500/1,000m range (mm): 20/13.2 Muzzle Velocity (m/s): 860	Name: NFI Type: metallic leaf sights Sight Range (m): 2,000 Name: Model 1943 Antiaircraft Sights Type: Computing AA sight Night Sights Available: Yes
		VARIANTS	
		DShKT: Tank mounted Chinese Type 54 Heavy Machinegun	

		Czech M54 Quad Mount	

NOTES

THE DSHK 38/46 IS A WIDELY PROLIFERATED HEAVY MACHINEGUN GENERALLY USED AS AN ANTI-AIRCRAFT OR ANTI-VEHICLE WEAPON. MANY COUNTRIES USE THE DSHK 38/46 ON VEHICULAR MOUNTS WHILE OTHERS USE IT MOSTLY ON ITS GROUND MOUNT. MANY ASIAN COUNTIES USE A 2-WHEEL MOUNT IN THE GROUND ROLE. THE M1938 TRIPOD IS USED FOR GROUND FIRE BUT CAN BE READILY CONVERTED FOR AA FIRE. M38 AND M46 AMMO BELTS ARE NOT INTERCHANGEABLE. A LARGE FLAT ARMORED SHIELD IS OCCASIONALLY USED TO PROTECT THE CREW WHEN THE GUN IS USED IN ITS GROUND ROLE. IN MANY COUNTRIES THIS WEAPON WAS REPLACED BY THE 12.7X108 MM NSV IN THE GROUND ROLE OR BY THE HEAVIER 14.5x114 MM ZPU SERIES IN THE ANTIAIRCRAFT ROLE.

RUSSIAN 12.7X108 MM HEAVY MACHINE GUN NSV/NSVT/KORD



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: NSVS (when mounted on tripod) Date of Introduction: 1974 Proliferation: Widespread. The original plant is in Kazakhstan (NSV/NSVT). After dissolution of the USSR, a Russian plant now produces the KORD HMG. NOTE: The HMG in the above picture is of a Finnish NSV.	Weight (kg): Total System (w/6T7): 43 Empty: 25 Loaded: INA Tripod (6T7 tripod): 16 Length (mm): Overall: 1,560 On 6T7 Tripod: 1,900 Width (on 6T7 tripod) (mm): 860 Height (on 6T7 tripod) (mm): 380 Barrel Life (rds): 5,000 Barrel Change Time (sec): 5 Barrel Weight (kg): 9.2 Mount Type: 6T7 (infantry) tripod or 6U6 (w/seat) universal tripod Mounted On: (see VARIANTS) Traverse (°): 360 Elevation (°): -5 to +75 Rate of Fire (rd/min): Cyclic: 680-800 Practical: 100 Fire Mode: Automatic; short bursts (four to six), long bursts (10 to 15), or continuously Operation: Gas Feed: Left or right from metal link belt from 50-rd boxes	12.7x108 mm cartridge API (B-32) API-T (BZT-44) HEI Typical Combat Load: 300 rds Name: B-32 Caliber and Length: 12.7x108 mm Type: Armor Piercing Incendiary Max Range (grd) (m): 7,850 Effective Range (m): AA: 1,000 Ground: 2,000 Armor: 800 Night (w/1PN52-1): 1,000 Armor Penetration @ 0° obliquity @ 500/1,000m range (mm): 20/13.2 Muzzle Velocity (m/s): 860	SIGHTS Name: INA Type: Metallic sights, (tangent leaf rear and folding front post) Sight Range (m): 2,000 Name: 10P50 Optical Type: Day optical sight Magnification: 3-6x Name: 1PN52-1 Type: Night sight Magnification: 5.3x Name: 10P80 (used w/ 6U6 mount) Type: AA collimating sight (aircraft speed to 300 km/h) Name: 10P81 (used w/ 6U6 mount) Type: Ground target sight Name: K10-T (on NSVT for T-72/T-80) Type: Reflex AA sight

		VARIANTS	
		NSVT: Tank-mounted version (See NOTES) A tripod-mount (6T7) version is available for infantry use in a ground role. However, the NSVT appears more commonly mounted on the turrets of tanks as an antiaircraft machinegun. Russian NSV/NSVT: The Russian version can produce the guns for either Russian 12.7x108 mm or NATO 12.7x 99 mm (.50-cal) ammunition. Kord: A Russian modernized version of the NSV/NSVT. Improvements include reduced weight (50% for hand-carry 6P57), reduced recoil, increased barrel life, improved reliability, improved accuracy, increased burst rate capacity, and improved reliability and maintenance. Reduced weight and recoil permits use with the 6T19 light machinegun bipod. Like the above Russian MGs, the Kord can be produced in either ammunition version. Vehicle version is 6P49. Swivel mount hand-operated versions are 6P58 and 6P59.	

NOTES

ON THE T-72 AND THE T-80, IT HAS A ROTATING MOUNT AND CAN BE FIRED FROM WITHIN THE TANK. THE TANK COMMANDER EMPLOYS THE K10-T REFLEX SIGHT TO ENGAGE AIRCRAFT. ON THE T-72/T-80 MOUNT HE ENGAGES GROUND TARGETS WITH METALLIC SIGHTS ON THE GUN ITSELF. THE T-64 TANK MOUNTS A MODIFIED VERSION WITH A FIXED MOUNT ON THE COMMANDER'S CUPOLA. IT FIRES BY MEANS OF AN ELECTRICAL SOLENOID WHEN THE TANK IS BUTTONED UP AND AN OPTICAL SIGHT INSIDE THE CUPOLA IS USED. INSTEAD OF THE NORMAL 50-ROUND AMMUNITION BELT CONTAINER, THE NSVT ON THE T-64 MAY USE A LARGER BELT CONTAINER HOLDING 200 ROUNDS.

UNITED STATES BROWNING HEAVY MACHINE GUN, CALIBER .50 M2 HB



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: M2A1, AN/M2, M296, M213, etc. Date of Introduction: 1933 Proliferation: Widespread	Weight (kg): Empty (gun only): 38 w/tripod and T&E: 58 Length (mm): Overall: 1,654 Quick-change Barrel: Yes Barrel Length (mm): 1,143 Mount Type: Vehicle or tripod. Rate of Fire (rd/min): Cyclic: 450-550 Sustained: ~40 Fire Mode: Automatic or single shot Operation: Short recoil, closed bolt Feed: Belt fed (M2 or M9 links), 110 round belts.	Ball M33 Tracer M17 API M8 API-T M20 SLAP M903 SLAP-T M962	Caliber and Length: .50 Caliber/12.7x99 mm Max Range (ground) (m): 6,800 Effective Range (m): 1,800 Muzzle Velocity (m/s): 890 (M33 Ball) VARIANTS: M2A1: Latest version (2010); does not require head space and timing adjustments by crew. Max eff range of approx 2,000m. SIGHTS: Type: metallic leaf sight (rear) and blade front w/cover. Sight Range (yds): 2,600

NOTES

THE BROWNING M2 IS A WIDELY PROLIFERATED HEAVY MACHINEGUN GENERALLY USED AS AN ANTI-AIRCRAFT OR ANTI-VEHICLE WEAPON. MANY COUNTRIES USE THE M2 ON VEHICULAR MOUNTS OR ON THE TRIPOD WITH ISSUED T&E FOR A VERY EFFECTIVE GROUND WEAPON FOR USE AGAINST VEHICLES OR TROOPS IN THE OPEN OR IN BUILDINGS. THE M2 CAN BE EQUIPPED WITH NIGHT OR DAY SCOPES, AND CAN BE USED AS A VERY EFFECTIVE SNIPER WEAPON WHEN EQUIPPED WITH A TELESCOPIC SIGHT AND USED IN ITS SINGLE SHOT MODE WITH SPECIAL AMMUNITION.

RUSSIAN 40 MM ANTITANK GRENADE LAUNCHER RPG-7V



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: N/A Date of Introduction: 1962 Proliferation: 70+ countries	Crew: 2 RPG-7V is light enough to be carried and fired by one person if needed. With a crew of 2, an assistant grenadier normally deploys left of the gunner to protect him from small arms fire. The full set has two bags: one has two grenades, spare parts, tools and accessories. The other has three more grenades. Caliber Launcher (mm): 40 The grenade warhead is forward of tube. Thus grenade diameter can be 105 mm or more. Weight (kg): 7.9 empty, loaded varies with grenade Length (mm): 950 Rate of Fire (rd/min): 4-6 Fire From Inside Building: No	40 mm grenade PG-7V PG-7VM PG-7VS PG-7VL PG-7VR TBG-7V OG-7V OG-7VM Combat load: 5 rockets Grenade Components: Warhead, rocket motor, tail assembly Name: PG-7V (Chinese variant is the Type 69) HEAT Caliber: 85 mm Type: HEAT (shaped-charge) Range (m): 500 effective, 300 vs moving targets Penetration: Armor (mm CE): 300 Concrete (m): .6 + Brick (m): 10 + Earth (m): 1.5 + Length (mm): INA Weight (kg): 2.2 The original (1962) PG-7 warhead had inconsistent lethality (260-330 mm) and an unreliable fuze. Many early foreign copies had the same problems. In 1965 they were corrected on the Russian standard PG-7V.	SIGHTS Name: PGO-7V Type: Optical illuminated Magnification: 2.7x, 13 of view Location: Top of launcher/sight-left side Sighting Range (m): 500 Name: PGO-7V3 (RPG-7V1 sight with longer range) Name: UP-7V For RPG-7V1, a telescopic collimating attachment fits on PGO-7V3 sight and extends sight range for larger munitions Night Sights Available: NSP-3, NSP-2 (IR), NSPU, PGN-1 (II), 1PN58 (II), 1PN51, 7V1N3

		The RPG-7V grenade launcher fires a variety of rocket-assisted grenades from its 40 mm smoothbore launcher tube. With grenade warheads outside of the tube, grenades can vary for different uses. AT grenade sizes have increased to match increased tank armors. **Name: PG-7VM replaced PG-7V in Russian forces in 1969.** **Caliber: 70.5 mm** **Type: HEAT (shaped-charge)** **Range (m): 500 effective** **Penetration:** **Armor (mm CE): 330 +** **Concrete (m): .7 +** **Brick (m): 1 +** **Earth (m): 1.8 +** **Muzzle Velocity (m/s): 140** **Length (mm): 950** **Weight (kg): 2** **Name: PG-7VS** **Caliber: 72 mm** **Type: HEAT (shaped-charge)** **Range (m): 500 effective** **Penetration:** **Armor (mm CE): 400 +** **Reinforced Concrete (m): 1 +** **Brick (m): 1.5 +** **Earth (m): 2.4 +** **Muzzle Velocity (m/s): INA** **Length (mm): INA** **Weight (kg): 2** **Name: PG-7VL adopted in 1977** **Caliber: 93 mm** **Type: HEAT (shaped-charge)** **Range (m): 300 effective** **Penetration:** **Armor (mm CE): 600** **Reinforced concrete (m): 1.2 +** **Brick (m): 1.7 +** **Earth (m): 2.4 +** **Muzzle Velocity (m/s): 112** **Length (mm): 980** **Weight (kg): 2.6**	

		Name: PG-7VR (uses RPG-7V1 launcher sights) Caliber: 105 mm Type: Tandem (same basic warhead as RPG-29) Range (m): 200 effective Penetration: Armor (mm CE): 750 + behind ERA; 950 + conventional Reinforced Concrete (m): 1.5 + Brick (m): 2 + Earth (m): 3.7 + Muzzle Velocity (m/s): INA Length (mm): 1,306 Weight (kg): 4.5 Name: Type 69 or DZGI-40 (Airburst, Chinese) Caliber: 75 mm Type: APERS (Anti-personnel), bounds 2 m prior to detonating Range (m): 1,500 effective Lethal Radius (m): 18 with 800 steel balls Name: HE/HEAT-MP (Chinese) Caliber: 92 mm Type: HE and HEAT effects, and 1,500 steel fragments Range (m): 600 HEAT, 1,800 vs soft targets in Type 69 launcher Casualty Radius (m): 20 against soft targets Name: OG-7VM Caliber: 40 mm Type: Frag-HE Range (m): 1,000 effective Casualty Radius (m): INA Muzzle Velocity (m/s): 145 Length (mm): 595 Weight (kg): 1.7 Name: OG-7V Caliber: 40 mm Type: Frag-HE Range (m): Effective: 280 (RPG-7V) Effective: 350 (RPG-7V1) Effective: 700 (RPG-7V1 w/UP-7V)	

		Max: 950 **Casualty Radius (m): 7 m w/flak vests on.** **Muzzle Velocity (m/s): 152** **Length (mm): 569** **Weight (kg): 1.7** **Name: TBG-7V (uses RPG-7V1 launcher sights)** **Caliber: 105 mm** **Type: Thermobaric (similar to RPO-A warhead)** **Range (m):** **Effective: 200 (RPG-7V)** **Effective: 550 (RPG-7V1 w/UP-7V)** **Max Range: 700** **Penetration:** **Armor (mm): INA** **Brick (m): +1.5** **Reinforced concrete (m): + 1.5** **Casualty Radius (m): Neutralizes personnel in trenches and bunkers at 2 m from a trench or bunker opening. Neutralizes a 300 m2 area.** **Muzzle Velocity (m/s): INA** **Length (mm): INA** **Weight (kg): 4.5** **Other Ammunition:** **More than 2 dozen countries produced improved grenades. European grenade options include HEAT grenades with penetration of 600 mm or more (including the Czech PG-7M 110, with 700 mm penetration).** **Anti-personnel (APERS) grenades are generally Frag-HE (see above). Other APERS include Czech Type 69. Several countries offer rockets to fit 60/82 mm mortar rounds for RPG-7V launch. This feature can extend ammunition availability and lethal area for this weapon.**	

		Other grenades include tear gas, illumination, incendiary, and multi-purpose. Multi-purpose grenades include dual-purpose (e.g., Chinese HE/HEAT-MP above), thermobaric multi-purpose (Romanian GTB-7G), and Incendiary-HE (Chinese 76mm). A private venture is the PG-7VYA HEAT grenade, with an optional spacer insert. Adding the insert changes it to a multi-purpose Frag-HE grenade. A modern trend is to give shoulder-launch weapons precision close to that of ATGMs. The RPG-7V achieves that with the Israeli G-LAW, a semi-active laser-homing HEAT grenade with precision to 800 m.	
		VARIANTS	
		This is the most widely proliferated infantry AT system in the world. There are dozens of copies and variants of this launcher. RPG-250: Prototype and test base for the RPG-7V. RPG-7B1N3, -7N, and -7N1: Night site variant RPG-7V1: Upgrade w/bipod and improved PGO-7V3 sight. This is the standard production ATGL version since the late 1990s. RPG-7D, RPG-7DV1, and RPG-7D2N3 (night): Folding variants used by airborne troops. RPG-7D3 is the airborne counterpart to RPG-7V1. Type 69-1, II, III: Chinese upgrades variants with lighter weight, a wide range of munitions, and 3.0 x longer range sights.	

NOTES
RPG-7V IS THE STANDARD (TIER 4) SQUAD ANTITANK WEAPON IN USE BY THE OPFOR. IT REQUIRES A WELL-TRAINED GUNNER TO ESTIMATE RANGES AND LEAD DISTANCES FOR MOVING TARGETS. THE RPG-7V HAS BEEN USED TO SHOOT DOWN HELICOPTERS IN SEVERAL CONFLICTS.

RUSSIAN 72.5 MM ANTITANK DISPOSABLE LAUNCHER RPG-22



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: INA Date of Introduction: 1985 Proliferation: 9 countries	Crew: 1 Caliber (mm): 72.5 Weight (kg): 2.8 Length (mm): Firing Position: 850 Travel Position: 750 Rifling: None Breech Mechanism Type: N/A Rate of Fire (rd/min): N/A (disposable) Fire From Inside Building: No, as back blast is out to 30 m behind the weapon.	Combat Load: INA Caliber: 72.5 mm Type: HEAT Range (m): Effective: 250 Arming Range: INA Penetration: Armor (mm CE): 390 Brick (m): 1.2 Reinforced Concrete (m): 1 Muzzle Velocity (m/s): Initial: 133 Maximum: 300 Length (mm): 618 Weight (kg): 1.48	SIGHTS: Type: Iron, calibrated for 50, 150, 200 m Magnification: None Location: Top of launcher Sighting Range (m): 250 Night Sights Available: No

NOTES

THE RPG-22 IS A LIGHTWEIGHT, SHOULDER-FIRED, PRELOADED, DISPOSABLE ANTI-ARMOR WEAPON INTENDED FOR FIRING ONE ROUND, AFTER WHICH THE TUBE IS DISCARDED. IT IS BASICALLY A SCALED-UP VERSION OF THE RPG-18 (SIMILAR TO THE US LAW) AND HAS NO DEDICATED GRENADIER; HOWEVER, ALL SOLDIERS TRAIN TO USE THE SQUAD-LEVEL DISPOSABLE WEAPON.

RUSSIAN 105 MM DISPOSABLE ANTITANK GRENADE LAUNCHER RPG-27



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: Tavolga (Meadow Grass) Date of Introduction: 1989 Proliferation: At least 15 countries	Crew: 1 Caliber: 105 mm Weight (kg): 8 Length (mm): Firing Position: 1,155 Travel Position: 1,155 Rate of Fire (rd/min): Single-shot disposable	Caliber: 105 mm Type: Tandem-HEAT Range (m): Effective: 200 Penetration: Armor: 750 + behind ERA, 950 + conventional Brick: 2,000 Reinforced Concrete: 1,500+ Log and Dirt (m): 3,700 Muzzle Velocity (m/s): 120	SIGHTS: Type: Raised iron peep sight Sighting Range (m): 50, 100, 150, 200 Night Sights Available: No (Can be used with NVG found in OPFOR units). Other sights can be adapted, such as the strap-on British Ring Sight, with NVG.

NOTES

THIS IS A DISPOSABLE LAUNCHER VERSION OF THE RPG-29. THE RPG-27 HAS A 105-MM TANDEM WARHEAD SIMILAR TO THAT OF THE PG-7VR (RPG-7V) AND THAT OF THE PG-29V (RPG-29).

RUSSIAN 125 MM ROCKET PROPELLED GRENADE RPG-28

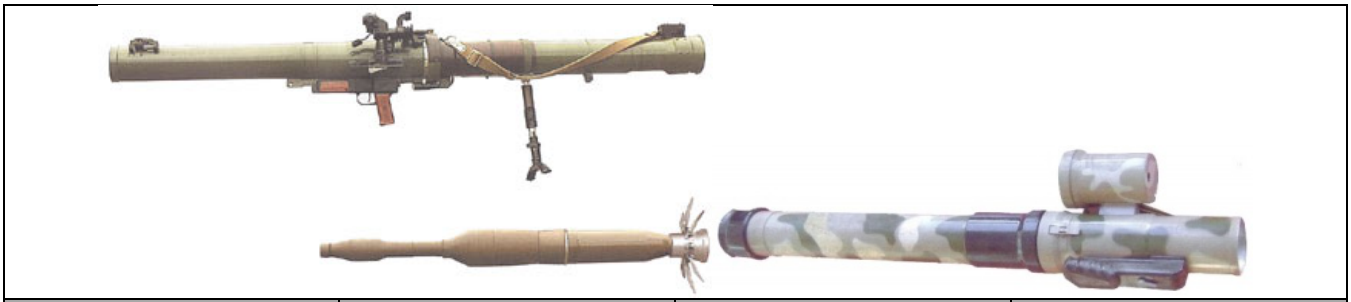


SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations: Klyukva (Cranberry) Date of introduction: 2011 Proliferation: Russian Federation	Weight (kg): 13.5 (loaded launcher) 12kg (rocket alone) Length (mm): 1200 (carry and firing) Rate of fire (rd/min): 1 (single shot, disposable launch tube) Operation: Manually cocked, then aimed and fired. Magazine: N/A Magazine capacity: N/A Fire mode: N/A	High Explosive, Anti-Tank (HEAT) RPG 125 mm, tandem warhead. Capable of penetrating ERA and up to 1000 mm of RHA; up to 3000 mm of brick/cinder block; 1500+mm of reinforced concrete; 3700 mm of logs and dirt (bunker).	SIGHTS: Type: PGO-7 Optical or iron peep sight. Iron sights are graduated 15, 100, 150, 200, and 300 meters 300m max effective range.

NOTES

THIS WEAPON IS CURRENTLY THE LARGEST RPG (125 MM TANDEM WARHEAD ROCKET) FIRED FROM A DISPOSABLE, NON-EXTENDING LAUNCHER KNOWN TO BE IN CURRENT SERVICE. OPERATED BY A SINGLE SOLDIER, THE RPG-28 IS CAPABLE OF INFLICTING A MOBILITY KILL OR A CATASTROPHIC KILL ON ANY MAIN BATTLE TANK (MBT) KNOWN TO BE IN SERVICE WITH ANY NATION.

RUSSIAN 105 MM ANTITANK GRENADE LAUNCHER RPG-29 AND RPG-32/HASHIM



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: Vampir (RPG-29); Hashim (RPG-32) Date of Introduction: 1989 (RPG-29); 2012 (RPG-32) Proliferation: 8+ (RPG-29); 3 (RPG-32)	RPG-29: Crew: 2 Caliber (tube) (mm): 105 Weight (w/o sight) (kg): 11.5 (launch tube and canister/extension) Length (transport) (mm): 1,000 without rear section/canister Length (firing) (mm): 1,850, with grenade canister attached Life of Tube/barrel: 300 Rate of Fire (rd/min): INA Fire From Inside Building: INA Maximum Target Speed (km/h): INA Emplacement/displacement time (min): <0.25 Deployment: The pintle permits the launcher to attach to a tripod ground mount or a vehicle mount. The RPG-29 can be broken down into two parts for one soldier carry (launcher unit front section, and grenade/canister rear section). It can be made ready to fire within a few seconds with quick connect couplings. A folding bipod is provided to assist aiming during prone firing. SIGHTS: Day sight: Name: 1P-38 Type: Optical and iron, for RPG-29 shoulder-launch	RPG-29: Name: PG-29V (in canister/launch tube extension) Caliber (warhead): 105 mm Type: Tandem HEAT (shaped charge) TBG-29V thermobaric rounds Effective range (m): 500 in the AT role, 800 for Multi-purpose with HE Penetration (mm CE): Armor: 750 + behind ERA, 950 + conventional Other: 1,500+ concrete and brick, 2,000 brick, 3,000 earth Length (mm): INA, but it fits in the 850 mm long canister Complete Round Weight (kg): 6.7 Muzzle Velocity (m/s): 280 Other: TBG-29V multipurpose HE thermobaric grenade. Blast effects are the same as the TBG-7V (previous pg). Effective range (m): 50-2,000 RPG-27, PG-7R grenade for RPG-7V, and RPG-32/Hashim use the same tandem warhead design. RPG-32: Name: PG-32V tandem HEAT TBG-32V thermobaric / FAE	RPG-32: Russian/Jordanian 105 mm ATGL with RPG-32V variant tandem HEAT and HE thermobaric grenades. The launcher base is a short tube with optics and trigger assembly. Sight is a collimating (binocular rangefinder) day/II night sight. The canister sleeve fits inside the short launcher stub to serve as a launch tube extension, resulting in a very lightweight 1.2-m length shoulder launcher ranging 700 m. Penetration is 850+mm vs conventional armor (650+ vs ERA), with 2 per carry case. It can launch 72.5 mm MRO-A thermobaric multi-role grenade, and perhaps other 72.5 mm grenades. Jordanian KADDB offers a vehicle remote weapons station with 7.62-mm MG, Hashim launcher, and thermal sight. An upgrade is due in 2010, to add "precision" for increased range and 80% P-hit. 1200 mm in length (105mm); 900 mm in length (72.5mm). Weight: 10kg/105 mm. 6kg/72.5 mm. Range: 700 m (max); 300 m (effective).

	Magnification: INA Location: Left side Sighting Range (m): 500 for optical sight. Effective range for the iron (post) sight would probably be less. Weight (kg): .6 Night Sight: Name: 1PN51, 1PN52 standard RPG-29 or RPG-29N Type: II sight Weight (kg): 2.1		
		VARIANTS	
		RPG-29 comes in three versions. The shoulder launch version is the base version described here (see photo above). The shoulder launch RPG-29 could become a standard squad ATGL for maneuver forces; However, the launcher, even stripped down for shoulder launch, is considered to be fairly burdensome and ungainly for use with squads attempting to move quickly in close quarters and dense cover. Thus the RPG-32/Hashim (below) was developed. RPG-29 Mounted is an improved crew-served launcher upgrade for a more limited use ground and vehicle mount (see page 6-21). For Tier 1 and Tier 2 COE OPFOR, RPG-29 Mounted is the crew weapon in Weapons Squads and other supporting tactical units. RPG-29N: Night sight only shoulder-launch variant No known RPG-32 variants.	

NOTES
RPG-29 IS A MULTI-PURPOSE FIRE SUPPORT SYSTEM WITH BOTH AT, HE AND THERMOBARIC GRENADES. THUS IT SERVES AS ALL-PURPOSE SMALL UNIT ARTILLERY AGAINST THE GAMUT OF TARGETS, INCLUDING VEHICLES, PERSONNEL, BUILDINGS, AND ANY OTHER DIRECT-FIRE TARGETS WITHIN RANGE - INCLUDING HELICOPTERS.

RUSSIAN 105 MM DISPOSABLE ANTITANK GRENADE LAUNCHER RPG-30

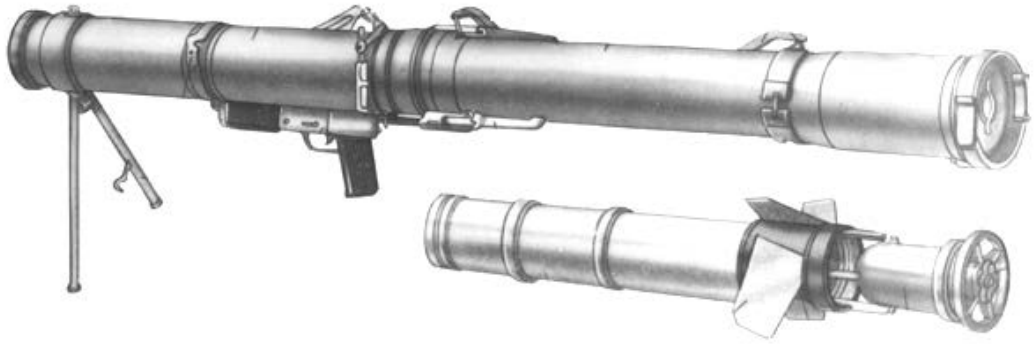


SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: Kryuk (Hook) Date of Introduction: 2011 Proliferation: Russian Federation	Crew: 1 Caliber: 105 mm main tandem warhead HEAT rocket; Approx. 40 mm sub-caliber precursor "decoy" rocket. Weight (kg): 12 (projectile) Length (mm): Firing Position: 1135 Travel Position: 1135 Rate of Fire (rd/min): Single-shot disposable	Caliber: 105 mm (PG-30) Type: Tandem-HEAT Range (m): Effective: 300 Penetration: Armor: 900 + behind ERA, 950 + conventional Brick: 3,000 Reinforced Concrete: 1,500+ Log and Dirt (m): 3,700 Muzzle Velocity (m/s): 120	SIGHTS: Type: Raised iron peep site Sighting Range (m): 50, 100, 150, 200 Night Sights Available: No (can be used with NVG found in OPFOR units). Other sights can be adapted, such as the strap-on British Ring Sight, with NVG.

NOTES

THE RPG-30'S 40 MM SUB-CALIBER PRECURSOR "DECOY" ROCKET, IS SPECIFICALLY DESIGNED TO DEFEAT ACTIVE PROTECTIVE SYSTEMS MOUNTED ON MBTS AND IFVS. THE DECOY ROCKET IS FIRED MERE MICRO SECONDS BEFORE THE MAIN 105 MM TANDEM WARHEAD HEAT ROCKET, AND THE DECOY WILL SET OFF THE APS, THUS LEAVING A GAP IN THE PROTECTION ON THE MBT OR IFV, THUS ALLOWING THE HEAT ROUND TO STRIKE THE VEHICLE IN A NOW VULNERABLE SPOT.

RUSSIAN 122 MM INFANTRY ROCKET FLAME WEAPON RPO



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: Rys (Lynx) Date of Introduction: Late 1970s. Proliferation: Russian Federation	Crew: 1 Weight (kg): Empty: 3.5 Pack (launcher and two rounds): 22 Length (ready to fire) (m): 1.44 Rate of Fire (rockets/min): 1 Reaction Time-Travel to Fire (sec): 60 Fire From Inside Building: INA Tube Life: 100 rounds Launcher Components: Firing tube, firing mechanism, mechanical sights, collapsing bipod and sling.	Type: Incendiary napalm Warhead Incendiary Fill (liters): 4 Weight of Incendiary in Warhead (kg): 4 Type of Incendiary: Pyrogel Burn Temperature (C) 1,000 Caliber: 122 mm Casualty Radius: Fire envelope 10-40 m deep in the direction of the shot with a spray width of 3-4 m. Components: Container, warhead canister, propulsion unit.	Range (m): Effective: 190 Maximum: 400 Minimum: INA Accuracy: INA Muzzle Velocity (m/s): INA SIGHTS: Type: Open metal, front and rear Location: Left side, rear is on-line with rear of grip Magnification: None Night Sights Available: INA

NOTES

THE RPO IS A COMBAT-TESTED, SHOULDER-FIRED REUSABLE WEAPON THAT FIRES A ROCKET-PROPELLED ENCAPSULATED NAPALM WARHEAD. IT WAS DESIGNED TO REPLACE THE LPO-50. THE RPO IS CARRIED IN TWO PARTS THAT MUST BE CONNECTED TO FIRE. SQUEEZING THE TRIGGER IGNITES THE ROCKET WITH AN ELECTRIC SPARK. PART OF THE PROPELLANT GAS ENTERS THE CONTAINER AND PUSHES THE CANISTER, KINDLING THE IGNITER, WHICH IN TURN IGNITES THE INCENDIARY MIXTURE. THE NAPALM IN THE RPO IGNITES AT THE INITIAL STAGE OF THE FLIGHT AND UPON IMPACT BURNING PIECES ARE SCATTERED ALL OVER THE TARGET. ALTHOUGH STILL IN USE BY THE OPFOR FLAMETHROWER BN (ENCAPSULATED) AT CORPS OR ARMY LEVEL (AND OTHER ARMIES), THE RPO HAS GENERALLY BEEN REPLACED BY THE INFANTRY ROCKET FLAME WEAPON RPO-A SERIES (RPO-A/D/Z).

RUSSIAN 93 MM INFANTRY ROCKET FLAME WEAPON RPO-A SERIES AND SHMEL-M



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: Shmel (Bumblebee). Although "RPO" may be used generically to describe various infantry flame weapons, RPO-A is this specific multi-role flame weapon system. Date of Introduction: 1984 Proliferation: Russian Federation and 9 other countries	Crew: 1 Number of Weapons in a Package: 2 Weight of Package (kg): 12 Total weapon (1) weight (kg): 11 Length (mm): 920 Rate of Fire (rockets/min): 2 Reaction Time-Travel to Fire (sec): 30 Fire From Inside Building: Yes. It can be fired in enclosures of 60m3 or greater or with a barrier behind the weapon. Components: Container, ejection motor, warhead.	RPO-A: Thermobaric-flammable mixture RPO-Z: Incendiary RPO-D: Smoke Shmel-M: Thermobaric Typical Combat Load: 2 per launcher. Name: RPO-A Type: Thermobaric (enhanced blast) explosive. The RPO-A is known as the infantryman's pocket artillery because the demolition effect corresponds to 122 mm HE artillery, and 120 mm mortar projectile. It can buckle armor, penetrate rubber seals and enter openings in vehicles, injure or kill personnel, and collapse roofs and doors on bunkers and buildings. Caliber: 93 mm Casualty Area: 50 m2 personnel in the open, 80 m3 enclosed space Lightly armored materiel kill probability at 400 m: 0.70 Burn Temperature (	PERFORMANCE: Range (m): Direct Fire: 200 with iron sight, 850 with optical sight Effective: 600 Minimum: 20 Indirect Fire: 1,000 Accuracy @ 200 m: .5 m2 Muzzle Velocity (m/s): 125 SIGHTS: Name: OPO-1 Type: Optical calibrated to 600 m Location: Left, next to grip Magnification: None Night Sights Available: INA

		Warhead Explosive Type: Trotyl equivalent (2 kg) **Warhead Mixture Weight (kg): 2.1** **Name: RPO-D** **Warhead Weight (kg): 2.3** **Smoke-Incendiary Type: Based on red phosphorous.** **Smokescreen:** **Time of Formation (min): 2** **Length (m): 55 to 90** **Depth and Height (m): INA** **Duration (min): 3 to 5** **Effective Against: Visual and infrared** **Name: RPO-Z** **Type: Incendiary** **Warhead Mixture Weight (kg): 2.5**	

VARIANTS

Shmel-M/PDM-A Priz: This is a reusable upgrade system adopted in the Russian Army in 2003 to replace the disposable RPO-A. It Includes a reusable mini-grip-stock launcher, with a reflex sight and pistol grip. Disposable canisters (with munitions) slide on and serve as the launcher tubes. The Shmel-M is more powerful (50 % more blast = 152/155-mm cannon round) and lighter in weight than RPO-A. Range is 800m, 300m direct fire. Specifications are: caliber 90 mm, length 940 mm, weight 8.8 kg for 2. In time other canister fills (e.g., smoke and incendiary) will be available. Standard issue (2 grenades per launcher) is more compact than 2 RPO-A launchers.

PF-97: Chinese licensed copy of RPO-A, with optical sight mounted on some launchers.

NOTES

DESIGNED AS A FOLLOW-ON TO THE RPO, THE RPO-A, -Z, AND -D ARE ONE-SHOT, DISPOSABLE, SHOULDER-FIRED, COMBAT TESTED (AFGHANISTAN, TAJIKISTAN, CHECHNYA), FLAME WEAPONS. THEY ARE RELIABLE. ANY SOLDIER CAN USE THIS CLOSE-COMBAT WEAPON WITH MINIMAL INSTRUCTION. THE RPO-A COMPRISES THREE BASIC COMPONENTS: CONTAINER, EJECTION MOTOR, AND CASE, WHICH IS FILLED, DEPENDING ON ITS PURPOSE, WITH THERMOBARIC (ENHANCED BLAST EXPLOSIVE), SMOKE OR INCENDIARY ROCKETS. AT ANY RANGE THE BLAST EFFECTS OF THE THERMOBARIC MUNITIONS ARE MUCH MORE SERIOUS THAN THE THERMAL EFFECTS. THE RPO SERIES OF FLAME WEAPONS ALSO SERVES AS AN EXTREMELY EFFECTIVE COUNTER-SNIPER WEAPON. THE ARMOR- AND MECHANIZED -BASED OPFOR USUALLY ISSUES ONE RPO-A PER BMP (MECHANIZED INFANTRY SQUAD). THEY ARE ALSO FOUND IN THE FLAMETHROWER BN (ENCAPSULATED) AT CORPS OR ARMY LEVEL. ONE SQUAD PER INFANTRY PLATOON HAS A RPO-A IN THE INFANTRY-BASED OPFOR. THE RPO-A SERIES OF FLAME WEAPONS ARE ISSUED MORE ALONG THE LINES OF AMMUNITION RATHER THAN A WEAPON, THEREFORE THE BOI MAY VARY.

CHINESE 120 MM ANTITANK GRENADE LAUNCHER PF-98



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: "Queen Bee" Date of Introduction: 2000 Proliferation: China and 3 other countries	Crew: 2, 3 if more rounds are needed Caliber (mm): Launch Tube: 120 Warhead: 120 Weight (kg): INA Length (mm): Firing Position: INA Travel Position: INA Rifling: None Breech Mechanism Type: Rocket canister is attached to end of launcher, extending the launch tube. Launcher mount: Shoulder for company launcher, Tripod, shoulder, or pintle for battalion launcher. Rate of Fire (rd/min): 4-6 Fire From Inside Building: No	Tandem HEAT and Multipurpose Name: HEAT, with time fuze Caliber: 120 mm Type: Tandem HEAT (shaped charge) Range (m): 800 battalion, 400-500 with company level launcher Penetration (mm CE): 800+ Weight (kg): 6.4 Time of Flight (sec): 10 Name: Multipurpose Caliber: 120 mm Type: Frag-HE-Incendiary (120 steel balls) Range (m): 2,000 Penetration: 400 mm KE for steel balls, 25 m lethal radius Weight (kg): 7.6	SIGHTS: Name: Y/MK/PF98(Y)-120 Type: Ballistic computer laser range-finder (LRF) sight for battalion version, and optical telescope for company sight Rate of fire: 4–6 rounds per minute Maximum range: 800 m (HEAT); 1800 m (HE) Combat Load: 5 rockets.
		VARIANTS	
		Company and battalion versions fire the same rounds. In subsequent years, these systems will proliferate	

		throughout battalions in weapons units and into infantry platoons and lower. Over time the battalion version will replace squad ATGLs. Battalion system could be a representative OE Tier 1 ATGL for infantry units.	

NOTES

THE PF-98 APPEARS TO HAVE EMPLOYED PROPULSION PRINCIPLES FROM THE SWEDISH BOFORS CARL GUSTAF 84-MM M2/M3 RECOILLESS GUN. THE CARL GUSTAF HAS A COMPACT ROUND WITH AN EXPULSION CHARGE TO LAUNCH ITS GRENADE, A METHOD WHICH OFFERS GREATER PRECISION THAN MORE COMMON ROCKET-PROPELLED SYSTEMS. BUT LIKE THE MORE RECENT AND LARGER GUSTAF ROUNDS, THE PF-98 ADDED ROCKET ASSIST TO EXTEND PROJECTILE RANGES. THUS THE PRODUCER REFERS TO PF-98 AS AN "ANTI-TANK ROCKET LAUNCHER". BY USING SEALED CANISTERS TO SERVE AS LAUNCHER EXTENSIONS, QUEEN BEE OFFERS A TREND-SETTING AND EFFECTIVE WAY TO INCREASE LETHALITY BY GROWING AMMUNITION TO 120 MM, WHILE RETAINING PORTABILITY AND EXTENDING RANGE CAPABILITY. BN DESIGNATION IS FOR LAUNCHER MOUNTED ON TRIPOD.

GERMAN 60 MM ANTITANK GRENADE LAUNCHER PANZERFAUST 3



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: Balliste, Pzf 3-T600 Date of Introduction: 1990, 1996 for 3-T600 Proliferation: 11 countries world wide	Crew: 2 Caliber (mm): Launch Tube: 60 Warhead: 110 Weight (kg): 12 Length (mm): Firing Position: 1,200 Travel Position: 1,200 Rifling: None Breech Mechanism Type: N/A Rate of Fire (rd/min): 5 Fire From Inside Building: Yes	Tandem HEAT Multipur-FRAG (MZ-110) BASTEG Illumination Smoke/IR Smoke Tandem HEAT Multipurpose HESH Tandem HEAT SAL-H (Pzf-3LR) Name: 3-T (Tandem) Caliber: 110 mm Type: Tandem HEAT (Pzf 3-T and 3-T600) Effective Range (m): 600 moving and stationary) Armor Penetration (mm CE): 800 behind ERA Weight (kg): 4.3 Muzzle Velocity (m/s): 152 Flight Velocity (m/s): 220 Time of Flight to 300 m (sec): INA Name: BASTEG (Barricade and Street Encounter Grenade) Caliber: 110 mm Type: Shaped-charge w/stand-off fuze Range (m): 11 to 600 Penetration (mm): 15 armor at 45 □, 920 concrete Weight (kg): 4.3 Time of Flight to 300 m (sec): INA Name: 3-IT (Improved Tandem) Caliber: 110 mm Type: Tandem HEAT/HESH (Dual-mode) on Pzf 3-IT600	Typical Combat Load: 5 rockets SIGHTS: Name: DynaRange (Simrad IS2000) for Pzf 3-T600 and Pzf 3-IT600 Type: Computer laser range-finder (LRF) sight Magnification: 1x/3.5 Location: Left side Night Sights Available: Yes, KN-250 series II Day sight can be used with Simrad GN1 NVG. OFF-ROUTE MINE SYSTEM AND REMOTE LAUNCHER: The original launcher and variants can be tripod mounted, and can be used autonomously with sensor package. Name: SIRA Target Speed range (km/h): 30-60 Effective Range (m): 150 Operational Time (days): 40 Acquisition: Targets detected by acoustic sensor which activates the infrared sensors.



		With nose retracted, HESH mode has greater effects against APCs, material targets, etc. Effective Range (m): 600 moving and stationary Armor Penetration (mm CE): 900+ behind ERA, with nose extended; 1,150 conventional, with nose extended Weight (kg): 5.4 Muzzle Velocity (m/s): 152 Flight Velocity (m/s): 220 Time of Flight to 300 m (sec): INA Other Grenades: See above. The new 3LWD multipurpose grenade has a shaped charge and HE/anti-armor effects of a high-explosive squash-head (HESH) round.	Sensors: Acoustic: Capacitative microphone to detect and arm IR Sensor: Passive, two-color IR Optics: Double parabolic, off-axis Name: Fire Salamander Remote launcher and off-route mine system Description: 4x Pzf-3 launcher mount on a tripod with remote controlled TV camera for controlled launch, and sensors for automatic launch.

VARIANTS

Panzerfaust 3 (Pzf 3): Original system with 110-mm HEAT grenade (nose probe for 700 mm penetration). Optical day sight limits range to 300 m moving, 400 stationary.

Panzerfaust 3-T: Upgrade with 3-T tandem HEAT grenade and original day sight. It is effective against targets to 300m stationary, 400m moving. Night sight is optional.

Panzerfaust 3-T600: Tier 2 upgrade adds the IS2000 computer laser day sight with range of out to 600 m for moving targets. It uses the Simrad KN250 series II night sight. Acquisition-to-firing time is 3-4 seconds.

Panzerfaust 3-IT600: Tier 1 capability upgrade adds more recent 3-IT grenade which penetrates 900 + mm armor behind ERA (equals 1,150 mm vs armor without ERA).

Panzerfaust 3LTW: Light-weight launcher weighing less than 10 kg.

Panzerfaust 3LR: Long-range semi-active laser homing (SAL-H) system requires CO2 laser guidance unit and SAL-H grenade. Range-800 m, armor penetration-700 mm.

NOTES

THE PANZERFAUST 3 SERIES OF LAUNCHERS IS A COMPACT, LIGHTWEIGHT, SHOULDER-FIRED, UNGUIDED ANTITANK WEAPON SERIES. IT CONSISTS OF A DISPOSABLE CANISTER WITH A 110-MM WARHEAD AND REUSABLE FIRING AND SIGHTING DEVICE. THE PANZERFAUST 3 IS LIGHT ENOUGH TO BE CARRIED AND FIRED BY ONE PERSON. IT CAN FIRE FROM ENCLOSURES. THE GUNNER CARRIES AT LEAST TWO ROUNDS WHILE THE ASSISTANT GRENADIER CARRIES AN ADDITIONAL THREE ROUNDS.

GERMAN 67 MM ANTITANK DISPOSABLE LAUNCHER ARMBRUST



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: "Crossbow" Date of Introduction: INA Proliferation: 8 countries	Crew: 1 Caliber: 67 mm Weight (kg): 6.3 Length (mm): 850 Rifling: None Breech Mechanism Type: N/A Rate of Fire (rd/min): N/A (disposable) Fire From Inside Building: Yes (see NOTES)	67 mm grenade HEAT Range (m): Maximum: 1,500 Effective AT: 400 Flight Time (sec) @ 300 m: 1.5 Penetration: Armor (mm CE): 300 Reinforced Concrete (m): INA Muzzle Velocity (m/s): 210 Typical combat load: INA	SIGHTS: Name: N/A Type: Reflex Magnification: None Location: Left side Sighting Range (m): INA Night Sights Available: INA

NOTES

THE ARMBRUST IS A PRELOADED, DISPOSABLE, SHOULDER-FIRED ANTITANK WEAPON. IT HAS A LOW SIGNATURE AND LOW IR DETECTABILITY AND CAN BE SAFELY FIRED FROM SMALL ENCLOSURES OR ROOMS. THE MUZZLE DOES NOT EMIT SMOKE OR BLAST AND NO FLASH CAN BE SEEN FROM THE REAR. ONLY .8 M CLEARANCE IS REQUIRED BETWEEN THE REAR OF THE WEAPON AND THE WALL. IT IS QUIETER THAN A PISTOL SHOT. THE ENTIRE WEAPON IS CONSIDERED A ROUND OF AMMUNITION AND THE LAUNCHER IS THROWN AWAY ONCE THE WEAPON IS FIRED. THE SYSTEM IS ALSO MANUFACTURED BY SINGAPORE INDUSTRIES.

SWEDISH CARL GUSTAF 84 MM RECOILLESS RIFLE M2/3/4



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: Date of Introduction: 1948 Proliferation: Widespread (40+ nations)	Caliber: 84 mm rifled (24 lands, progressive twist) Crew: 2 optimal, 1 minimal Weights: 14.2 kg (M2); 8.5 kg (M3); 7.0 kg (M4) Length: 1.13m (M2); 1.07m (M3); 1.0m (M4) Breech: Hinged Rate of fire: 6 rounds per minute Sights: Iron sights, optical 3×, laser rangefinder, image intensification system for the newer M3 and M4 series	HEAT (tandem) HEDP HEAT HE Smoke Illumination Note that the following are Canadian designations (other countries use similar terminology, replacing the "FFV") Name: FFV 751 Type: HEAT (tandem) Range (m): Effective: 600+ Arming range: 20-40 Moving: INA Penetration: Armor (mm CE): 500+ behind ERA Weight (kg): 4 Name: FFV 502 Type: HEDP with dual mode fuze (impact and delay) Range (m): Effective (personnel in open): 1,000 Effective (stationary): 500 Moving: 300 Arming Range: 15-40 Penetration:	System improvements have been in the areas of length, weight, sighting systems, and in the types of ammunition available.

		Armor (mm CE): 150+ with brush safety fuze and delay fuze Weight (kg): 3.3 complete round Muzzle Velocity (m/s): 230 Name: FFV 551 Type: HEAT Range (m): Effective: 700 Arming Range: 5-15 Penetration: Armor (mm CE): 400 Weight (kg): 3.2 Muzzle Velocity (m/s): 255 Name: FFV 441B Type: HE Range (m): Effective (unprotected troops, soft-skinned vehicles): 1,100 Arming Range: 20-70 Casualty Radius (m): INA Weight (kg): 3.1 Muzzle Velocity(m/s): 240 Name: ADM 401 Type: Flechette (1,100 per round) Range (m): Effective: 100 Arming Range: 0 Casualty Pattern: 5-10 flechettes per m2 upright target at 100 m Name: FFV 469B/C Type: Smoke Range (m): Effective: Up to 1,300 Weight (kg): 3.1 Muzzle Velocity (m/s): 240 Name: FFV 545C Type: Illumination Range (m): Practical: 300-2,100 Burning Time (sec): 30 Illuminated Area, dia: 400-500 Candle Power: 650,000 cd Weight (kg): 3.1 complete, 0.8 of smoke composition	

		Muzzle Velocity (m/s): 260 **Other Ammunition:** **FFV 441D HE Impact/Airburst, with 800 stell pellets and time delay.** **Range is 1250 m.** **HEAT 655 CS (Confined Spaces)**	
		VARIANTS	
		M1 (1948 **M2 (1963)** **M3 (1991)** **M4 (2014)**	

NOTES

THE 84 MM CARL GUSTAF RECOILLESS RIFLE IS A ONE-MAN PORTABLE, DIRECT-FIRE, SINGLE-SHOT, BREECH-LOADING WEAPON. SEVERAL VERSIONS OF THE CARL GUSTAF ARE PRODUCED OUTSIDE SWEDEN, HOWEVER, THE AMMUNITION IS INTERCHANGEABLE AMONG THE VARIANTS. WHILE THE WEAPON CAN BE OPERATED BY ONE PERSON IT IS BETTER TO HAVE TWO—ONE TO FIRE THE GUN, AND THE OTHER TO CARRY AND LOAD THE AMMUNITION. IN ADDITION TO ITS ANTITANK ROLE, THE WEAPON CAN BE USED AS PART OF AN ILLUMINATION PLAN, TO PROVIDE SMOKE, OR FOR BUNKER BUSTING.

SWEDISH 84 MM DISPOSABLE LIGHT ANTITANK WEAPON AT4



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: US M136, Bofors AT 4, FFV AT4 Date of Introduction: 1987 Proliferation: 24 countries	Crew: 1 Caliber (mm): 84 Weight (kg): 6 Length (mm): Firing Position: 1,000 Travel Position: 1,000 Rate of Fire (rd/min): N/A (disposable) Fire From Inside Building: Yes (See AT4 CS)	Name: AT4 HEAT Caliber: 84 mm Type: HEAT Range (m): Effective: 300 Arming Range: INA Penetration: Armor (mm CE): 420 Weight (kg): 6.7 Muzzle Velocity (m/s): 285 Name: LMAW (see VARIANTS) Caliber: 84 mm Type: HEDP, modified Carl Gustaf HEPD FFV 502 (with dual mode fuze) Range (m): Effective: 300 Arming Range: INA Penetration: Armor (mm CE): 150 Concrete (m): INA Casualty Radius (m): INA Muzzle Velocity (m/s): 235 Name: AT4 CS (confined space) can fire from confined spaces as small as 22.5 m3 Caliber: 84 mm Type: HEAT or HEDP (LMAW) warheads Range (m): Effective: INA Arming Range: INA Penetration: Armor (mm CE): 500 Weight (kg): INA Muzzle Velocity (m/s): INA	SIGHTS Name: INA Type: Popup, preset to 200 m Location: Top left Night Sights Available: Yes, INA

		Name: AT4 HP (high penetration) Caliber: 84 mm Type: HEAT Range (m): Effective: INA Arming Range: INA Penetration: Armor (mm CE): 600 Weight (kg): Less than 7 Muzzle Velocity (m/s): 290	
		VARIANTS	
		LMAW: Light Multipurpose Assault Weapon, uses HEDP AT4 CS: Confined space AT4 HP: High penetration	

NOTES

THE AT4 IS A LIGHTWEIGHT, PRELOADED, DISPOSABLE ANTI-ARMOR WEAPON INTENDED FOR FIRING ONE ROUND, AFTER WHICH THE TUBE IS DISCARDED. ALL AT4 SYSTEMS SHARE THE SAME LAUNCHER BUT MAY CONTAIN DIFFERENT PRELOADED MUNITIONS. THE VARIANT SELECTED DEPENDS ON THE INTENDED USE. THE AT4'S AVERAGE RECOIL IS COMPARABLE TO THE M16 RIFLE.

UNITED STATES 90 MM RECOILLESS RIFLE M67



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation: None. Date of Introduction: Type classified in 1959. Early variants had been in the Army inventory since the late 1940s. Proliferation: 10 + countries.	Crew: 3 (see Note) Caliber: 90 mm Weight (empty) (kg): 16.4 Length (mm): 1.35 Height (ground-mounted) (mm): 432 Mount: Rear bipod and forward monopod Feed: Manual Rate of Fire (rd/min): Maximum: 1 each 6 seconds, not to exceed 5 rounds Sustained: 1 Fire From Inside Building: No	HE HEAT APERS Target Practice Name: INA Type: HE Range (m): Effective: 400 Weight (kg): INA Name: M371E1 Type: HEAT Range (m): Aimed: 800 Effective: 420 Penetration: Armor (mm CE): 350 Weight (kg): 4.2 Fuze: Point Detonating Muzzle Velocity (m/s): 213 Name: XM590E1 Type: APERS Canister (antipersonnel) Fill: 2,400 eight-grain flechettes Range (m): Effective: 200 Weight (kg): 3.08 Muzzle Velocity (m/s): 381	SIGHTS: Name: M103 Type: Optical, (graduated in 50 m intervals up to 400 m, every 100 m up to 800 m) Magnification: x3 Field of View (☐): 10 Location: Left center

		Name: XM590E1 Type: Target Practice Range (m): Ballistically identical to the HEAT M371E1 Weight (kg): 3.08 Muzzle Velocity (m/s): 381	
		VARIANTS	
		Early variants maybe found in other countries. The M67 has reportedly been reintroduced as late as 2011 for use in Iraq/Afghanistan by some units.	

NOTES

THE M67 90 MM RECOILLESS RIFLE IS A LIGHTWEIGHT, PORTABLE, DIRECT-FIRE ONLY, CREW-SERVED ANTITANK WEAPON. IT IS DESIGNED TO BE FIRED PRIMARILY FROM THE GROUND USING THE BIPOD AND MONOPOD, BUT IT MAY BE FIRED FROM THE SHOULDER. IT IS AN AIR COOLED, BREECH LOADED, SINGLE SHOT RIFLE THAT FIRES FIXED AMMUNITION. ALTHOUGH INTENDED PRIMARILY FOR USE AS AN ANTITANK WEAPON, THE M67 CAN BE USED AGAINST SECONDARY TARGETS SUCH AS GUN EMPLACEMENTS AND BUNKERS. IT IS ALSO VERY EFFECTIVE IN AN ANTI-PERSONNEL ROLE. ALTHOUGH NO LONGER PRODUCED IN THE US, THE M67 IS STILL IN PRODUCTION BY SOUTH KOREA.

THE CREW CONSISTS OF A GUNNER, ASSISTANT GUNNER, AND AMMO BEARER. THE M67 CAN BE OPERATED WITH A CREW OF ONLY TWO; HOWEVER, THE THIRD CREW MEMBER (AMMO BEARER) IS CONSIDERED NECESSARY FOR EFFICIENT OPERATIONS. IN THE ABSENCE OF AN INDIVIDUAL TO PERFORM THE DUTIES ASSIGNED TO THE AMMO BEARER, THE GUNNER (CREW MEMBER 1) LAYS AND FIRES THE 90-MM RIFLE AND IS THE CREW LEADER. HE CARRIES THE M67 AND A PISTOL. THE LOADER (CREW MEMBER 2) IS RESPONSIBLE FOR LOADING THE RIFLE AND ACTS AS THE GUNNER WHEN REQUIRED. HE SECURES AMMUNITION AND CHECKS THE CLEARANCE OF THE BACK BLAST AREA PRIOR TO FIRING. HE CARRIES A PISTOL, SPARE PARTS, CLEANING MATERIEL, AND 3 ROUNDS OF 90-MM. THE AMMUNITION BEARER (CREW MEMBER 3) IS RESPONSIBLE FOR SECURING AMMUNITION AND PROVIDING SECURITY FOR THE RECOILLESS RIFLE POSITION. HE CARRIES AN ASSAULT RIFLE AND 4 ROUNDS OF 90 MM. THE M67 HAS BEEN REPLACED BY THE CARL GUSTAV M2 AND THE AT4 WEAPONS SYSTEMS.

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Worldwide Equipment Guide

Chapter 3: Infantry Vehicles



TRADOC G-2 ACE–Threats Integration
Ft. Leavenworth, KS

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Chapter 3: Infantry Vehicles

Infantry vehicles include all military vehicles designed for use by infantry and other tactical units. They vary from unarmored multi-role vehicles to specialized armored vehicles. Mechanized infantry units often use *light armored fighting vehicles* (LAFV) designed as infantry squad carriers. Infantry units use large numbers of vehicles, armored and unarmored, for support missions. Due to budgetary constraints, some forces also use commercial vehicles or military vehicles considered obsolete by other militaries. The US Army will likely encounter infantry forces with a mix of older, newer, and upgraded infantry vehicles in their next battle.

Vehicle Classification: The infantry can use LAFVs, multi-purpose support vehicles, specialized vehicles or commercial vehicles to transport soldiers. In wartime, the OPFOR will use all systems available to execute the mission. This chapter is divided into three sections: **armored infantry carriers**, **fire support vehicles (FSV)**, and **combat support vehicles** (CSV).

Armored infantry carriers, also known as armored fighting vehicles (AFV) are normally divided into two types: armored personnel carriers (APC) and infantry fighting vehicles (IFV). In both types, a small crew of two or three soldiers stay with the AFV while a dismount team of five or more soldiers can conduct missions on foot. Normally, most AFVs carry approximately of ten soldiers, but some AFVs can carry more while others less. The difference between the APC and the IFV is the APC is a "battle taxi" that dismounts the soldiers outside of direct fire range while the IFV is designed to fight with soldiers onboard to and through the objective. To qualify as an IFV, the vehicle must be able to carry a team or squad; contain enough armor to protect the occupants from light machine guns; feature a medium cannon or automatic grenade launcher (AGL) that can defeat enemy armor vehicles; shoot on the move; possess the mobility to stay with tanks while traveling on roads or across country. Many manufacturers call their vehicles various names to make them sound like an IFV, but are not. The addition of a medium cannon to an APC does not make it an AFV unless it possesses the other characteristics. Some AFVs may be dropped from the air to be used by paratroopers on the ground. Some sources will describe a vehicle as a medium armored vehicle (MAV) or a heavy armored vehicle (HAV). The term MAV will not be used in this chapter and HAVs are often AFVs built on the same track system as a tank so they can stay up with the armor. The term heavy infantry fighting vehicle (HIFV) or heavy armored personnel carrier (HAPC) refers to the vehicles protection capability, not the vehicle's weight. For information on HAVs mounted with some type of cannon, see Chapter 4.

AFVs normally are differentiated based on three categories: mobility, survivability, and lethality. Some AFVs travel on wheels while others travel on tracks. While not a necessity, most IFVs operate on tracks in order to travel the same terrain as tanks as the tracks more evenly distribute the vehicle's weight. Wheeled vehicles are more likely to succumb to mobility kills than tracked vehicles as tires are susceptible to punctures. Two flat tires on the same side of the vehicle may bring the vehicle to a complete stop. Survivability is the ability of the vehicle to protect its occupants and remain operational. Survivability is based on the vehicle's armor thickness, type (modern such as reactive armor), and style (slope). Adding armor to an AFV may reduce its mobility and creates a dilemma between survivability versus mobility. Lethality is based upon the AFV's weapon systems and the weapons' ability to penetrate other vehicles' armor. Increasing the size of a main gun on a vehicle, however, often reduces its mobility. Some AFVs may feature a turret, 1-man or 2-man, but others will not. AFVs often operate auxiliary weapons such as coaxial mounted machine guns (fire in the same direction as the main gun), turret-mounted machine guns, AD machine guns, or an AGL.

Many infantry units also field FSVs featuring air defense (AD), anti-tank (AT) weapons, or mortars to guard their formations against aerial or armor threats. These vehicles may be used by chemical detection teams, field artillery forward observer teams, or Many of the AT systems are discussed in Chapter 5. The OPFOR may use civilian four-wheeled drive vehicles, sport utility vehicles, or commercial vans adapted for military roles. This chapter has been reordered to put vehicles with similar characteristics together.

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Selection Matrix for Infantry Carriers in a Military Force

Factors which impact the selection of the right vehicle for use in a military force may vary based on budget constraints, industrial base limitations, or political-military-industrial alliances. The following table offers engineering and employment considerations for use in selecting vehicles. An OPFOR squad is 9 to 10 personnel, counting the vehicle crew. Team size is 3 to 4, counting the vehicle crew. Infantry in this context includes SOF, insurgents, criminals and any other maneuver forces.

Factor	Tracked IFV	Wheeled IFV	Tracked APC	Wheeled APC	Light Wheeled APC	Armored Tactical Utility Vehicle	Light Strike Vehicle
Role	Fight with Squad onboard/ dismount; provide lethal fires	Fight with Squad onboard/ dismount; provide lethal fires	Carry Squad to dismount point; give covering fire	Carry Squad to dismount point; give covering fire	Carry Squad to dismount point; provide fire protection	Team carrier and multi-role functions; fire protection	Team carrier and multi-role functions; fire protection
Costs (1-10 with 10 being high)	9 to 10	8 to 10	3 to 5	4 to 7	1 to 3	1 to 3	1 to 3
Weight (mt)	@ 20 to 35	@ 20 to 25	@ 11 to 13	@ 10 to 15	@ 6 to 8	@ 4	@ 1.5
Time Deploy & Movement	Fast dash; slow over distance	Slow dash; fast over distance	Fast dash, slow over distance	Medium dash; fast over distance	Medium dash; fast over distance	Medium dash; fast over distance	Fast dash; fast over distance
Terrain	Good off-road; most swim	Poor off-road; some swim	Good off-road; all swim	Fair off-road; all swim	Medium off-road; most swim	Good off-road; most swim/high ford	Good off-road; most high ford
Threat to Vehicle (Frontal Protection)	Aircraft, AFV, AT weapon, mine/IED, artillery, flame, some obstacles 20 mm rd	Same as left; 5.56+mm MG to tires, obstacles 14.5 mm rd	Same as left; some obstacles 12.7 mm rd	Same as left; 5.56+ mm MG to tires; many obstacles 12.7 mm rd	Same as left, some obstacles 7.62 mm rd	Same as left; a few obstacles 7.62 mm rd	Same as left; almost no obstacles 5.56 mm rd

Targets for On-Board Weapons	All targets; 30-mm gun; ATGM; AGL; MG	All targets; 30-mm gun; ATGM; AGL; MG	Aircraft; LAV; 12.7 to 30 mm gun; MG; personnel	Aircraft; LAV; 12.7 to 30 mm gun; MG; personnel	Aircraft; LAV; 12.7 gun; MG; personnel	Aircraft; LAV; 7.62 to 12.7 gun; MG; personnel	Aircraft; LAV; 7.62 to 12.7 gun; MG; personnel
Support Required	High fuel use; load limits for aircraft	Medium fuel use; load limits for aircraft	Low fuel use; most aircraft loadable	Low fuel use; most aircraft loadable	Low fuel use; most aircraft loadable	Low fuel use; most aircraft loadable	Low fuel use; most aircraft loadable
Social Impact	Road size; noise; maneuver damage	Road size; block traffic if stuck	Road size; road noise	Road size; block traffic if stuck	No major	No major	No major
Example	BMP-2M	BTR-90M	Type 85	BTR-80A	Otokar Cobra	VBL	Spider

FRENCH INFANTRY FIGHTING VEHICLE AMX-10P



AMX-10P

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	INA	Name:	GIAT M693 (F2) Main Gun
Date of introduction:	1973	Caliber/length (mm):	20
Proliferation: Vehicles Countries:	1091+ 7+	Type:	Automatic Cannon
Description:	IFV with exit doors in the rear with space for 8 soldiers	Ammo (Rds): APDS-T/API-T HI/HEI-T:	260 500
Crew (driver, commander, & gunner):	3	Max Effective Range (m): AP HE	1200 2000
Combat weight (mt):	14.5	Armor penetration:	INA
Chassis length overall (m):	5.8	Muzzle velocity (m/s): APDS: HE	1250 1050
Height overall (m):	2.57	Name:	Coaxial
Width overall (m):	2.78	Caliber/length (mm):	7.62
Ground pressure (kg/cm²):	.53	Type:	Machine Gun
Automotive performance:	Renault HS-115 Engine	Ammo (Rounds): Tracer, AP, API, Incendiary:	2000
Engine type:	8.2 liter liquid-cooled, turbo-charged, V-8 diesel	Max Effective Range (m): Approximately	600
Cruising range (km):	600	Armor penetration:	INA
Speed (km/h): Max road: Max off-road: Average cross-country Max swim:	40.4 INA INA 7	Muzzle velocity (m/s): Approximately	830
Fording depths (m):	Amphibious	Name:	Milan-2
Radio:	INA	Caliber/length (mm):	115
Protection:		Type:	ATGM
Armor, turret front (mm):	12.7	Ammo (Rds): Tandem HEAT	Varies

Applique armor (mm):	N/A	Max Effective Range (m): Approximately	3000
Explosive reactive armor(mm):	Available	Armor penetration:	INA
Active Protection System:	N/A	Muzzle velocity (m/s):	200
Self-entrenching blade:	No	VARIANTS	SPECIFICATIONS
NBC protection system:	Yes	AMX-10P	Variant profiled with Milan-2
Smoke equipment: Smoke grenade launchers	4	AMX-10P/Milan	ATGM launcher vehicle with 2 launchers
Survivability equipment:	INA	AMX/HOT	ATGM launcher vehicle with 2-man Lancelot turret with 4 HOT launchers & 14 reloads
VARIANTS	SPECIFICATIONS	AMX-10 TM	Mortar carrier with 1-man Toucan I turret towing 120-mm RT-61 mortar (60 rounds)
AMX-10 Ambulance	Unarmed variant with air condition for 3 litter or 1 litter/4 ambulatory casualties	AMX-10P w/ 120-mm mortar	Prototype w/o Toucan turret & 120-mm mortar replaces troop compartment
AMX-10 ECH	Armored repair vehicle with 6000 kg extensible jib crane & Toucan I turret	AMX-10P Marine	Improved swim variant with 12.7 machine gun, 25-mm cannon or a 90-mm gun
AMX-SAO	Battlefield observation vehicle with a 7.62-mm machine gun ILO the Toucan ** turret	AMX-10 PC	Command variant with command stations for 2 staff and 2 radio operators
AMX-10 RATAC	Artillery surveillance & fire-control radar vehicle	AMX-10 SAT	AMX-10 PC w/ specialized navigation equipment
AMX-10 RAV	Artillery resupply vehicle, but never produced	AMX-10 RAC	AMX-10 RC chassis with 105-mm gun
AMX-10 TMC-81	Prototype with a CL-81 81-mm smoothbore gun (118 rounds)	AMX-10 PAC 90	Fire support/AT variant with GIAT 90-mm gun (30 rounds)
AMX-10 VOA	Artillery observation vehicle with a low profile 2-man turret ILO of the Toucan turret	AMX-10 RC	Wheeled (6 X 6) variant fire support vehicle with 90-mm gun

NOTES
SOURCES: 2014 WEG AND MILITARY PERISCOPE; FRENCH SNPE ERA KIT & OTHERS AVAILABLE FOR USE ON THE AMX-10P. DURING DISMOUNTED TROOP MOVEMENT, ERA WOULD BE A HAZARD. PASSIVE ARMOR IS MORE LIKELY

GERMAN INFANTRY FIGHTING VEHICLE MARDER 1A3



Marder 1

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	See variants	Name:	Mk 20 Rh202
Date of introduction:	1971	Caliber/length (mm):	20
Proliferation: Vehicles: Countries:	689+ 3+	Type:	Automatic Cannon
Description:	IFV with rear exit doors; space for 6 soldiers; 2 firing ports on both sides of the vehicle	Ammo (rounds): API-T, APDS-T, HEI, HEI-T, CAN	1250
Crew (driver, commander & gunner—1 can dismount):	3	Max Effective Range (m):	2000
Combat weight (mt): Earlier Versions	35 29.2	Armor penetration:	INA
Chassis length overall (m):	6.88	Muzzle velocity (m/s): APDS-T: API-T: CAN: HEI, HEI-T:	1150 1100 1055 1045
Height overall (m):	3.02	Name:	Turret Coaxial
Width overall (m):	3.38	Caliber/length (mm):	7.62
Ground pressure (kg/cm²):	0.94	Type:	MG3 Machine Gun
Automotive performance:	MTU 833	Ammo (Rounds): AP	5000
Engine type:	Ea-500, 22.4-liter, liquid-cooled, turbo-charged V-6 diesel	Max Effective Range (m):	1500
Cruising range (km):	500	Armor penetration:	INA
Speed (km/h): Max road: Max off-road: Average cross-country Max Swim:	75 65 35 N/A	Muzzle velocity (m/s): Approximately	820
Fording depths (m): With preparation:	1.5 2.0	Name:	Milan, Milan-2, Milan-3
Radio:	INA	Caliber/length (m):	115
Protection:		Type:	ATGM

Armor, turret front (mm): Rounds against:	30	Ammo (Rds): Tandem HEAT	Varies
Applique armor (mm):	Standard	Max Effective Range (m): less than	3000
Explosive reactive armor(mm):	Brenus ERA available	Armor penetration:	INA
Active Protection System:	INA	Muzzle velocity (m/s):	200
Self-entrenching blade:	Yes	**VARIANTS**	**SPECIFICATIONS**
NBC protection system:	Collective	Marder 1	Original variant with a rear 7.62 MG; most are upgraded or no longer in service
Smoke equipment (Smoke grenade launchers:	6	Marder A1(+)	Fully upgraded vehicle; some with thermal pointers
Survivability equipment:	Mine clearing equipment	Marder 1A1A	No passive vision equipment
VARIANTS	**SPECIFICATIONS**	Marder 1A1A2	A1 turret and A2 chassis with a PERI-Z59 sight
TAM (Tanque Argentia Mediano)	Argentina built tank based on the Marder chassis	Marder 1A1A3	1A1 with SEM 80/90 radios
VCTP (Vehiculo de Combate Transporte de Personal)	Argentina built vehicle with simplified 20-mm gun turret, 3 firing ports, 2 large roof hatches, & can carry 12 troops	Marder 1A1A4	1A1A with SEM 80/90 radios
Radarpanzer TUR	Marder chassis with a Siemens MPDR 3002S E-band air surveillance radar system	Marder 1A1A5	A1A2 with SEM 80/90 radios
Roland Air Defense Vehicle	2 Roland missiles ready to launch with 8 more in the hull	Marder 1A2	1983 upgrade includes thermal-imaging and the removal of the rear MG mount
Marder 2/KUKA M12 IFV/ Schutzenpanzer 2000 IFV	35-mm cannon equipped Marder, but program was canceled	Marder 1A3	Converted 1A1s and 1A2s into the A3 with passive armor & moving the 7.62-mm MG to the turret's extreme left
Marder 1A5A1	AC and electronic jammers added for Afghanistan	Marder 1A4	1A3 with SEM93 radio system
Marder 1A1A4	1A1A with SEM 80/90 radios	Marder 1A5	Extra mine-protection
NOTES			
SOURCES: 2014 WEG AND MILITARY PERISCOPE; EARLIER VERSIONS HAD A SLIGHTLY LOWER FIGURES FOR THE PROFILE, HEIGHT, WIDTH, AND GROUND PRESSURE. ERA KITS AVAILABLE, BUT WOULD BE A HAZARD DURING DISMOUNTED OPERATIONS. MILAN-3 COUNTERMEASURES ONLY FUNCITON WITH THE MILAN-3 LAUNCHER EVEN THOUGH ALL MILAN LAUNCHERS CAN FIRE ALL MILAN ATGMS.			

BRITISH INFANTRY FIGHTING VEHICLE WARRIOR



Warrior

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	FV 511, MCV-80, Fahris ACV	Name:	L21 Rarden
Date of introduction:	1988	Caliber/length (mm):	30
Proliferation: Vehicles: Countries:	1040+ 3+	Type:	Automatic Cannon
Description:	IFV with exit doors in the rear with space for 7 soldiers; no firing ports	Ammo (Rounds carried) APDS-T, APSE-T, HEI-T; rounds):	228
Crew (driver, commander, & gunner:	3	Max Effective Range (m): Day:	1100
Combat weight (mt):	24	Armor penetration:	INA
Chassis length overall (m):	6.34	Muzzle velocity (m/s):	INA
Height overall (m):	2.79	Name:	Turret Coaxial
Width overall (m):	3.03	Caliber/length (mm):	7.62
Ground pressure (kg/cm²):	0.65	Type:	L94A1 chain gun
Automotive performance:	Rolls Royce	Ammo (Ball, Ball-T- rounds:	2200
Engine type:	CV8 TCA 17.41-liter air-cooled, turbo-charged V-8 diesel	Max Effective Range (m ~):	1500
Cruising range (km at 60 km/h on flat terrain):	410	Armor penetration:	INA
Speed (km/h): Max road Max off-road: Average cross-country: Max swim:	85 40 INA N/A	Muzzle velocity (m/s ~):	862
Fording depths (m):	1.3	VARIANTS	SPECIFICATIONS
Radio:	INA	Infantry Section Vehicle	Basic version with 30-mm Rarden cannon, 7.62-mm chain gun with bolt-on armor
Protection:		Desert Warrior (Fahris)	AC and 25-mm chain gun for desert warfare

Armor, turret front (mm-against):	14.5	FV514 Mechanized Artillery Observation Vehicle	Dummy cannon, Battlefield Artillery Target Engagement System (BATES) computers, GPS, & laser designator
Applique armor (mm):	Available (see variants)	Desert Warrior for Kuwait	Warrior with a Delco LAV-25 2-man turret with M242 chain gun, 7.62-mm coaxial machine gun, & a single Hughes ATGM missile launcher
Explosive reactive armor(mm):	No	Reconnaissance Desert Warrior	Designed to operate in the front with a 25-mm M242 chain gun, 7.62-mm coaxial machine gun, & a single Hughes ATGM missile launcher
Active Protection System:	No	Arctic Warrior	Desert Warrior with a high-performance heater instead of air conditioning
Self-entrenching blade:	No	Command Vehicle	Battalion, Company, and Platoon versions with different radios and 30-mm Rarden cannon
Yes	Collective	Battery Command Vehicle	For British Royal Artillery commanders
Smoke equipment (grenade launchers):	4	Warrior with Milan Launcher	Milan ATGM launcher mounted on right side of the turret
Survivability equipment: All Warriors can be equipped with mine-clearing equipment	INA	Mortar Vehicle	Rear passenger compartment replace with space for an 81-mm or 120-mm mortar; turret replace with a cupola with a 7.62-mm machine gun
		Warrior Engineer Vehicle	Features a Thorn EMI Ranger mine-laying system and 7.62-mm machine gun
		TRIGAT Warrior	Fitted with hydraulic jackknife AT missile launcher with 16 missiles
		FV512 Warrior Mechanized Combat Repair Vehicle (MCRV)	Similar to the MRV(R) but w/o the winch or earth anchor; 7.62-mm chain gun in turret
		FV513 Warrior Mechanized Recovery Vehicle (Repair) (MRV))	6500 kg capacity crane, 20000 kg winch, earth anchor, air compressor, and 7.62-mm L94A1 chain gun

NOTES

SOURCES: 2014 WEG AND MILITARY PERISCOPE. VARIANTS AVAILABLE BUT NOT IN PRODUCTION INCLUDE A LIGHT TANK, ATGM, ANTI-AIRCRAFT, MLRS, AND A 90-MM GUN.

RUSSIAN AIRBORNE INFANTRY FIGHTING VEHICLE BMD-1/BMD-2



BMD-1



BMD-2

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	See variants	Name:	2A28 /Grom
Date of introduction:	1969	Caliber/length (mm):	73
Proliferation: Vehicles: Countries:	1081+ 8+	Type:	Smoothbore Gun with automatic loader
Description:	Air droppable IFV with rear exit; space for 5 soldiers; 1 firing port on each side; 1 firing port in left rear door	Ammo: HEAT-FS (Est) HE (Est)	16 24
Crew (driver & commander:	2	Max Effective Range (m): HEAT-FS/HE: HEAT-FS/HE (on move) HEAT-FS/HE (at night)	 1300 600 800-1000
Combat weight (mt): (BMD-2 in parenthesis)	7.5 (8.0)	Armor penetration: HEAT-FS (PG-15VNT) HEAT-FS (PG-15) HE (OGBG1): HE (OG-15VM)	 550-700 335 INA (damage or defeat an APC) INA (damage or defeat an APC)
Chassis length overall (m):	5.4 (5.5)	Muzzle velocity (m/s):	700
Height overall (m):	1.97 (2.18)	Name:	ATGM
Width overall (m):	2.63 (2.7)	Caliber/length (mm):	125
Ground pressure (kg/cm^2):	0.57 (0.50)	Type:	AT-3 Sagger or AT-4 Spigot
Automotive performance:	Type 5D-20	Ammo (MCLOS-rounds):	3
Engine type:	Liquid-cooled, V-6 diesel	Max Effective Range (m): Minimum Range (m):	3000 500
Cruising range (km):	320 (500)	Armor penetration:	INA
Speed (km/h): Max road: Max off-road: Average cross-country: Max Swim:	70 (60) 40 (INA) INA 10 (10)	Muzzle velocity (m/s):	INA
Fording depths (m):	Amphibious	Name:	Coaxial
Radio:	INA	Caliber/length (mm):	7.62
Protection:		Type:	PKT machine gun
Armor, turret front (mm):	23	Ammo (Ball, Tracer):	2000
Applique armor (mm):	Available	Max Effective Range (m): Day: Day on move: Night:	 1300 400-500 800

Explosive reactive armor(mm):	Available	Armor penetration:	INA
Active Protection System:	N/A	Muzzle velocity (m/s):	825
Self-entrenching blade:	N/A	Name:	Bow
NBC protection system:	Collective	Caliber/length (mm):	7.62
Smoke equipment:	VEESS	Type:	2 PKT machine guns
Survivability equipment:	INA	Ammo (Ball, Tracer):	4000
VARIANTS	SPECIFICATIONS	Max Effective Range (m):	1000
BMD-1M	Improved ventilation & different road wheels	Armor penetration:	INA
BMD-1P Airborne Combat Vehicle	Modified for 2-man crew & 6 passengers; AT-4 Spigot instead of the AT-3 Sagger	Muzzle velocity (m/s):	825
BMD-1 82-MM Mortar Carrier	An 82-mm mortar is mounted rearward in the troop compartment		

NOTES

SOURCES: 2014 WEG AND MILITARY PERISCOPE; VEHICLE CAN BE LANDED WITH TROOPS ON BOARD. FRENCH SNPE ERA AVAILABLE, BUT HAZARD TO DISMOUNTED TROOPS IN IMMEDIATE VICINITY. OTHER OPTIONS AVAILABLE INCLUDE A B30 TURRENT (2A42 30-MM GUN, 7.62-MM COAX MG & 9P135M LAUNCHER FOR AT-5/5B ATGM), AGS-17 30-MM AUTOMATIC GRENADE LAUNCHER, SPALL LINERS, AIR CONDITIONING, & MORE POWERFUL ENGINE.

RUSSIAN AIRBORNE INFANTRY FIGHTING VEHICLE BTR-D (BMD 1979)



BTR-ZD

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	See variants	Name:	PKT
Date of introduction:	1969	Caliber/length (mm):	7.62
Proliferation: Vehicles: Countries: (only some BTR-Ds):	1081+ 8+	Type:	2 PKT machine guns
Description:	Air droppable IFV with exit doors in the rear with space for 10 soldiers; 2 firing ports on each side; 1 firing port in left rear door	Ammo (Rounds carried): Light Ball, Ball-T, Heavy Ball, API, API-T, Incendiary in rounds	2000
Crew (driver, gunner, & commander:	3	Max Effective Range (m): Day: On the move: Night:	 1000 400-500 INA
Combat weight (mt):	6.7	Armor penetration (RHA at 500 m):	8
Chassis length overall (m):	5.88	Muzzle velocity (m/s):	825
Height overall (m):	1.67	VARIANTS	SPECIFICATIONS
Width overall (m):	2.63	1V119 Spektr	1V 118 Reostat without the Tall Mike radar system
Ground pressure (kg/cm^2):	0.50	S0-120 (2S9 Anona) SP Howitzer/Mortar	Self-propelled howitzer/ mortar built on same chassis
Automotive performance:	Type 5D-20	BMD-KShM	Command vehicle with 30-mm AG17 AGL & folding antenna; no firing ports or smoke dischargers
Engine type:	Liquid-cooled, V-6 diesel	BRehM-D Repair & Recovery Vehicle	BTR-D chassis with recovery crane, winch, dozer blade, & welding system to recover BMD vehicles; 7.62-mm machine gun

Cruising range (km):	500	BTR-RD Robot (BMD-1D)	AT variant with the AT-5 Spandrel (9K113 Konkurs) ATGM launch rail, 2 bow-mounted 7.62-mm machine guns with a AT-4/AT-5 launcher available for dismount use only
Speed (km/h): Max road: Max off-road: Average cross-country: Max Swim:	61 35 INA 10	BTR-ZD (BMD 1979)	AD variant with twin 23-mm ZU-23 AA gun
Fording depths (m):	Amphibious	BMD-1 with Schmel-1 RPV (Bumble Bee-1)	Second generation battlefield surveillance UAV launcher system
Radio:	INA	BMD-OBD Communications System	BTR-D chassis with an R-440 satellite commo system
Protection:		1V 118 Reostat	Observation vehicle for the 2S9 120-mm SP howitzer w/o the turret
Armor, turret front (mm; anti-bullet against):	7.62		
Applique armor (mm):	No		
Explosive reactive armor(mm):	No		
Active Protection System:	No		
Self-entrenching blade:	No		
NBC protection system:	Yes		
Smoke equipment (V4 Forward firing smoke grenade launchers:	VESS		
Survivability equipment:	INA		

NOTES

SOURCES: 2014 WEG AND MILITARY PERISCOPE; THIS IS THE BMD-1 WITH AN ADDITIONAL ROAD WHEEL, THE TURRENT REMOVED, A RAISED HATCH AREA, AND AN EXTENDED PASSENGER COMPARTMENT TO HOLD MORE SOLDIERS. OPTIONS INCLUDE AN AGS-17 30-MM AUTOMATIC GRENADE LAUNCHER IN THE REAR OR A KILIVER TURRET (30-MM GUN, 7.62-MM COAXIAL MACHINE GUN, THERMAL SIGHTS, SUPERIOR DAY SIGHTS, AND 4 KORNET ATGM LAUNCHERS). SOME ANALYSTS CONSIDER THIS VEHICLE MORE AN APC THAN AN IFV.

RUSSIAN AIRBORNE INFANTRY FIGHTING VEHICLE BMD-3/BMD-4



BMD-3



BMD-4

	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	See variants	Name:	2A42
Date of introduction:	1990	Caliber/length (mm):	30
Proliferation: Vehicles: Countries:	830+ 7+	Type:	Automatic Gun
Description:	Air droppable with rear exit doors; 4 dismounted soldiers; 2 firing ports on each side	Ammo(Rounds carried): AP-T, APDS-T, APFSDS: HE-T, Frag-HE:	860 120-160 240-340
Crew (driver, gunner, & commander):	3	Max Effective Range (m): Day: On the move: Night:	 1000 400-500 INA
Combat weight (mt):	13.2	Armor penetration (RHA at 500 m):	8
Chassis length overall (m):	6.36	Muzzle velocity (m/s):	825
Height overall (m):	2.25	Name:	AT-5B (Konkurs-M/9P135M2)
Width overall (m):	3.13	Caliber/length (m):	135
Ground pressure (kg/cm²):	0.54	Type:	ATGM-SACLOS
Automotive performance:	WV-60-2	Ammo: Ready Stowed	1 3
Engine type:	Water-cooled diesel	Max Effective Range (m): Minimum Range:	4000 70
Cruising range (km):	500	Armor penetration (RHA):	750-800
Speed (km/h): Max road: Max off-road: Average cross-country: Max Swim	44 44 INA 10	Muzzle velocity (m/s):	200
Fording depths (m):	Amphibious	Name:	AGS-17
Radio:	INA	Caliber/length (mm):	30
Protection:		Type:	Automatic grenade launcher
Armor, turret front (mm; anti-bullet against):	7.62	Ammo (rounds):	551
Applique armor (mm):	No	Max Effective Range (m):	1700
Explosive reactive armor(mm):	Available	Armor penetration:	INA
Active Protection System:	No	Muzzle velocity (m/s):	185
Self-entrenching blade:	No	Name:	Turret coaxial
NBC protection system:	Collective	Caliber/length (mm):	7.62
Smoke equipment (Smoke grenade launchers VESS:	6	Type:	PKT machine gun

Survivability equipment:	Kmt-8 Plow or KMT-10 roller can be mounted on vehicle	Ammo (Tracer, AP, API, Incendiary):	2000
VARIANTS	SPECIFICATIONS	Max Effective Range (m): Day: Night	 2000 1000
BMD-3M	100-mm 2A70 gun, 30-mm cannon, & a 7.62-mm MG	Armor penetration:	INA
2S25 SPATG	SP ATGM	Muzzle velocity (m/s) ~:	830
RKhM-5	Chemical recon vehicle	Name:	RPK-74
BMD-4	100-mm 2A70 cannon, 30-mm 2A72 30-mm auto cannon, 2 7.62-mm PKT machine guns; 9M117 Arkan AT or 9K113 Konkurs ATGM; 5 dismounts	Caliber/length (mm):	5.45
BMD-4M	Holds 6 dismounts	Type:	Light machine gun
		Ammo (rounds):	2325
		Max Effective Range (m): Ball/Tracer	 1700
		Armor penetration (mm):	INA
		Muzzle velocity (m/s):	960

NOTES

SOURCES: 2014 WEG AND MILITARY PERISCOPE. FRENCH SNPE ERA OR OTHER KITS AVAILABLE, BUT THEIR OPERATION DURING DISMOUNTED TROOP MOVEMENT COULD BE HAZARDOUS. ADDED ERA WEIGHT AFFECTS THE VEHICLE'S SWIM CAPABILITY. PASSIVE ARMOR IS MORE LIKELY AND ONES USED FOR AMPHIBIOUS OPERATIONS WILL LIKE NOT HAVE ANY EXTRA ARMOR. OPTIONS AVAILABLE INCLUDE SPALL LINERS, AIR CONDITIONING, & A MORE POWERFUL ENGINE. OTHER TERMAL SIGHTS ARE AVAILABLE FOR THE ATGM LAUNCHER. INDIAN FLAME-V ADAPTER KITS PERMITS THE BMD-3 TO FIRE THE MILAN, MILAN-2, AND MILAN-3 ATGMS.

RUSSIAN INFANTRY FIGHTING VEHICLE BMP-1



BMP-1

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	BMP Model 1970, Korshun	Name:	2A28 /Grom
Date of introduction:	1970	Caliber/length (mm):	73
Proliferation: Vehicles: Countries:	10151+ 44+	Type:	Smoothbore Gun with automatic loader
Description:	IFV with exit doors in the rear with space for 8 soldiers; 4 firing ports on each side; 1 firing port in left rear door	Ammo (Rounds carried): HEAT-FS (Est): HE (Est):	40 16 24
Crew (driver, commander, gunner):	3	Max Effective Range (m): HEAT-FS/HE-day: On the move: Night:	 1300 600 800-1000
Combat weight (mt):	13.5	Armor penetration (mm): HE (OGBG1) HE (OG-15VM) HEAT-FS (PG-15VNT) HEAT-FS (PG-15)	 INA (damage/defeat an APC) Ina (damage/defeat an APC) 550-700 335
Chassis length overall (m):	6.74	Muzzle velocity (m/s):	700
Height overall (m):	2.15	Name:	ATGM
Width overall (m):	2.94	Caliber/length (mm):	125
Ground pressure (kg/cm^2):	0.60	Type:	AT-3 Sagger
Automotive performance:	UTD-20	Ammo (MCLOS-rds carried):	3
Engine type:	Water-cooled, V-6 diesel	Max Effective Range (m) Minimum (m)	3000 5000
Cruising range (km):	600	Armor penetration:	INA
Speed (km/h): Max road: Max off-road: Average cross-country: Max swim:	65 45 INA 7	Muzzle velocity (m/s):	INA
Fording depths (m):	Amphibious	Name:	Turret coaxial
Radio:	INA	Caliber/length (mm):	7.62
Protection:		Type:	PKT machine gun
Armor, turret front (mm):	19-23	Ammo (Rounds carried): Tracer, AP, API, Incendiary	2000

Applique armor (mm):	Available	Max Effective Range (m): Day: On the move: Night:	1300 400-500 800
Explosive reactive armor(mm):	Available	Armor penetration:	INA
Active Protection System:	No	Muzzle velocity (m/s~):	830
Self-entrenching blade:	No	VARIANTS	SPECIFICATIONS
NBC protection system:	Collective	BMP-1 Model 1970	Principal longer (200-mm) model with better NBC gear
Smoke equipment:	VEESS	BMP-1 Ambulance (Iraq)	Evacuate wounded
Survivability equipment:	INA	BMP-1M	Kliver turret & drop down gate
VARIANTS	SPECIFICATIONS	Type 86/WZ-501 (China)	Chinese BMP-1 IFV
BMP-1 Finnish variant	East German vehicles with autoloaders removed	BMP-1 KShM (Command Vehicle)	Communication equipment similar to BMD KShM variant
BMP-1 with Poyaud engine (Egypt)	150 with replaced 10.47-liter Poyaud 6-cylinder engine	BMP-1G ICV	AT-4/AT-5 ATGM & 30-mm AGS-17 AGL
BMP-1 with applique armor (Iraq)	Armor to resist 12.7-mm & 14.5-mm AP shells at 200 m	BMP-1K (BMP 1974)	Command variant with additional radios
BMP-1A1 Ost	German model: no automatic loader & 6 passengers	BMP-1 with Soviet modifications in Afghanistan	Applique armor, AT-4 ATGM some with AGS-17 30-mm AGL
BMP-1 with CERAWA armor (Poland)	CERAWA ERA on the glacis, hull, & turret front	BMP-IRM ("Zhuk"-Beetle)	Engineer recon vehicle with front mine claws; 1 MG only
OT-90 (Czech Republic)	OT-64 1-man turret with 14.5-mm & 7.62-mm machine guns	BMP-1 with mine plow	KMT-8 or KMT-10 mine-clearing plows attached
BPzV (Czech Republic)	Recon with Tall Mike radar	MP-31	Modernized command vehicle
DP-90 (Czech Republic)	0T-90 maintenance variant	BMP-R (BMP M1976)	Recon vehicle with larger rear hatches & 2-man turret
MU-90 (Czech Republic)	Turretless mine-laying OT-90	BRM-1/BRM-1K Reconnaissance	BMP-R with a GS-12 Tall Mike radar ILO AT-3 Sagger (see Chapter 1)
MLI-84 (Romania)	Larger & heavier w/ 12.7-mm machine gun	BREM-2	Light recovery vehicle w/crane
Pansarbandvgn 501 (Pbv 501 (Sweden)	East German vehicles to mechanized Swedish infantry	BMP-40	Larger turret; carries 6 soldiers, prototype model only
BREM-4 recovery vehicle	No turret & crane (Czech version is the VPV)	PRP-3/PRP-4 (Radar)	Artillery recon vehicle with 7.62 MG ILO 73-mm cannon
BRM-23 (Bulgaria)	Recon with 23-mm cannon	VP-90 (Czech Republic)	Recon with OT-64 turret; 14.5-mm & 7.62-mm MGs
82-mm SP Automatic mortar (Hungary)	Vasilyek mortar ILO troop compartment	SVO Mine clearer (Czech Republic)	Turretless BMP-1 with 24 245-mm explosive rockets
PRAM-S (Czech Republic)	SP 120-mm mortar carrier	BMP-PP0	Training variant w/o turret
		Snezka (Czech Republic)	Battlefield surveillance vehicle

NOTES

SOURCES: 2014 WEG AND MILITARY PERISCOPE. ORGINAL BMP BEGAN IN 1966 BUT DID NOT PERFORM SATISFACTORIALY UNTIL 1970. FRENCH SNPE ERA KIT & OTHERS ARE AVAILABLE FOR USE, BUT IS DANGEROUS WITH SOLDIERS DISMOUNT. OTHER OPTIONS INCLUDE IMPROVED TRACKS, SPALL LINERS, AIR CONDTIONING, SMOKE GRENADE LAUNCHERS, LASER WARNING RECIVERS, & A MORE POWERFUL ENGINE.

RUSSIAN INFANTRY FIGHTING VEHICLE BMP-1P



BMP-1P

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	BWP-1 (Poland); see notes	Name:	2A28 /Grom
Date of introduction:	1974	Caliber/length (mm):	73
Proliferation: Vehicles (includes all BMP-1s: Countries:	 10151 7+	Type:	Smoothbore Gun with automatic loader
Description:	Improved BMP-1; rear exit doors; 6 soldiers; 4 firing ports each side; 1 rear firing port	Ammo (Rounds carried): HEAT-FS (Est): HE (Est):	40 16 24
Crew (driver, commander, gunner:	3	Max Effective Range (m): HEAT-FS/HE-day: On the move: Night:	 1300 600 800-1000
Combat weight (mt):	13.4	Armor penetration (mm): HE (OGBG1) HE (OG-15VM) HEAT-FS (PG-15VNT) HEAT-FS (PG-15)	 INA (damage/defeat an APC) INA (damage/defeat an APC) 550-700 335
Chassis length overall (m):	6.74	Muzzle velocity (m/s):	700
Height overall (m):	2.15	Name:	9P135M2
Width overall (m):	2.94	Caliber/length (mm):	135
Ground pressure (kg/cm²):	0.57	Type:	AT-4 Fagot; AT-4b Faktoriya; AT-5 Konkurs; AT-5B Konkurs-M
Automotive performance:	UTD-20	Ammo (SACLOS-rds carried):	4
Engine type:	Water-cooled, V-6 diesel	Max Effective Range (m): AT-4: AT-4b: AT-5/AT-5b:	 2000 2500 4000
Cruising range (km):	600	Armor penetration (HEAT-mm; RHA): AT-4 AT-4b AT-5 AT-5b	 480 550 mm 650 mm 925 mm
Speed (km/h): Max road:	65	Muzzle velocity (m/s):	

Max off-road: Average cross-country): Max swim:	45 INA 7	AT-4/AT-4b: AT-5/AT-5b: AT-5b:	186 200
Fording depths (m):	Amphibious	Name:	Turret coaxial
Radio:	R-123 or R-173	Caliber/length (mm):	7.62
Protection:		Type:	PKT machine gun
Armor, turret front (mm):	19-23	Ammo (Rounds carried): Tracer, AP, API, Incendiary	2000
Applique armor (mm):	No	Max Effective Range (m): Day: On the move: Night:	1300 400-500 800
Explosive reactive armor(mm):	Available	Armor penetration:	INA
Active Protection System:	No	Muzzle velocity (m/s~):	830
Self-entrenching blade:	No	VARIANTS	SPECIFICATIONS
NBC protection system:	Collective	BMP-1P	One of the most widely copied IFV with an AT-4/5 ATGM ILO of the AT-3. Standard OPFOR BMP-1. For Tier 4 portrayals, the ATGM is an AT-4. For a modern OPFOR, use an AT-5B
Smoke equipment (81-mm smoke grenade launchers):	6 VEESS	BMP-1PG	BMP-1P with an AGS-17 30-mm AGL & other upgrades
Survivability equipment:	INA	BMP-1PK	BMP-1P command variant with additional R-126 & R-107 radio equipment; right side firing ports & telescopes are blocked & features a small telescoping antenna
VARIANTS	SPECIFICATIONS	WZ 501/Type 86 (China)	China has built various BMP-1 variants over the years. Many are similar to the BMP-1P
BWP-1 (Poland)	BMP-1P built in Poland	BVP-1 (Czech Republic)	Czech built BMP-1P
		BVP-1 ARV (Czech Republic)	BMP-1P with no turret & 1500 kg crane mounted in passenger compartment

NOTES

SOURCES: 2014 WEG AND MILITARY PERISCOPE. A VARIETY OF UPGRADES ARE AVAILABLE: IMPROVED TRACKS, SPALL LINERS, AIR CONDITIONING, SMOKE GREANDER LAUNCHERS, LASER WARNING RECEIVERS, & MORE POWERFUL ENGINES. FRENCH SNPE ERA & OTHER KITS AREAVAILABLE, BUT ARE HAZARDOUS DURING DISMOUNTED OPERATIONS. ADDITONAL ARMOR MAY JEOPARDIZE AMPHIBIOUS CAPABILITY. KORTNET ATGM LAUNCHER CAN BE MOUNTED ON OTHER BMP-1 VARIANTS. RUSSIAN AGS-17 & AG-30 30-MM AUTOMATIC GRENADE LAUNCHERS ARE ALSO AVAILABLE. KEY LIMITATION FOR BMP-1S IS THE 1-MAN TURRET, BUT BMP-1S CAN BE UPGRADED TO 2-MAN TURRETS.

RUSSIAN INFANTRY FIGHTING VEHICLE BMP-2



BMP-2

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	Yozh (Russia); Sarath (India); BVP-2 (Czech); ZVS PRAM-S SP Mortar System	Name:	2A42
Date of introduction:	1980	Caliber/length (mm):	30
Proliferation: Vehicles: Countries:	10903+ 29+	Type:	Dual-feed automatic cannon
Description:	Improved BMP-1 IFV with rear exit; space for only 7 dismounts; 4 firing ports on left; 3 firing ports on right; 1 firing port in left rear door	Ammo (Rounds carried): HEI-T; Frag-HE: AP-T, APDS-T, APFSDS-T:	500 340 160
Crew:	3 (driver, commander, gunner)	Max Effective Range (m): AP-T Day/Night: APDS Day/Night: APFSDS-T M929 Day/Night: Frag-HE Day/Night:	 1500/1300 2000/1300 2000+/1300 4000/1300
Combat weight (mt):	14.3	Armor penetration (mm RHA): AP-T at 1500 m & 60˚ APDS at 1500 m & 60˚ APFSDS-T M929 at 1000 m APFSDS-T M929 at 2000 m Frag-HE:	 18 25 55 45 INA
Chassis length overall (m):	6.74	Muzzle velocity (m/s):	970
Height overall (m):	2.45	Name:	9P135M1 or 9P135M3
Width overall (m):	3.15	Caliber/length (mm):	135
Ground pressure (kg/cm^2):	0.64	Type:	AT-4 Fagot; AT-4b Faktoriya; AT-5 Konkurs; AT-5B Konkurs-M
Automotive performance:	UTD-20 or UTD-23	Ammo (SACLOS-rds carried):	4
Engine type:	Turbo-charged, water-cooled, in-line 6-cylinder diesel	Max Effective Range (m): AT-4: AT-4b: AT-5/AT-5b:	 2000 2500 4000
Cruising range (km):	600	Armor penetration (HEAT-mm; RHA): AT-4 AT-4b	 480 550 mm

		AT-5 AT-5b	650 mm 925 mm
Speed (km/h): Max road: Max off-road: Average cross-country): Max swim:	65 50 34 7	Muzzle velocity (m/s): AT-4/AT-4b: AT-5/AT-5b: AT-5b:	 186 200
Fording depths (m):	Amphibious	Name:	Turret coaxial
Radio:	R-123M or R-173	Caliber/length (mm):	7.62
Protection:		Type:	PKT machine gun
Armor, turret front (mm):	23-33	Ammo (Rounds carried): Tracer, AP, API, Incendiary	2000
Applique armor (mm):	On BMP-2D	Max Effective Range (m): Day: On the move: Night:	1300 400-500 800
Explosive reactive armor(mm):	Available	Armor penetration:	INA
Active Protection System:	No	Muzzle velocity (m/s~):	830
Self-entrenching blade:	No	VARIANTS	SPECIFICATIONS
NBC protection system:	PAZ automatic overpressure	BMP-2K	Command w/ additional radio/antenna
Smoke equipment (smoke grenade launchers:	6 VEESS	BMP-2D	Add-on armor, but no swim; seen in Afghanistan; mine plow available
Survivability equipment:	KMT-8 or KMT-10 Mine Plow Automatic fire extinguishing	Improved BMP-2	Better 30-mm cannon stabilization, improved communications; no swim
VARIANTS	SPECIFICATIONS	BMP-2ZS	Loudspeakers for PSYOP operations
BMP-2E	Improved protection with 6-mm steel plates & track skirts	BMP-2/LAHAT	Russian test variant with an Israeli ATGM system for potential sale
BVP-2 (Czech)	Czech BMP-2 designation	BMP-1U (Ukraine)	1-man OWS with 30-mm gun & AT-5
ZVS PRAM-S 120-mm SP Mortar System (Czech)	120-mm breach-loaded mortar mounted on a BMP-2 chassis	BMP-23 (Bulgaria)	MT-LB chassis with a 23-mm auto-cannon; inferior lethality & protection
BMP-2 with mine plow	KMT-8 or KMT-10 mine plow, but limited capabilities	BMP-30 (Bulgaria)	BMP-2 turret on a heavier chassis (protection against 20-mm ammo); operates with 7 road wheels
Sarath Indian Combat Vehicle (India)	Locally produced BMP-2 with a number of variants available		

NOTES

SOURCES: 2014 WEG AND MILITARY PERISCOPE. MANY COUNTRIES: HAVE UPGRADED THEIR OLDER BMP-1S WITH 23-MM, 25-MM, & 30-MM AUTOMATIC CANNONS REPLACING THE 73-MM GUN; SOME HAVE REPLACE THE 1-MAN BMP-1 TURRET WITH A 2-MAN TURRET THAT REQUIRES EXTENSIVE BODY WORK. OPTIONS AVAILABLE INCLUDE IMPROVED TRACKS, SPALL LINERS, AIR CONDITIONING, SMOKE GRENADE LAUNCHERS, LASER WARNING RECEIVERS, OR A MORE POWERFUL ENGINE. FRENCH SNPE ERA & OTHER KITS ARE AVIALBLE, BUT WOULD BE HAZARDOUS DURING DISMOUNTED OPERATIONS. THE KBP KVARTET 4-MISSILE FOR THE KORNET ATGM CAN BE MOUNTED ON THE BMP-1 OR BMP-2 CHASSIS. INDIAN FLAME-V ADAPTOR KITS PERMITS THE BMP-2 TO LAUNCH MILAN, MILAN-2, OR MILAN-3 ATGMS.

RUSSIAN INFANTRY FIGHTING VEHICLE BMP-2M & BMP-2M Berezhok



BMP-2M

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	BMP-2M is an early BMP2 upgrade. This is an OPFOR Tier surrogate, with options.	Name:	2A42
Date of introduction:	1995	Caliber/length (mm):	30
Proliferation: Vehicles: Countries: (Upgrades planned in 3 Countries):	10903 (part of the BMP-2 #s) 1+	Type:	Dual-feed automatic cannon
Description:	Improved version of the BMP-1 IFV with rear exit doors; space for 7 soldiers. 4 firing ports on left; 3 firing ports on right; 1 firing port in left rear	Ammo (Rounds carried): HEI-T; Frag-HE: AP-T, APDS-T, APFSDS-T:	 500 340 160
Crew (driver, commander, gunner):	3	Max Effective Range (m): AP-T Day/Night: APDS Day/Night: APFSDS-T M929 Day/Night: Frag-HE Day/Night:	 1500/1300 2000/1300 2000+/1300 4000/1300
Combat weight (mt):	14.3	Armor penetration (mm RHA): AP-T at 1500 m & 60˚ APDS at 1500 m & 60˚ APFSDS-T M929 at 1000 m APFSDS-T M929 at 2000 m Frag-HE:	 18 25 55 45 INA
Chassis length overall (m):	6.74	Muzzle velocity (m/s):	970
Height overall (m):	2.45	Name:	9M133
Width overall (m):	3.15	Caliber/length (mm):	152
Ground pressure (kg/cm²):	0.64	Type: BMP-2M Improved BMP-2M	Kornet-LR or AT-5B AT-5B/Konkurs-M
Automotive performance:	UTD-23	Ammo (SACLOS): Kornet:	6

		AT-5B	4
Engine type:	Turbo-supercharged diesel engine	Max Effective Range (m): Kornet-LR (Day/Night): Minimum Range (m):	 5500/3500 100
Cruising range (km):	600	Armor penetration (mm RHA): Kornet-LR HEAT: AT-5b HEAT:	 1100 925
Speed (km/h): Max road: Max off-road: Average cross-country): Max swim:	65+ 45+ 35+ 7	Muzzle velocity (m/s):	550
Fording depths (m):	Amphibious	Name:	Turret coaxial
Radio:	R-123M or R-173	Caliber/length (mm):	7.62
Protection:		Type:	PKT machine gun
Armor, turret front (mm):	23-33	Ammo (Rounds carried): Tracer, AP, API, Incendiary	2000
Applique armor (mm): BMP-2D; Add to BMP-2M for near-term IFV	23+	Max Effective Range (m): Day: On the move: Night:	 1300 400-500 800
Explosive reactive armor(mm):	Available	Armor penetration:	INA
Active Protection System:	No	Muzzle velocity (m/s~):	830
Self-entrenching blade:	No	Name:	AGS-30 or AGS-17
NBC protection system:	Collective	Caliber/length (mm):	30
Smoke equipment (Smoke grenade launchers):	6 VEESS	Type:	Automatic Grenade Launcher (AGL)
Survivability equipment:	KMT-8 Mine Plow available	Ammo (Rounds carried):	400
VARIANTS	**SPECIFICATIONS**	Max Effective Range (m): Day/Night:	1700
BMP-2M	BMP-1 to BMP-2 standards	Armor penetration:	INA
Kurganmashzavod Upgraded BMP-2	Export w/ 30-mm AGS-17 AGL & 2 ATGM launchers	Muzzle velocity (m/s):	185
BMP-2M Berezhok	Berezhok 2-man turret (Tier 1 OPFOR IFV)	**VARIANTS**	**SPECIFICATIONS**
BMP/Kliver	Kliver turret added (see separate entry)	"BMP-2M"	BMP-3M turret, 100-mm gun, ATGM, 30-mm coaxial gun, 7.62-mm anti-personnel coaxial gun. Limited space for dismounts

NOTES

SOURCES: 2014 WEG AND MILITARY PERISCOPE. SEE BMP-2 ENTRY FOR POSSIBLE UPGRADES AVAILABLE. FRENCH SNPE & OTHER ERA KITS AVAILABLE, BUT WOULD BE HAZARDOUS DURING DISMOUNTED OPERATIONS.

RUSSIAN INFANTRY FIGHTING VEHICLE/INFANTRY FSV BMP-3M



BMP-3M

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	None. Similar to BMP-3 (UAE). Could become a Heavy IFV if supplemental armor added	Name:	2A70
Date of introduction:	1990	Caliber/length (mm):	100
Proliferation: Vehicles: Countries: (Turret exported to 2 Countries):	1382+ 12+	Type:	Rifled gun
Description:	Improved BMP-2 IFV with rear exit doors; space for 7 soldiers; 2 firing ports on each side & 1 firing port in the rear door	Ammo (Rounds-mix varies): Frag-HE 3UOF17; Frag-HE 3UOF19 (electronic fuse); AT-10b/Arkan ATGM (see AT chapter	48
Crew (driver, commander, gunner:	3	Max Effective Range (m-Day/Night): Frag-HE 3UOF17: Frag-HE 3UOF19: AT-10b/Arkan ATGM: ATGM Minimum Range:	 4000/2600+ 7000/5000 4000-5000/4000-5000 100
Combat weight (mt):	18.7	Armor penetration: Frag-HE 3UOF17: Frag-HE 3UOF19: AT-10b/Arkan ATGM (mm-RHA) Behind ERA: Conventional Armor:	 INA INA but can defeat IFV/APC 750 mm 700 800+
Chassis length overall (m):	6.8	Muzzle velocity (m/s):	250-355
Height overall (m): (some variants reach 2.45 m)	2.30	Name:	2A72
Width overall (m):	3.23	Caliber/length (mm):	30
Ground pressure (kg/cm²):	0.62	Type:	Automatic Gun
Automotive performance:	UTD-29M	Ammo (total rounds):	500

		HEI-T, Frag-HE: APFSDS-T	340 160
Engine type:	10-cylinder, 4 stroke, v-shaped, water-cooled diesel	Max Effective Range (m) (Day/Night)	2500+
Cruising range (km):	600 (highway)	Armor penetration (mm RHA): 1000 m: 2000 m)	55 45
Speed (km/h): Max road: Max off-road: Average cross-country): Max swim:	70 45 35 10	Muzzle velocity (m/s):	INA
Fording depths (m):	Amphibious	Name:	Turret coaxial
Radio:	R-173 or R-173P	Caliber/length (mm):	7.62
Protection:		Type:	PKT machine gun
Armor, turret front (mm):	30-100	Ammo (Rounds carried): Tracer, AP, API, Incendiary	2000
Applique armor (mm):	On Turret	Max Effective Range (m): Day: On the move: Night:	1300 400-500 800
Explosive reactive armor(mm):	Additional stand-off plate	Armor penetration:	INA
Active Protection System:	Available	Muzzle velocity (m/s~):	830
Self-entrenching blade:	Yes	Name:	Bow mounted
NBC protection system:	Automatic overpressure system	Caliber/length (mm):	7.62
Smoke equipment (81-mm smoke grenade launchers:	6 VEESS	Type:	2 PKT machine guns
Survivability equipment:	KMT-8 Mine Plow available	Ammo (Rounds carried): Tracer, AP, API, Incendiary	4000
VARIANTS	**SPECIFICATIONS**	Max Effective Range (m): Day: On the move: Night:	 1000 400-500 INA
Desert BMP-3/BMP-3 (UAE)	See separate entry	Armor penetration:	INA
BMP-3M with Arena-E Active Protection System	Cost will limit fielding	Muzzle velocity (m/s):	~ 830
BM-3M with ERA	Box ERA gives protection against KE rounds	**VARIANTS**	**SPECIFICATIONS**
Bakcha-U/BMP-3M Unified Fighting Compartment	Drop-in turret on other chassis	Type 97 IFV (China)	Chinese counterpart (AKA 2G) to BMP-3M
BMD-4 & BMD-4M	Amphibious IFVs with compact hulls & Bakcha-U turret		

NOTES

SOURCES: 2014 WEG, MILITARY PERISCOPE. RUSSIAN AGS-17 AUTOMATIC GREANDE LAUNCHER & SHTORA IR ATGM JAMMER COUNTERMEASURE SYSTEM IS AVAILABLE. CHSSIS IS ALSO SUITED FOR MOUNTING OTHER WEAPONS: KORNET/KRIZANTEMA AT LAUNCHERS, 2S31 120-MM COMBINATION GUN; HERMES-A MISSILE LAUNCHER; PANTSIR-S1-0 AIR DEFENSE SYSTEM.

RUSSIAN INFANTRY FIGHTING VEHICLE/INFANTRY FSV BMP-3 UAE



BMP-3 (UAE)

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	Desert BMP-3	Name:	2A70
Date of introduction:	1990 (BMP-3); After 2000 for this variant	Caliber/length (mm):	100
Proliferation: Vehicles (includes all BMP-3s): Countries:	 1382+ 9+	Type:	Rifled gun
Description:	BMP-3 with adjustable suspension system, the Namut thermal sight, improved fire control system, & air conditioning	Ammo (Rounds-mix varies): Frag-HE 3UOF17; Frag-HE 3UOF19 (electronic fuse); AT-10b/Arkan ATGM (see AT chapter	48
Crew (driver, commander, gunner):	3	Max Effective Range (m-Day/Night): Frag-HE 3UOF17: Frag-HE 3UOF19: AT-10b/Arkan ATGM: ATGM Minimum Range:	 4000/2600+ 7000/5000 4000-5000/4000-5000 100
Combat weight (mt):	18.7	Armor penetration: Frag-HE 3UOF17: Frag-HE 3UOF19: AT-10b/Arkan ATGM (mm-RHA) Behind ERA: Conventional Armor:	 INA INA but can defeat IFV/APC 750 mm 700 800+
Chassis length overall (m):	6.73	Muzzle velocity (m/s):	250-355
Height overall (m):	2.45	Name:	2A72
Width overall (m):	3.15	Caliber/length (mm):	30
Ground pressure (kg/cm^2):	0.62	Type:	Automatic Gun
Automotive performance:	UTD-29	Ammo (total rounds): HEI-T, Frag-HE: APFSDS-T	500 340 160
Engine type:	10-cylinder, 4 stroke, v-shaped, water-cooled diesel	Max Effective Range (m) (Day/Night)	 2500+

Cruising range (km):	600 (highway)	Armor penetration (mm RHA): 1000 m: 2000 m)	 55 45
Speed (km/h): Max road: Max off-road: Average cross-country): Max swim:	70 45 35 10	Muzzle velocity (m/s):	INA
Fording depths (m):	Amphibious	Name:	Turret coaxial
Radio:	R-173 or R-173P	Caliber/length (mm):	7.62
Protection:		Type:	PKT machine gun
Armor, turret front (mm-front glacis):	30-35	Ammo (Rounds carried): Tracer, AP, API, Incendiary	2000
Applique armor (mm):	On Turret	Max Effective Range (m): Day: On the move: Night:	1300 400-500 800
Explosive reactive armor(mm):	Available	Armor penetration:	INA
Active Protection System:	No	Muzzle velocity (m/s~):	830
Self-entrenching blade:	Yes	Name:	Bow mounted
NBC protection system:	Collective	Caliber/length (mm):	7.62
Smoke equipment (Smoke grenade launchers	6 VEESS	Type:	2 PKT machine guns
Survivability equipment:	KMT-8 Mine Plow available	Ammo (Rounds carried): Tracer, AP, API, Incendiary	4000
VARIANTS	SPECIFICATIONS	Max Effective Range (m): Day: On the move: Night:	 1000 400-500 INA
9P162	ATGM w/ AT-14 Kornet ATGM	Armor penetration:	INA
BMMP	Amphibious IFV; BMP-3 chassis & BMP-2 fighting compartment	Muzzle velocity (m/s):	~ 830
BREhM-L	Armored Recovery Vehicle	VARIANTS	SPECIFICATIONS
9P157-2	ATGM w/ AT-15/Krizantema	BMP-3	Original IFV with 1K13-2 II night sight
BMP-3F	Naval amphibious prototype; some with Kliver turret	BMP-3K	Cmd w/ HEF 100-mm round, no bow MGs & additional radios
		BRM-3K	Recon vehicle with 30-mm gun only & radar

NOTES

SOURCES: 2014 WEG, MILITARY PERISCOPE. CAN BE USED AS A STANDARD IFV, BUT ITS COST MAY MAKE IT MORE SUITED FOR SPECIALIZED ROLES. THE UNIFIED FIGHTING COMMPARTMENT IS BEING FITTED TO OTHER VEHICLES. ITS SWIM CAPABILITIES & FIREPOWER MAKE IT WELL SUITED FOR AMPHIBIOUS OPERATIONS. THE 100-MM CANNON IS NOT RESPONSIVE TO QUICK SLEWING MAKING IT LESS EFFECTIVE IN CLOSE TERRAIN. FRENCH SNPE & OTHER ERA KITS ARE AVAILABLE.

TURKISH ARMORED INFANTRY FIGHTING VEHICLE (AIFV) FNSS



FNSS

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	AAPC Armored Personnel Carrier (See Variants)	Name:	Giat M811 or Oerlikon Contraves cannon
Date of introduction:	1992	Caliber/length (mm):	25
Proliferation: Vehicles: Countries:	2738+ 6	Type:	Dual-fed cannon
Description:	M113 family IFV w/ rear exit; space for 10 soldiers	Ammo (Rounds carried): HEI-T; APDS-T; APFSDS-T	INA
Crew (driver, command, gunner):	3	Max Effective Range (m):	1500+
Combat weight (mt-base):	13.7	Armor penetration:	INA
Chassis length overall (m):	5.26	Muzzle velocity (m/s):	INA
Height overall (m):	2.01	Name:	Turret coaxial
Width overall (m):	2.82	Caliber/length (mm):	7.62
Ground pressure (kg/cm^2):	0.67	Type:	Machine Gun
Automotive performance:	ACV-300	Ammo (Rounds carried): Tracer, AP	INA
Engine type:	Detroit Diesel Model 6V-53T	Max Effective Range (m)	INA
Cruising range (km):	490	Armor penetration:	INA
Speed (km/h): Max road: Max off-road: Average cross-country): Max swim:	65 INA INA 6	Muzzle velocity (m/s):	INA
Fording depths (m):	Amphibious		
Radio:	INA	VARIANTS	SPECIFICATIONS
Protection:		AIFV	Original with 25-mm Giant M811 cannon; some may have the 25-mm Oerlkon Contraves cannon
Armor, turret front (mm):	INA	Advanced Armored Personnel Carrier (AAPC)	1-man turret with 12.7-mm & 7.62-mm machine guns

Applique armor (mm):	INA	Armored Mortar Vehicle (AMV)	6 personnel operate an 81-mm mortar & 7.62-mm machine gun
Explosive reactive armor(mm):	INA	Armored TOW Vehicle (ATV)	4-man crew operate a Norwegian ALT turret with 2 TOW missiles
Active Protection System:	No	Recovery Vehicle	AIFV with crane & winch, uprated engine with special cooling package
Self-entrenching blade:	No	ACV-S	Stretched ACV-300 with wider hull, 6 road wheels, 2-man turret, & upgraded armor for protection
NBC protection system:	INA	ACV-S with BMP-3 Turret	AIFC with 2-man BMP-3 turret (100-mm 2A70 rifled gun, coaxial 30-mm Mk 44 cannon, & coaxial 7.62-mm machine gun
Smoke equipment (Smoke grenade launchers):	6	ACV-S Tracked Load Carrier	Supply vehicle to carry 6 metric tons
Survivability equipment:	INA	ACV-300 Modular Electronic System Vehicle	Command vehicle with special communication equipment
VARIANTS	SPECIFICATIONS	ACV-300 with Hellfire Anti-Tank Missiles	4 Hellfire AT missiles on launchers with 4 additional carried internally; requires manual reloading (8000 m range)
ACV-300 Adnan IFV (Malaysia)	10 variants with KVH TechNav navigation system & night sight	SPM-120 SP Mortar Vehicle	Swiss RUAG 120-mm Bighorn smoothbore mortar with automatic loader
ACV-S 120-mm Armored Mortar Vehicle (Malaysia)	120-mm 2R2M mounted mortar	Adnan IFV with stabilized cannon (Malaysia)	Sharpshooter turret with an ATK Bushmaster M242 25-mm chain gun
Artillery Support (UAE)	Forward Observation vehicle with laser rangefinder & radar	Adnan Anti-Tank (Malaysia)	Mounts the Pakistani Baktar Shikan ATGM system (Red Arrow 8)

NOTES

SOURCES: MILITARY PERISCOPE. MOST VEHICLES ARE IN THE TURKISH ARMY, BUT OTHER ARMIES DO OPERATE THE AIFV. THE AIFV WAS BUILT BASE ON THE M113 TECHNOLOGY AND CONTINUED AFTER THE BRADLEY (M-2 & M-3) FIGHTING VEHICLE WON THE CONTRACT TO FIELD THE IFV TO THE AMERICAN ARMY

AMERICAN INFANTRY FIGHTING VEHICLE YPR 765



YPR 765

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative destinations:	Egyptian Infantry Fighting Vehicle (EIFV); See Variants	Name:	Oerlikon KBA-B02
Date of introduction:	1978	Caliber/length (mm):	25
Proliferation: Vehicles: Countries:	1497+ 8	Type:	Cannon
Description:	IFV modified from the M113 with exit ramp in the rear with space for 7 soldiers; 2 firing ports on each side & 1 firing port in the left of the ramp	Ammo (Rounds carried): Ready: Reserve: HEI-T, APDS-T; SAPHEI-T, TP-T, APP-T, FAPDS	 180 144
Crew:	3 (driver, commander, gunner)	Max Effective Range (m)	2000
Combat weight (mt):	13.7	Armor penetration:	INA
Chassis length overall (m):	5.26	Muzzle velocity (m/s): HEI-T APDS-T	1360 1100
Height overall (m):	2.79 (2.01 hull top)	Name:	Turret Coaxial
Width overall (m):	2.82	Caliber/length (mm):	7.62
Ground pressure (kg/cm²):	0.67	Type:	Machine Gun
Automotive performance:	6V-53T	Ammo (Rds) AP, Tracer, Ball Ready: Reserve	1840 230 1610
Engine type:	Water-cooled, turbocharged, 2-stroke, V-6 diesel Allison	Max Effective Range (m):	1100
Cruising range (km):	490 (483-EIFV)	Armor penetration (mm by AP at 500 m)	7
Speed (km/h): Max road: Max off-road: Average cross-country): Max swim:	61 INA INA 7	Muzzle velocity (m/s):	853
Fording depths (m):	Amphibious	Muzzle velocity (m/s):	INA
Radio:	INA		
Protection:		VARIANTS	SPECIFICATIONS

Armor, turret front (mm): (Against 14.5-mm AP rounds)	INA	EIFV	6 dismounted soldiers; M242 Bushmaster 25-mm w/ 900 rounds; BGM-71 TOW ATGM w/ 6 rounds; M240 MG w/ 4400 rounds
Applique armor (mm):	Aluminum hull with spaced laminate steel on front & sides	Mortar Prime Mover (Dutch YPR 765 PRMR)	Tows the 120-mm Thomson-Brandt mortar with crew of 7
Explosive reactive armor(mm):	INA	Cargo Carrier (Netherlands: YPR 765 PRVR-A/B)	Crew of 2 can carry cargo into the combat zone
Active Protection System:	INA	TOW Missile Carrier (Netherlands: YPR 765 PRAT)	Similar to the US M901 ITOW variant of the M113 with an Emerson TOW AT system
Self-entrenching blade:	No	Ambulance (Netherlands: YPR 765 PRGWT)	Unarmed variant with a crew of 4
NBC protection system:	Yes (Details INA)	Bn Command (Netherlands: YPR 765 PRCO-C1)	Specialized for infantry battalion commanders
Smoke equipment (Smoke grenade launchers):	6	Bn Gunnery Center (Netherlands PRCO-C2)	Specialized for use by artillery battalions
Survivability equipment:	INA	Mortar Fire-Control Vehicle (Netherlands PRCO-C3)	Specialty vehicle to control indirect mortar fire
VARIANTS	**SPECIFICATIONS**	Anti-Aircraft Control Vehicle (Netherlands PRCO-C4)	Specially designed for air defense command & control
Command Vehicle	Room for 9-man crew with additional communication equipment	YPR 765 PRCO-C5 (Netherlands)	Observation vehicle with only a 4-man crew
AIFV-B (Belgium)	40-caliber MG, NBC protection, & Halon fire-extinguishing system	YPR 765 PRRDR (Netherlands)	Operated the British ZB 298 battlefield surveillance radar
AIFV-B-CP (Belgium)	Pintle-mounted 12.7-mm MG, crew of 7, NBC protection, & Halon fire-extinguishing system	YPR PRRDR-C (Netherlands)	Radar/Command Vehicle
Philippine Variant	Converted to accept 50-caliber MG ILO 25-mm cannon	YPR 765 PRI/I (Netherlands)	Squad vehicle with M113 cupola, M2 HB MG, 9 soldiers, & driver
YPR-765 KMAR Military Police Vehicle	YPR-765 PRI/I modified for use by military police	YPR 806 PRBRG (Netherlands)	Recovery vehicle with HIAB crane, crew of 4, & 8 smoke grenade launchers
Turkish ACV	See separate vehicle for the FNSS IFV	YPR-2000 (Netherlands)	Upgrade included more storage containers

NOTES

SOURCES: MILITARY PERISCOPE & TM 43-0001-27. VEHICLES 76-590 FEATURED ANOTHER 25-MM RIFLED CHAIN GUN ILO OF THE KBA-B02 WITH 220 ROUNDS (175 HE-I & 45 APDS-T)

SOUTH KOREAN INFANTRY FIGHTING VEHICLE KIFV



KIFV

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	None	Name:	M2
Date of introduction:	1985	Caliber/length (mm):	12.7
Proliferation: Vehicles: Countries:	1811+ 2	Type:	Machine Gun
Description:	IFV derived from the FMC YPR 765; rear exit ramp; space for 9 soldiers; firing ports	Ammo (Rounds carried): AP, API, APIT	INA
Crew (driver, commander, gunner:	3	Max Effective Range (m):	1800
Combat weight (mt):	12.9	Armor penetration (mm): At 91 m: At 500 m:	 22.2 19
Chassis length overall (m):	5.49	Muzzle velocity (m/s):	884
Height overall (m): (with MG shield)	1.93 2.52	Name:	Pintle-mounted
Width overall (m):	2.85	Caliber/length (mm):	7.62
Ground pressure (kg/cm^2):	0.67	Type:	Machine Gun
Automotive performance:	D2848T	Ammo (Rounds carried): AP, Tracer, Ball	INA
Engine type:	Doosan V-8 Diesel	Max Effective Range (m):	1100
Cruising range (km):	480	Armor penetration (mm): At 500 M	7
Speed (km/h): Max road: Max off-road: Average cross-country):	74 INA INA	Muzzle velocity (m/s):	853

Max swim:	4		
Fording depths (m):	Amphibious		
Radio:	INA	VARIANTS	SPECIFICATIONS
Protection:		Vulcan Air Defense Carrier	KIFV with 20-mm Vulcan AD system & AN/PVS-2 range-only radar
Armor, turret front (mm):	INA	Mortar Carrier	81-mm (7-man) or 107-mm (5-man) fires through roof; dismount option available
Applique armor (mm):	Welded aluminum armor with applique laminated steel plates	Recovery Vehicle	3500 kg crane & 20,000 kg winch
Explosive reactive armor(mm):	INA	NBC Recon Vehicle	No firing ports, single left-opening door, 5 crew members, & NBC equipment
Active Protection System:	INA	Command Post (Malaysia)	Roof-mounted 12.7-mm MG with additional communication equipment
Self-entrenching blade:	No	Ambulance (Malaysia)	Handles wounded personnel
NBC protection system:	Yes (Details INA)	40-mm Turret	40-mm gun mounted in turret
Smoke equipment (Smoke grenade launchers):	6	Smoke Generation	Creates smoke on the battlefield
Survivability equipment:	INA	K200A1	Upgraded variant to 70 km/hr; quicker dash speed; faster amphibious speed
		Gun Carriers	Prototype vehicles with either a 30-mm or 90-mm cannon
		TOW Carrier	Proposed variant with turret with 2 TOW missiles in the ready-to-fire position

NOTES

SOURCES: MILITARY PERISCOPE, MILITARY FACTORY, & TM 43-0001-27. VEHICLE SERVED AS A REPLACEMENT FOR SOUTH KOREA'S M113S. CURRENTLY ONLY OPERATED BY SOUTH KOREA & MALAYSIA. MALAYSIAN KIFVS USED DURING BOSNIAN PEACEKEEPING OPERATIONS. MECHANICAL ISSUES IN BOSNIA CAUSED MALAYSIA TO LOOK AT REPLACING THE KIFV WITH A WHEELED APC TO SUPPLEMENT THE KIFV IN FUTURE MILITARY OPERATIONS.

SOUTH AFRICAN INFANTRY FIGHTING VEHICLE RATEL



Ratel

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	See variants	Name:	M2
Date of introduction:	Mid-1970s	Caliber/length (mm):	12.7
Proliferation: Vehicles: Countries:	1667+ 8+	Type:	Machine Gun
Description:	6 X 6 wheeled IFV with rear door & 4 roof hatches for 5 soldiers to dismount; 4 firing ports on both sides	Ammo (Rounds carried): AP, API, APIT	INA
Crew (commander, driver, main gunner, rear anti-aircraft gunner, section commander):	5	Max Effective Range (m):	1800
Combat weight (mt):	19	Armor penetration at 91 m: At 500 m	22.2 19
Chassis length overall (m):	7.21	Muzzle velocity (m/s):	884
Height overall (m):	2.92	Name:	Turret coaxial
Width overall (m):	2.52	Caliber/length (mm):	7.62
Ground pressure (kg/cm^2):	INA	Type:	Machine Gun
Automotive performance:	D 3256 BTXF	Ammo (Rounds carried): AP, Tracer, Ball	6000
Engine type:	6-cyclinder, in-line turbocharged diesel	Max Effective Range (m)	1100
Cruising range (km):	1000	Armor penetration (mm by AP round at 500 m):	7
Speed (km/h): Max road: Max off-road: Average cross-country): Max swim:	105 65 INA 4	Muzzle velocity (m/s):	853
Fording depths (m):	INA	Name:	Anti-Aircraft
Radio:	INA	Caliber/length (mm):	7.62
Protection:		Type:	2 Machine Guns

Armor, turret front (mm):	20	Ammo (Rounds carried—all 3 machine use the same ammo source): AP, Tracer, Ball	6000
Applique armor (mm):	INA	Max Effective Range (m):	1100
Explosive reactive armor(mm):	INA	Armor penetration (mm by AP round at 500 m):	7
Active Protection System:	INA	Muzzle velocity (m/s):	853
Self-entrenching blade:	No	VARIANTS	SPECIFICATIONS
NBC protection system:	INA	Ratel 20	Original version with French designed turret with 20-mm F2 cannon with 1200 rounds
Smoke equipment (81-mm Smoke grenade launchers):	4	Ratel 60	Eland 60 turret with 60-mm breech-loading mortar with 3-man crew, 451 rounds (45 HE, 3 Smoke, 3 Illumination) & 7 other soldiers
Survivability equipment:	INA	Ratel 81	No turret with an 81-mm mortar installed in crew compartment for indirect fire support
VARIANTS	SPECIFICATIONS	Ratel 90	Eland 90 turret with crew of 3 & 6 other soldiers available for dismount operations
Ratel AA (Jordan)	Twin 23-mm air defense cannons from a BTR-94 mounted on the Ratel body	Ratel Command	2-seated turret with 12.7-mm, 2 7.62-mm AA MGs, & crew of 9 Soldiers
Ratel 120	Prototype 120-mm mortar carrier not yet in production	Ratel EAOS	Enhanced Artillery Observation System (EAOS) with radar capability
Ratel Logistic	8 X 8 prototype with only 2 vehicles produced	Ratel Maintenance	Mobile workshop
Lklwa	Prototype with upgraded engine that has been moved from the rear to the front	Ratel ZT3	ATGM platform with 3 ZT3 laser guided missiles on launcher with 12 additional in storage; 7.62-mm MG for self-defense

NOTES

SOURCES: MILITARY PERISCOPE, MILITARY FACTORY, & TM 43-0001-27. WHILE THE VEHICLE HAS WHEELS (6 X 6), IT IS STILL AN IFV BECAUSE IT IS MEANT TO FIGHT THROUGH THE OBJECTIVE INSTEAD OF DISMOUNTING BEFORE THE OBJECTIVE. THE WHEEL VEHICLE MAKES IT FASTER, ESPECIALLY ON ROADS, WITH BETTER FUEL CONSUMPTION. THE DRAWBACK IS THAT WHEELED VEHICLES USUALLY CANNOT GO WHERE TRACK VEHICLES CAN NAVIGATE.

AUSTRIAN ARMORED PERSONNEL CARRIER PANDUR



Pandur I

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	Vlauk (Slovenia); See variants	Name:	M2HB
Date of introduction:	1996	Caliber/length (mm):	12.7
Proliferation: Vehicles: Countries:	336+ 6+	Type:	Machine Gun
Description:	8 X 8 wheeled APC with 2 exit doors in the rear & 2 roof hatches; 2 firing ports on both sides with a capacity for 8 dismounted soldiers	Ammo (Rounds carried, but depends on configuration: Ball, Tracer, AP, API, API-T, AP Hardcore, Multipurpose, SLAP, SLAPT	1000
Crew (driver & commander):	1	Max Effective Range (m against High Hard Armor (HHA))	1500
Combat weight (mt):	13.5	Armor penetration (mm; SLAP (Sabot Light Armor Penetrator) against HHA at 500 m):	34
Chassis length overall (m):	5.70	Muzzle velocity (m/s): M33 Ball SLAPT (Tracer)	 890 1215
Height overall (m):	1.82	VARIANTS	SPECIFICATIONS
Width overall (m):	2.50	Pandur 1	Basic version as in the description
Ground pressure (kg/cm²):	INA	Belgian Pandur	Belgian SMAS radio, NBC protection, armed with 12.7-mm & 7.62-mm machine guns
Automotive performance:	WD 612.95		
Engine type:	6-cylinder, turbo-charged water-cooled Steyr diesel	Amphibious Pandur	Electric bilge pumps, closed air intakes-capable of 11 km/h in water

Cruising range (km):	700	Pandur Ambulance	3-man crew for 4 stretcher, 2 seated & 2 stretcher, or 2 seated patients
Speed (km/h): Max road: Max off-road: Average cross-country): Max swim:	62 INA INA N/A	Pandur Anti-Aircraft	Twin 20-mm cannon or SANTAL SAM in turret
Fording depths (m):	8.5	Pandur ATGM Carrier	HOT AT missile in a Euromissile UTM 800 launcher or a TOW AT missile in a Kvaerner-Eurkea turret; additional missiles stored in the hull
Radio:	INA	Pandur Armored Recon/Fire Support Vehicle (FSV)	2-man LCTS turret with a Cockerill 90-mm Mk 8 gun or a Giat TS-90 turret with a 90-mm CN90F4 gun or Cockerill CSE90 turret with an Mk III 90-mm gun
Protection:	INA	Pandur Mechanized Infantry Combat Vehicle (MICV)	MGTS with a choice of armaments: 12.7-mm M2 & 7.62-mm MGs; 30-mm M230 chain gun & 7.62-mm MG; or 40-mm AGL & 12.7-mm MG
Armor, turret front (mm; protects against 7.62-mm AP rounds at 30 m):	INA	Pandur Mortar Carrier	In the passenger compartment, there is an 81-mm or 120-mm mortar mounted on a turntable
Applique armor (mm):	INA	Command & Control Vehicle	For C2 operations
Explosive reactive armor(mm):	INA	Armored Recovery/Repair Vehicle	For vehicle recovery operations
Active Protection System:	INA		
Self-entrenching blade:	No		
NBC protection system:	Available		
Smoke equipment (Smoke grenade launchers):	6		
Survivability equipment:			

NOTES

SOURCES: 2014 WEG, MILITARY PERISCOPE, U.S. ORDNANCE, GLOBAL SECURITY, & MILITARY FACTORY. OPTIONAL WEAPONRY INCLUDES A 20-MM AUTOCANNON IN TRAVERSING TURRET, 30-MM MAUSER DUAL-FEED CANNON IN 2-MAN TURRET, 90-MM MAIN GUN IN A 2-MAN TURRET, HEAVY MORTARO, OR A HOT 4000 AT LAUNCHER.

CHINESE ARMORED PERSONNEL CARRIER TYPE 63



YW 531C/Type 63C

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	YW 531A; see variants YW 531C (Data shown) VTT-323 (North Korea-see separate entry)	Name:	Type 54 (DShKM copy)
Date of introduction:	1964	Caliber/length (mm):	12.7-mm
Proliferation: Vehicles: Countries:	2086+ 9+	Type:	Machine Gun
Description:	Lightly armored APC with exit door in the rear with space for 10 soldiers; 2 firing ports on left side, 1 firing port on right side, & 1 firing port in the rear door (other models vary)	Ammo (Rounds carried): APDS (Tungsten Core); API, API-T, Russian Duplex, Russian Duplex-T, Incendiary-T, HE-T, Type MDZ, HeI Type ZP	1120
Crew (driver & commander:	2	Max Effective Range (m):	2000
Combat weight (mt):	12.6	Armor penetration (mm) API at 500 m: API at 1000 m:	 21 13
Chassis length overall (m):	5.48	Muzzle velocity (m/s):	850
Height overall (m):	2.85	VARIANTS	SPECIFICATIONS
Width overall (m):	2.98	YW 531/Type 63/K-63	Original variant with 7.62-mm MG
Ground pressure (kg/cm²):	0.57	YW 531A/Type 63A	1968 production model with 12.7-mm MG
Automotive performance:	BF8L 413F	Type 63-1	5-road wheel variant for the YW 70-I 122-mm SP howitzer
Engine type:	4-cycle, turbocharged, air-cooled, V-8 diesel	VTT-323	North Korean Type 63-1 (see separate entry)
Cruising range (km):	500 (61-water)	Type 63-2	4 X 2 drive APC with gun shield
531C Speed (km/h): Max road: Max off-road: Average cross-country):	 66 40 INA	WZ 701	Type 63-2 command vehicle with 7.62-mm MG

Max swim:	6		
531A Speed (km/h): Max road: Max off-road: Average cross-country): Max swim:	 42 32 INA 6	Type 70 Rocket Launcher	Type 63-2 130-mm (19 tubes) MRL
Fording depths (m):	Amphibious	Anti-Tank Missile Carrier	Red Arrow 8 AT launcher with 4-rail launcher & 4 stowed ATGMs
Radio:	Type 889	YW 531C/Type 63C	4 X 2 drive APC with gun shield, better vision ports, improved German KHD diesel engine, & better ventilation
Protection:		YW 531D/Type 63D	YW 531C, but with only 1 firing port on the left side & different radio
Armor, turret front (mm; front glacis):	14	YW 531E/Type 63E	YW 531C, but with only 1 firing port on the left side & 2 radios
Applique armor (mm):	No	Type 701	With Type 63C, better suited for high sea-state amphibious operations
Explosive reactive armor(mm):	No	YW 750	Ambulance for 4 stretcher or 8 seat patients
Active Protection System:	No	YW 701/B	Command vehicles with Type 56 7.62-mm MG for self-defense; export model has 12.7-mm AA MG
Self-entrenching blade:	No	YW 304	82-mm M-1937 SP mortar with 120 rounds & 12.-7-mm AA MG
NBC protection system:	No	YW 381	120-mm SP mortar with 50 rounds
Smoke equipment:	No	Type 54-1	122-mm mobile gun mounted in an open-topped troop compartment
Survivability equipment:	INA	Psychological Warfare	Variant with roof-mounted speakers
		Type 85/YW 531H	Latest YW 531 variant with new suspension system, 5 road wheels, & 3 return rollers (see separate entry)

NOTES

SOURCES: 2014 WEG AND MILITARY PERISCOPE. PRIMARY INFORMATION IS ON THE YW 531C, THE MOST LIKELY VEHICLE TO ENCOUNTER ON THE BATTLEFIELD.

CHINESE ARMORED PERSONNEL CARRIER TYPE 85



Type 85

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	YW 531H; see variants	Name:	Type 54 (DShKM copy)
Date of introduction:	1986	Caliber/length (mm):	12.7-mm
Proliferation: Vehicles: Countries:	1030+ 4+	Type:	Machine Gun
Description:	Improved Type 69 APC with rear exit door& emergency roof hatches with space for 13 soldiers who can dismount; firing ports vary depending on variant	Ammo (Rounds carried): APDS (Tungsten Core); API, API-T, Russian Duplex, Russian Duplex-T, Incendiary-T, HE-T, Type MDZ, HeI Type ZP	1120
Crew (driver & commander):	2	Max Effective Range (m):	2000
Combat weight (mt): With ATGM	13.6 13.8	Armor penetration (mm) API at 500 m: API at 1000 m:	 21 13
Chassis length overall (m):	6.13	Muzzle velocity (m/s):	850
Height overall (m):	2.59	VARIANTS	SPECIFICATIONS
Width overall (m):	3.06	Type 85/YW 531H	Domestic/export base model
Ground pressure (kg/cm²):	0.546	YW703H	Command variant
Automotive performance:	BF8L 413F	Type 85 Armored Command Vehicle	2-man crew, 6 staff, additional communications equipment, & fewer ammunition rounds; used at regimental or division level
Engine type:	Turbocharged, air-cooled, V-8 diesel	Type 85 Recovery Vehicle	1000 KG crane with 5-man crew
Cruising range (km):	500	Type 85 Maintenance Engineering Vehicle	Similar to the WZ 751 (ambulance), but for support
Speed (km/h): Max road: Max off-road: Average cross-country): Max swim:	65 46 35 6	Type 85 Mortar Carriers	82-mm & 120-mm variants similar to the YW 531
Fording depths (m):	Amphibious	WZ 751 Armored Ambulance	2-man crew with space for 4 litter or 8 seat patients; 12.7-mm MG

Radio:	Type 889 or VRC 83	Type 85 SP Howitzer (Type 70-1/YW 302)	Type 54-1 122-mm howitzer on Type 85 chassis
Protection:		Type 85 ATGM Launcher Vehicle	Railed hull with 4-rail Red Arrow-8 SACLOS wire-guided ATGM
Armor, turret front (mm; front glacis):	14	YW 307 IFV	Type 89 with a 25-mm cannon similar to the Bushmaster & the 7.62-mm coaxial MG
Applique armor (mm):	No	YW 309 Infantry Combat Vehicle (ICV)	3-man crew, 73-mm low pressure main gun, 7.62-mm coaxial MG & Red Arrow 3 ATGM
Explosive reactive armor(mm):	No	HJ-8 Anti-Tank Vehicle	AT traversable launcher with 4 HJ-8 ATGMs & 4 loads in storage in the hull
Active Protection System:	No	NVH-1	Joint Chinese/British variant with 25-mm gun
Self-entrenching blade:	No	Type 90	Updated design with reduced height, improved hull shape, & better transmission
NBC protection system (INA for additional information):	Yes	Thai versions	Similar to the Chinese variants, but armed with a M-2HB MG
Smoke equipment (Smoke grenade launchers):	8	Artillery Command Post Vehicle	YW 531H modified with a raised rear superstructure
Survivability equipment:	INA	YW 306	130-mm MRL platform
		Type 89 (YW 534/WZ 534)	Improved power pack & night vision equipment for domestic use & export with longer & wider chassis, improved engine, & mobility

NOTES
SOURCES: 2014 WEG AND MILITARY PERISCOPE.

CHINESE ARMORED PERSONNEL CARRIER TYPE 92



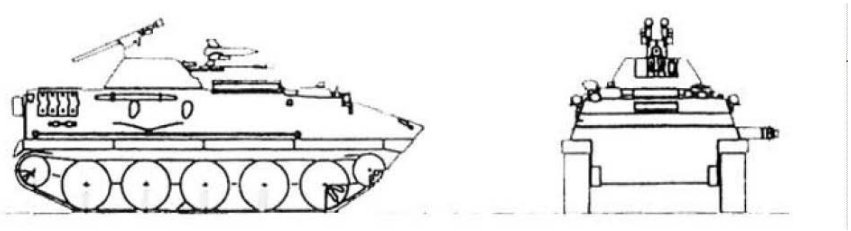
Type 92A

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	WZ 551A; See variants	Name:	INA
Date of introduction:	1987	Caliber/length (mm):	25
Proliferation: Vehicles: Countries:	1347 9+	Type:	Automatic overhead turreted gun
Description:	6 X 6 wheeled APC; similar to VAB; single rear exit door and two roof hatches for a total of 12 soldiers (crew included); 4 firing ports on both sides	Ammo (Rounds carried): Ready: Stowed API (Est): HE (Est):	600 200 400 240 360
Crew (driver & commander):	2	Max Effective Range (m; Est):	1500-2000
Combat weight (mt):	15.00 (different for variants)	Armor penetration:	INA
Chassis length overall (m): Base: Some variants:	 6.73 6.80	Muzzle velocity (m/s):	INA
Height overall (m): Base Some Variants	 2.10 2.89	Name:	PKT
Width overall (m):	2.86	Caliber/length (mm):	7.62
Ground pressure (kg/cm²):	INA	Type:	Turret Coaxial
Automotive performance:	BF8L413FC	Ammo (Rounds carried): Light Ball, Ball-T; Heavy Ball, API, API-T, Incendiary	2000
Engine type:	Deutz 4-cycle, air-cooled, V-8 diesel	Max Effective Range (m): Day: On the move: Night:	 1000 400-500 800+
Cruising range (km):	800	Armor penetration (RHA at 500 m):	8
Speed (km/h): Max road:	85-100	Muzzle velocity (m/s):	825

Max off-road: Average cross-country): Max swim:	INA INA 8		
Fording depths (m):	Amphibious	VARIANTS	SPECIFICATIONS
Radio:	Type 83, VIC-83 telephone	Type 92 (6 X 6)	Basic model with 25-mm automatic overhead turreted gun
Protection:		Type 92A/WZ 551A (6 X 6)	Basic model with 12.7-mm machine gun
Armor, turret front (mm; protects against 12.7-mm):	10	WZ 901/Type 92B (4 X 4)	Riot control vehicle; 1-man turret with machine guns; used for internal security
Applique armor (mm):	No	WZ 550 (4 X 4)	Red Arrow 9 ATGM launcher vehicle
Explosive reactive armor(mm):	No	WZ 531 Armored Recovery Vehicle	Turret removed with crane on vehicle's rear & telescopic jib
Active Protection System:	No	WZ 551/Type 86 (6 X 6)	Original model with 256-hp engine
Self-entrenching blade:	No	WZ 551 IFV (6 X 6)	3-man crew; 73-mm main gun, 7.62-mm coax MG, Red Arrow 3 ATGM, 8 soldiers
NBC protection system:	Collective	DK-9/WZ 551D	PL-9C missile SAM launcher missile
Smoke equipment (Smoke grenade launchers):	8	WZ 551S (6 X 6)	Cargo variant that can carry 7000 kg
Survivability equipment:	Obstacle-clearing blade available	WZ 551 Reconnaissance Vehicles (6 X 6)	Various models with sensors, laser rangefinders, & communication gear
VARIANTS	SPECIFICATIONS	WZ 554 Self-Propelled Anti-Aircraft (8 X 8)	Prototype twin 23-mm SP anti-aircraft vehicle yet to be massed produced
Armored Ambulance (6 X 6)	4 stretcher or 8 seated patients; MG for self defense	WZ 91 (4 X 4)	Red Arrow 8 ATGM launcher vehicle with 4 missiles & 8 missiles in hull
NGV-1 IFV (6 X 6)	Prototype with Nexter Systems Dragar 1-man turret with 25-mm cannon, 7.62-mm coaxial MG, & 6 smoke grenade launchers	WMA 301 Assaulter 105-mm tank destroyer (6 X 6)	105-mm low-recoil gun in a 3-man turret with 30 105-mm rounds, 7.62-mm coax MG, & 12.7-mm anti-aircraft MG
WMZ 551 (6 X 6)	Prototype 1-man turret with 12.7-mm MG, ATGM launcher, & smaller weapons	WZ 551/ZSL-92 (6 X 6)	25-mm cannon (400 rounds), coaxial 7.62-mm (1000 rounds), & improved diesel engine
BK-1990 (8 X 8)	105-mm SP AT gun	BK-1970 (6 X 6)	105-mm SP AT gun
PLL05 120-mm mortar vehicle (6 X 6)	120-mm SP combo gun version (see 2S23 elsewhere in WEG)	VL1 (4 X 4)	Shortened WMZ 551 for 8 personnel for internal security missions
PTL02/WMA 301 (6 X 6)	100-mm SP AT gun, ATGM capable	Yitian Air Defense System (6 X 6)	Yitian short-range air defense system mounted on the WZ 551 chassis
		Self-Propelled Howitzer (8 X 8)	Stretched WZ551 with 122-mm howitzer with 40 stowed rounds in hull

NOTES
SOURCES: 2014 WEG, MILITARY PERISCOPE, MILITARY TODAY, AFRICA DEFENSE JOURNAL, & GLOBAL SECURITY. SOME ANALYSTS CALL THE TYPE 92 WITH THE 25-MM TURRETED GUN AN IFV, BUT IT DOES NOT MEET ALL THE CRITERIA.

NORTH KOREAN ARMORED PERSONNEL CARRIER VTT-323



VTT-323

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	M1973	Name:	KPVT
Date of introduction:	1973	Caliber/length (mm):	14.5
Proliferation: Vehicles (includes Chinese Type 63s): Countries:	2086+ 9+	Type:	2 Heavy Machine Guns
Description:	North Korean produced Type 63 APC using PT-85 chassis with rear exit door & at least 2 firing ports on each side with space for 10 soldiers	Ammo (Rounds carried): API-T, API: 500 HE-T: 500 Other available: I-T, Type MDZ	1000
Crew (driver, commander, gunner, & loader):	4	Max Effective Range (m): Day: Night:	 1500 INA
Combat weight (mt):	13.5	Armor penetration (mm): API-T at 500 m: API-T at 1000 m:	 30 20
Chassis length overall (m):	6.20	Muzzle velocity (m/s):	1005
Height overall (m):	2.50	Name (on AT vehicles only):	9P111
Width overall (m):	3.06	Caliber/length (mm):	125
Ground pressure (kg/cm^2):	0.58	Type:	MCLOS Wire ATGM
Automotive performance:		Ammo (Rounds carried): AT-3c Imp/Polk HEAT (Slovenia) HJ Red Arrow-73A HEAT (China) HJ Red Arrow-73B/C HEAT (China)	4
Engine type:	Diesel	Max Effective Range (m): Minimum Range:	3000 500
Cruising range (km):	450	Armor penetration (mm): AT-3c Imp/Polk HEAT (RHA): Red Arrow-73A HEAT (RHA): Red Arrow-73B/C HEAT (RHA):	 580 500 600
Speed (km/h): Max road: Max off-road: Average cross-country): Max swim:	80 70 INA 10	Muzzle velocity (m/s):	130
Fording depths (m):	Amphibious		

Radio:	INA	VARIANTS	SPECIFICATIONS
Protection:		VTT-323 Anti-Tank Vehicle	AT-3C tandem HEAT ATGM or other AT system replaces the twin 14.5-mm machine guns
Armor, turret front (mm):	24	Infantry Fire Support Vehicle (FSV)	AT-3 ATGM launcher and carries SA-7b, SA-14, or SA-16 MANPADS
Applique armor (mm):	No	120-mm Gun/Mortar	Carries a combination 120-mm Gun/ Mortar instead of infantry soldiers
Explosive reactive armor(mm):	No	Mortar Carrier	82-mm or 120-mm mortars mounted in the passenger compartment
Active Protection System:	No	122-mm SP Howitzer	122-mm SP howitzer mounted on VTT-323 chassis
Self-entrenching blade:	No		
NBC protection system:	No	107-mm MRL Carrier	107-mm MRL system (12, 18 or 24 tubes) mounted on rear of vehicle
Smoke equipment:	No	SP Anti-Aircraft Gun	4 14.5-mm guns mounted
Survivability equipment:	INA	M1985	AT-3 type anti-tank system with 4 rails
		PT-85 Light Tank	Uses the same chassis

NOTES
SOURCES: 2014 WEG, MILITARY PERISCOPE, & GLOBAL SECURITY. THERMAL SIGHTS ARE AVAILABLE. THE SLOVENIAN TS-M ATGM THERMAL NIGHT SIGHT CAN DETECT TARGETS AT 4,500 M & PROVIDE RECOGNITION AT 2,000 M. THE HE-BLAST ATGM IS USED FOR KILLING PERSONAL, DESTROYING BUNKERS, OR FIRING OTHER FORTIFICATIONS.

FRENCH ARMORED PERSONNEL CARRIER VAB



VAB AZURE Urban Combat Vehicle



VAB APC



VAB APC



VAB Memphisto Anti-Tank APC

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	Vehicule de l'Avant Blinde	Name:	AA-52
Date of introduction:	1976	Caliber/length (mm):	7.62
Proliferation: Vehicles: Countries:	5012+ 12+	Type:	Machine Gun
Description:	4 X 4 wheeled APC with 2 rear exit doors & roof hatches for 10 soldiers; 3 firing ports on each side & a port in each rear door	Ammo (Rounds carried): Ball, Tracer; Other types INA	1250
Crew (driver & commander):	2	Max Effective Range (m):	3000
Combat weight (mt; higher for 6 X 6 & 8 X 8 variants)):	13.0	Armor penetration:	INA
Chassis length overall (m; longer for 6 X 6 & 8 X 8 variants):	5.98	Muzzle velocity (m/s):	830
Height overall (m):	2.06	VARIANTS	SPECIFICATIONS
Width overall (m):	2.50	VAB RASIT	Recon vehicle with radar
Ground pressure (kg/cm²):	INA	VAB RATAC	Artillery target acquisition
Automotive performance:	VI MIDS 06.20.45 (MAN C.2356 HM 72 also available)	VAB Sanitaire Ambulance	Carries 4 litter, 10 sitting, or 2 litter/5 seated patients
Engine type:	Renault water-cooled, turbo-charged in-line, 6-cyclinder diesel	VAB VDAA Santal SAM System	6 X 6 VAB with 2-man turret with 6 MATRA Mistral SAMs with 6 extra rounds in vehicle
Cruising range (km):	1000	VAB with ESD	TA-20 turret mounted anti-aircraft system

Speed (km/h): Max road: Max off-road: Average cross-country): Max swim:	92 INA INA 8	VAB Echelon Repair Vehicle	4 X 4 or 6 X 6 variants for battlefield repairs with a 7.5-mm or 7.62-mm machine gun
Fording depths (m):	Amphibious	VAB PC Command Vehicle	Crew of 6 with additional radios & mapboards; FDC & FO versions also available
Radio:	INA	VAB Bromure Electronic Warfare Vehicle	Crew of 3 operate Thomson-CSF VHF tactical jammer
Protection:		VAB ATILA	Artillery fire & command
Armor, turret front (mm; protects against 7.62):	INA	VAB Reco	NBC reconnaissance vehicle
Applique armor (mm):	INA	VAB Genie Engineer Vehicle	Crew of 9 with roof-mounted raft
Explosive reactive armor(mm):	INA	VTM 120-mm Mortar Towing Vehicle	Tows Thompson Brandt 120-mm Mortar with 70 rounds
Active Protection System:	INA	VPM 81	81-mm mortar fires through roof opening
Self-entrenching blade:	Bulldozer blade available	VAB TOW	Basic VAB with TOW ATGM launcher with 16 reloads
NBC protection system:	Yes	VAB TOW-ALT	Thune-Eureka 2-tube TOW turret with 16 reload missiles
Smoke equipment (Smoke grenade launchers):	4	VAB with UTM 800 Anti-Tank Launcher	4 non-retractable HOT tube launchers with 8 reloads
Survivability equipment:	Vehicle chassis design helps protect vehicle from mines	VCAC HOT Mephisto Anti-Tank Vehicle	4 retractable HOT tube launchers with SACLOS missiles & 8 additional rounds
VARIANTS	**SPECIFICATIONS**	VMO	Internal Security Vehicle
VCAC Milan	Trial 4 X 4 with 2 Milan ATGMs	VMO with TOI	Standard VMO with cupola, 7.62-mm MG & AGL
VAB VDAA Albi SAM System	Prototype 4 X 4 or 6 X 6 with turret with 2 MATRA SAM launchers & 6 extra missiles	VAB AZURE	Urban warfare with bulldozer blade & panoramic periscopes
VAB New Generation/ Improved VAB	1996 Upgrade with most variants available	VAB Atlas	Improved ATILA Artillery C2
VCI	More heavily armed than the basic VAB with many variants	VAB Mark III	Latest upgrade from 2014; 6 X 6 with advanced protection & mobility

NOTES

SOURCES: MILITARY PERISCOPE & GLOBAL SECURITY. ALTERNATE PRIMARY WEAPON IS A 12.7-MM MACHINE GUN WITH 1200 ROUNDS. VEHICLE COMES IN 6 X 6 OR 8 X 8 VARIANTS THAT INCREASE THE VEHICLE'S WEIGHT. VEHICLE CAN BE USED AS A PLATFORM FOR A VARIETY OF WEAPONS IS EVIDENT BY THE NUMBER AND VARIETY OF VARIANTS AVAILABLE.

RUSSIAN ARMORED PERSONNEL CARRIER BTR-152



BTR-152

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	BTR 150 Type 56 APC (China)	Name:	SGMB
Date of introduction:	1950	Caliber/length (mm):	7.62
Proliferation: Vehicles: Countries:	1880+ 21+	Type:	Medium Machine Gun
Description:	Outdated 6 X 6 wheeled APC with rear exit doors, but many variants feature an open roof & very limited armored protection; passenger space for 17 soldiers; 3 firing ports on each side with 2 in rear doors	Ammo (Rounds carried): In box ready to fire: Ready: Light Ball, Ball-T, API	1250 250 1000
Crew (driver & commander):	2	Max Effective Range (m): Day: Night: Anti-Aircraft:	1000 INA 1000
Combat weight (mt):	9.0	Armor penetration (mm at 500 m):	8
Chassis length overall (m):	6.83	Muzzle velocity (m/s):	800
Height overall (m):	2.36	Name (Option available):	Pintle Mounted SGMB
Width overall (m):	2.32	Caliber/length (mm):	7.62
Ground pressure (kg/cm^2):	INA	Type:	2 Medium Machine Gun
Automotive performance:	ZIL-123	Ammo (Rounds carried): In box ready to fire: Ready: Light Ball, Ball-T, API	1250 250 1000
Engine type:	Water-cooled, in-line, 6-cylinder gasoline	Max Effective Range (m): Day: Night: Anti-Aircraft:	1000 INA 1000

Cruising range (km):	600-650	Armor penetration (mm at 500 m):	8
Speed (km/h): Max road: Max off-road: Average cross-country): Max swim:	75 INA INA N/A	Muzzle velocity (m/s):	800
Fording depths (m):	0.80		
Radio:	10RT-12 or R-123	VARIANTS	SPECIFICATIONS
Protection:		BTR-152	Basic version with open top & no winch that has been converted to other uses such as fire support vehicles, gun trucks, ambulances, or engineer vehicles
Armor, turret front (mm; hull front):	11-15	BTR-152A	Anti-aircraft variant with twin 14.5-mm MGs mounted in a turret
Applique armor (mm):	No	BTR-152D/BTR-152E	Anti-aircraft version with 4 14.45-mm machine guns
Explosive reactive armor(mm):	No	BTR-152I	BTR-152V converted to use as an artillery command vehicle
Active Protection System:	No	BTR-152 (Model D)	Similar to the BTR-152V3, but with an overhead armor & 2 roof hatches
Self-entrenching blade:	No	BTR-152V	Open top with central tire-pressure regulation system (CTPRS)
NBC protection system:	No	BTR-152V1 (Model B)	BTR-152V with 5000 KG front winch
Smoke equipment:	No	BTR-152V2	BTR-152V without the winch
Survivability equipment:	No	BTR-152V3 (Model C)	BTR-152V with winch, internal CTPRS air lines & infrared driving lights
		BTR-152U	Command vehicle features a high rear structure & CTPRS
		BTR-152 with ZU-23 Mount (Lebanon)	2 23-mm anti-aircraft machine guns mounted in troop compartment
		BTR-152 with Czech M53 (Egypt)	4 12.7-mm DShKM anti-aircraft MGs mounted in troop compartment

NOTES

SOURCES: 2014 WEG, ACE-THREATS BTR HANDBOOK, & MILITARY PERISCOPE. SEE THE ACE-THREATS BTR HANDBOOK PUBLISHED IN 2014 FOR DETAILED INFORMATION ON ALL BTR-152 VARIANTS.

RUSSIAN ARMORED PERSONNEL CARRIER BTR-40



BTR-40

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	Type 55 (China)	Name:	SGMB
Date of introduction:	1950	Caliber/length (mm):	7.62
Proliferation: Vehicles: Countries:	1301+ 12+	Type:	Medium Machine Gun
Description:	4 X 4 wheeled APC based on the GAZ-63 truck with an open top & a single rear exit door; passenger space for 8 soldiers; 3 firing ports on each side & 2 in the rear door	Ammo (Rounds carried): In box ready to fire: Ready: Light Ball, Ball-T, API	1250 250 1000
Crew (driver & commander):	2	Max Effective Range (m): Day: Night: Anti-Aircraft:	1000 INA 1000
Combat weight (mt):	5.3	Armor penetration (mm at 500 m):	8
Chassis length overall (m):	5.00	Muzzle velocity (m/s):	800
Height overall (m):	1.75	Name (Option available):	Pintle Mounted SGMB
Width overall (m):	1.90	Caliber/length (mm):	7.62
Ground pressure (kg/cm²):	INA	Type:	2 Medium Machine Gun
Automotive performance:	GAZ-40	Ammo (Rounds carried): In box ready to fire: Ready: Light Ball, Ball-T, API	1250 250 1000
Engine type:	Water-cooled, in-line, 6-cylinder gasoline	Max Effective Range (m): Day: Night: Anti-Aircraft:	1000 INA 1000

Cruising range (km):	285	Armor penetration (mm at 500 m):	8
Speed (km/h): Max road: Max off-road: Average cross-country): Max swim:	80 INA INA N/A	Muzzle velocity (m/s):	800
Fording depths (m):	0.80		
Radio:	INA	VARIANTS	SPECIFICATIONS
Protection:		BTR-40A	5 person crew fires 2 14.5-mm KPV heavy MGs (2400 rounds) from a ZPTU-2 turret
Armor, turret front (mm):	8	BTR-40B	Only 6 dismounted soldiers can fit into this vehicle with overhead armor with 4 roof hatches
Applique armor (mm):	No	BTR-40Kh	NBC decontamination vehicle with poles to mark cleared lanes
Explosive reactive armor(mm):	No	BTR-40 with AT-3 Sagger	East Germany converted some BTR-40s to ATGM vehicles with a triple launcher under overhead cover
Active Protection System:	No	BTR-40zhd	This vehicle uses a metal wheel suspension to travel on railroad lines on scouting missions
Self-entrenching blade:	No	Type 55 (China)	Chinese BTR-40 with different engine
NBC protection system:	No	Walid (Egypt)	Variants besides the APC include a smoke rocket launcher or a minelayer vehicle
Smoke equipment:	No		
Survivability equipment:	No		

NOTES

SOURCES: ACE-THREATS BTR HANDBOOK, & MILITARY PERISCOPE. SEE THE ACE-THREATS BTR HANDBOOK PUBLISHED IN 2014 FOR DETAILED INFORMATION ON ALL BTR-40 VARIANTS.

RUSSIAN ARMORED PERSONNEL CARRIER BTR-50



BTR-50

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	See variants	Name:	SGMB
Date of introduction:	1954	Caliber/length (mm):	7.62
Proliferation: Vehicles: Countries:	2375 18+	Type:	Medium Machine Gun
Description:	The only BTR APC that uses tracks instead of wheels. There are no exit doors forcing the 18 soldiers to dismount over the sides; 2 firing ports on each side of the vehicle	Ammo (Rounds carried): In box ready to fire: Ready: Light Ball, Ball-T, API	1250 250 1000
Crew (driver & commander):	2	Max Effective Range (m): Day: Night: Anti-Aircraft:	1000 INA 1000
Combat weight (mt):	14.2	Armor penetration (mm at 500 m):	8
Chassis length overall (m):	7.08	Muzzle velocity (m/s):	800
Height overall (m):	1.97		
Width overall (m):	3.14	VARIANTS	SPECIFICATIONS
Ground pressure (kg/cm²):	0.51	BTR-50P	Original with open troop compartment without NBC protection; 57-mm or 85-mm anti-tank (AT) gun could be mounted on the rear deck
Automotive performance:	Model	BTR-50PA	No AT gun ramp mount; sometimes featured a 14.5-mm KPVT heavy MG
Engine type:	V-6 water-cooled, in-line, 6-cylinder diesel	BTR-50PK	Primary model with covered troop compartment, 4 firing ports & NBC protection system

Cruising range (km):	400	BTR-50PU	Command vehicle with additional radios, 4 antennae, & auxiliary power supply
Speed (km/h): Max road: Max off-road: Average cross-country): Max swim:	44 INA INA 7	BTR-50PK(B)	Amphibious armored recovery vehicle designed for river crossings
Fording depths (m):	Amphibious	MTP	BTR-50PK converted into a rolling workshop with 15000 crane, 8000 tow bar, & block/tackle system to raise capacity
Radio:	INA	MTK (UR-67)	Mine-clearing rocket launcher system
Protection:		MTR-1	BTR-50 designed for repairing equipment
Armor, turret front (mm):	6-10	OT-62 (Slovakia & Poland)	Originally the Czech produced BTR-50
Applique armor (mm):	No	Type 77 (China)	Chinese produced BTR-50P
Explosive reactive armor(mm):	No	Nimda BTR-50PK (Israel)	Improved engine, electrical system, & fuel system
Active Protection System:	Mine	Schuetzenpanzer 50PK (North Vietnam)	BTR-50PK produced by North Vietnam
Self-entrenching blade:	No	Upgraded BTR-50 (Ukraine)	Improved performance vehicle with 60 km/hr speed on land, 10 km/hr in water, & with a heavier payload
NBC protection system:	Collective	Civilian BTR-50	BTR-50P converted for civilian use such as topographic reconnaissance
Smoke equipment:	No		
Survivability equipment:	Automatic engine fire-extinguishing system on closed vehicles; mine-clearing system available		

NOTES

SOURCES: ACE-THREATS BTR HANDBOOK, & MILITARY PERISCOPE. THE SOVIET UNION PRODUCED THIS APC USING A PT-76 LIGHT TANK CHASSIS. SEE THE ACE-THREATS BTR HANDBOOK PUBLISHED IN 2014 FOR DETAILED INFORMATION ON ALL BTR-50 VARIANTS.

RUSSIAN ARMORED PERSONNEL CARRIER BTR-60



BTR-60PB

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	See Variants	Name:	KPVT
Date of introduction:	1960	Caliber/length (mm):	14.5
Proliferation: Vehicles: Countries:	9074+ 44+	Type:	Heavy Machine Gun
Description:	Wheeled APC to replace the BTR-152; original had open top & soldiers exited over the top; 3 firing ports on each side	Ammo (Rounds carried): API, API-T	500
Crew (driver & commander):	2	Max Effective Range (m): Day: Night:	 2000 INA
Combat weight (mt):	10.3	Armor penetration (mm CE): 500 m: 1000 m:	 30 20
Chassis length overall (m):	7.56	Muzzle velocity (m/s):	1005
Height overall (m):	2.31	Name:	PKT
Width overall (m):	2.83	Caliber/length (mm):	7.62
Ground pressure (kg/cm²):	INA	Type:	Turret Coaxial
Automotive performance:	GAZ-49B	Ammo (Rounds carried): Light Ball, Ball-T; Heavy Ball, API, API-T, Incendiary	2000
Engine type:	2 water-cooled, in-line, 6-cylinder gasoline (1 YaMZ-236A 4-stroke diesel in BTR-60PB)	Max Effective Range (m): Day: On the move: Night:	 1000 400-500 INA
Cruising range (km):	500	Armor penetration (RHA at 500 m):	8
Speed (km/h): Max road: Max off-road: Average cross-country): Max swim:	80 60 INA 10	Muzzle velocity (m/s):	825

Fording depths (m):	Amphibious	VARIANTS	SPECIFICATIONS
Radio:	R-123	BTR-60P	Initial model with open top, pintle-mounted 7.62-mm machine gun
Protection:		BTR-60PA/BTR-60PK (12 passengers only)	Covered top, NBC protection, pintle-mounted 7.62-mm MG, still exit over top
Armor, turret front (mm):	7-9 mm	BTR-60PB (8 dismounted soldiers)	Most common w/ BRDM-2 MG turret; 14.5-mm MG & coaxial 7.62-mm
Applique armor (mm):	No	Modernized BTR-60PB	BM2 Turret w/ 30-mm 2A42 Cannon & 7.62-mm PKTM MG; 30-mm AGS-17 AGL
Explosive reactive armor(mm):	No	BTR-60U	Command vehicle with additional radios
Active Protection System:	No	BTR-60 PU-12/12M	Anti-Aircraft units' command vehicle
Self-entrenching blade:	No	BTR-60 MS	Radio vehicle with High Ball antenna
NBC protection system:	Collective (on closed vehicles)	BTR-60 VVS	Sans turret with additional radios
Smoke equipment:	No	BTR-60 PBK	BTR-60PB with 3 radios
Survivability equipment:	No	BTR-60 1V18	Artillery observation vehicle
VARIANTS	SPECIFICATIONS	BTR-60 1V19	BTR-60 1V18 for FDC operations
BTR-60PAU (Bulgaria)	Artillery command vehicle	BTR-60 R-145BM	Communications vehicle with 5 radios
BTR-60PB-MD (Bulgaria)	Upgraded engine, radios, & NBC equipment	BTR-60 R-975	Forward air-control vehicle with turret
BTR-60P Maintenance Assistance (MTR-2)	Maintenance vehicle with tarp over troop compartment	BTR-60-Z-351BR	Power production vehicle with generator
BTR-60 SPAAG (Cuba)	Twin 30-mm anti-aircraft cannons	BTR-60-P-238BT	Switchboard vehicle for communications
BTR-60 Djibouti (Djibouti)	AML-90 turret on BTR-60	BTR-60-P-240BT	R-123M radio & R-241 switchboard
BTR-60BD	Speed increased to 100 km/h & range to 800 km	BTR-60-P241BT	Equipped with P-241 telephone system
MTP-2	Armored Recovery Vehicle	BTR-60-R-137B	Communications vehicle with turret
BTR-60PZ	Final production model with 1PZ-2 roof-mounted periscope	BTR-60 ACRV	Artillery Battery C2 & recon vehicle
BTR-60-R-140BM	C2 vehicle with turret	BTR-60-R-145	Additional radio, but no turret
MEP	Infantry command post	BTR-60-R-156BTR	C2 vehicle with additional radios
BTR-60PB FAC	Turreted FAC vehicle without the gun	BTR-60-R-409BM	Relay vehicle-R-409 & R-123M radios

NOTES

SOURCES: ACE-THREATS BTR HANDBOOK, MILITARY PERISCOPE & MILITARY FACTORY. SEE THE ACE-THREATS BTR HANDBOOK PUBLISHED IN 2014 FOR DETAILED INFORMATION ON ALL BTR-60 VARIANTS.

RUSSIAN ARMORED PERSONNEL CARRIER BTR-70



BTR-70

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	See Variants	Name:	KPVT
Date of introduction:	1979	Caliber/length (mm):	14.5
Proliferation: Vehicles: Countries:	6524+ 19+	Type:	Heavy Machine Gun
Description:	8 X 8 wheeled APC as an upgrade to the BTR-60; 9 soldiers had to exit through 2 roof hatches; 3 firing ports on each side of vehicle	Ammo (Rounds carried): API, API-T	500
Crew (driver & commander):	2	Max Effective Range (m): Day: Night:	 2000 INA
Combat weight (mt):	11.5	Armor penetration (mm): At 500 m: At 1000 m:	 30 20
Chassis length overall (m):	7.53	Muzzle velocity (m/s):	1005
Height overall (m):	2.24	Name:	PKT
Width overall (m):	2.80	Caliber/length (mm):	7.62
Ground pressure (kg/cm^2):	INA	Type:	Turret Coaxial
Automotive performance:	ZMZ-4905	Ammo (Rounds carried): Light Ball, Ball-T; Heavy Ball, API, API-T, Incendiary	2000
Engine type:	Liquid-cooled, in-line, 6-cylinder gasoline	Max Effective Range (m): Day: On the move: Night:	 1000 400-500 INA
Cruising range (km):	600	Armor penetration (mm RHA at 500 m:	8

Speed (km/h): Max road: Max off-road: Average cross-country): Max swim:	80 INA INA 10	Muzzle velocity (m/s):	825
Fording depths (m):	Amphibious	VARIANTS	SPECIFICATIONS
Radio:	INA	BTR-70 MS	Communications vehicle sans turret
Protection:		BTR-70 BMP	Artillery command vehicle
Armor, turret front (mm; greater than the BTR-60:	INA	BTR-70KShM	Command vehicle with improved communications & navigation equipment
Applique armor (mm):	No	BREM	Armored recovery vehicle sans turret with front-mounted jib crane
Explosive reactive armor(mm):	No	BTR-70 with AGL	30-mm AGS-17 automatic grenade launcher (AGL) mounted to the roof of the vehicle
Active Protection System:	No	BTR-70 with modified turret	BTR-70 retrofitted with BTR-80 turret, additional firing ports, & a bow-mounted wave deflector for amphibious operations
Self-entrenching blade:	No	BTR-Kh	Chemical reconnaissance vehicle
NBC protection system:	Collective	SPR-2	Turretless & replaced with a large telescopic mast for radar-jamming
Smoke equipment:	No	TAB-77 (Romania)	BTR-70s made under license in Romania
Survivability equipment:	No	Ukrainian upgrade	1-man weapon station with a 2A72 30-mm cannon or Ukrainian KBA-2 30-mm cannon & a 7.62-mm coaxial machine gun with a TKN-42 day/night weapon sight; 2 SMD-21 four-stroke diesel engines increase fuel efficiency increases range to 560 km
		BTR-70 Zhalo-s (Sting)	Prototype 85-mm long barreled gun mounted on a BTR-70 chassis for use as a tank destroyer

NOTES

SOURCES: ACE-THREATS BTR HANDBOOK, MILITARY PERISCOPE & MILITARY FACTORY. STORAGE SPACE FOR RPG-7 ROCKET LAUNCHERS & 2 30-MM AGS-17 AGLS. MANY OF THE BTR-70 APCS DID NOT PERFORM TO EXPECTATIONS DURING THE RUSSIAN ARMY'S CAMPAIGN IN CHECHNYA. SEE THE ACE-THREATS BTR HANDBOOK PUBLISHED IN 2014 FOR DETAILED INFORMATION ON ALL BTR-60 VARIANTS.

RUSSIAN ARMORED PERSONNEL CARRIER BTR-80



BTR-80A

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	GAZ-5903; See Variants	Name:	KPVT
Date of introduction:	1984	Caliber/length (mm):	14.5
Proliferation: Vehicles: Countries:	2252+ 28+	Type:	Heavy Machine Gun
Description:	8 X 8 wheeled APC as an upgrade to the BTR-70; 7 soldiers exit through 2 side doors; 4 firing ports on the right & 3 firing ports on the left	Ammo (Rounds carried): API, API-T	500
Crew (driver, command & gunner):	3	Max Effective Range (m): Day: Night:	 2000 INA
Combat weight (mt): BTR-80: BTR-80A:	 13.6 14.6	Armor penetration (mm): At 500 m: At 1000 m:	 30 20
Chassis length overall (m): BTR-80: BTR-80A:	 7.55 7.65	Muzzle velocity (m/s):	1005
Height overall (m): BTR-80: BTR-80A:	 2.41 2.80	Name:	PKT
Width overall (m): BTR-80: BTR-80A:	 2.95 2.80	Caliber/length (mm):	7.62
Ground pressure (kg/cm²):	INA	Type:	Turret Coaxial
Automotive performance:	260 hp	Ammo (Rounds carried): Light Ball, Ball-T; Heavy Ball, API, API-T, Incendiary	2000
Engine type:	Water-cooled, V-8 diesel	Max Effective Range (m): Day: On the move: Night:	 1000 400-500 INA

Cruising range (km): BTR-80: BTR-80A:	 600 800	Armor penetration (mm RHA at 500 m:	8
Speed (km/h): BTR-80: Max road: Max off-road: Average cross-country): Max swim:	 80 60 40 10	Muzzle velocity (m/s):	825
Speed (km/h): BTR-80A: Max road: Max off-road: Average cross-country): Max swim:	 90 INA 40 10	Name:	2A72 (On BTR-80A ILO of 14.5-mm MG)
Fording depths (m):	Amphibious	Caliber/length (mm):	30-mm
Radio:	R-173 (R-163-50U VHF, R-163-UP receiver, R-174 intercom)	Type:	Automatic Gun
Protection:		Ammo:	300 rounds HEI-T, Frag-HE-T, APT-, APDS-T, APFSDS-T
Armor, turret front (mm):	Defeat 12.7-mm rounds	Max Effective Range (m)	2500+ m (Day & Night)
Applique armor (mm):	No	Armor penetration:	55 mm at 1000 m & 45 mm at 2000 m (RHA)
Explosive reactive armor(mm):	No	Muzzle velocity (m/s):	INA
Active Protection System:	NoZS	**VARIANTS**	**SPECIFICATIONS**
Self-entrenching blade:	No	BTR-80 (GAZ-5903)	Original w/ 3 firing ports on each side & smoke grenade launchers
NBC protection system:	Collective	BTR-80A (GAZ-59034)	Stabilized turret w/ 2A72 gun, 7.62-mm coax MG, & new right side firing port
Smoke equipment (81-mm Smoke grenade launchers):	6	BTR-80AK	BTR-80A CP variant with 1 firing port on right side & 2 whip antennas at rear corners
Survivability equipment:	No	BTR-80K (GAZ-59031)	Command Post for 6; different turret w/ MGs & 3 radios (R-173, R-173P & R-159)
VARIANTS	**SPECIFICATIONS**	BTR-80 Kushetka-B (M1989/1)	Command vehicle with additional communications gear & gun removed
BTR-80 1V152	Artillery C2 & forward observation vehicle w/ range finding, navigation & new optics	BTR-80 PBKM (KM-80)	Command vehicle with increased radio communications equipment
BTR-80 R-975	Forward air control vehicle	BTR-80S	Modular turret armaments system (14.5-mm KPVT MG) & better fire control/sights
2S23 (Nona-SVK) SP Gun-Mortar System (Fire Support Vehicle)	Breach-loaded 2A60 120-mm rifled mortar/gun system similar to the 2S9	BTR-80 with Cummins Diesel	Western Cummins 6CTA 8.3-C250 diesel engine test model; road speed to 100 km/h and range to 600 km

BMM	Medical series; BMM-1 (ambulance), BMM-2 (Bn Aid Stn), & BMM-3 (Bde Aid Stn)	BTR-82/BTR-82A (Russia & Kazakhstan)	Latest version; see separate WEG sheet
BMM-1	Battlefield ambulance for first aid & MEDVAC operations	BTR-80UP (Ukraine)	BTR-80 with 300-hp engine, improved armor protection & air conditioning
BMM-2	Battlefield ambulance for use at the battalion level for field treatment	BTR-80UP-KB (Ukraine)	Battalion level command vehicle
BMM-3	Battlefield ambulance used as a mobile field hospital	BTR-80UP-KR (Ukraine)	Company level command vehicle
BMM-80 (GAZ-59039 or Simfoniya)	Battlefield ambulance for 9 sitting or 2 litter patients	BTR-80UP-S (Ukraine)	Staff vehicle
BREM-K (GAZ-59033) ARV	Armored recovery vehicle with A-frame, tow bars, & stabilizers	BTR-80UP-M (Ukraine)	Battlefield ambulance
E-351BrM	Mobile power station with diesel/electric generator	BTR-80UP BREM (Ukraine)	ARV
K1Sh1 (GAZ-59032) (UNSH)	Command Post with enlarged hull w/o turret armament	BTR-80UP-R (Ukraine)	Dedicated reconnaissance vehicle
P-240BTZ	Switchboard platform	BTR-80UP-T (Ukraine)	Dedicated cargo transport variant
PU-12M6 (9S482M6)	Field Artillery (FA) battery command vehicle	KShM Kushetka-B (Ukraine)	Command vehicle based on the K1Sh1
PU-12M7 (9S482MU)	Improved PU-12M6 FA battery command vehicle	BTR-94 (Ukraine)	Amphibious armored car with twin 23-mm 2A7M guns (same guns as the ZSU-23-4)
R-149BMR	Signal/Communications vehicle	BTR-3U/Okhotnik (Guardian) (Ukraine)	2001 BTR-94 upgrade w/ Shkval 1-man turret w/ 30-mm gun, twin AT-5 ATGM launchers, 30-mm AGL, & a 7.62-mm MG. Jordanian version uses twin 23-mm gun & donated to the new Iraqi armed forces
R-149BM4A	Command and Signal Vehicle	BTR-3E1 (Ukraine)	Export BTR-3U with the Shturm turret; 30-mm ZTM cannon, a 40-mm AGL, & a 7.62-mm MG & a twin Barrier ATGM system.
R-165B	Short-wave signal/ communications vehicle	BTR-4 (Ukraine)	Soldiers enter & leave the vehicle through rear doors; Grom overhead weapons station with 30-mm automatic cannon, 7.62-mm coax MG, & up to 4 9P135M Konkurs or Baryer ATGM missiles, & 1 30-mm AGL
R-439-BK (Legenda 2BK)	Satellite communications vehicle	BTR-80 GKKO (Hungary)	Proposed vehicle with additional observation equipment, but no turret
R-439-BK1	Improved R-439-BK satellite communications vehicle	BTR-80M (Hungary)	1993 Improvement with 240-hp DMZ-238M2 series engine
R-439-MD2	Satellite communications vehicle	BTR-80 MPAEJ (Hungary	Battlefield engineer variant without turret

RPM-2 (NKR)	Radiological Reconnaissance Vehicle that first appeared in 2000	BTR-80 MPFJ (Hungary)	Obstacle clearance vehicle without armament
RKhM-4 NBC Reconnaissance Vehicle	Outfitted with NBC equipment	BTR-80 MVJ (Hungary)	ARV
RKhM-4-01	Improved/modernized RKhM-4 NBC vehicle	BTR-80 SKJ (Hungary)	Battlefield ambulance variant with enlarged passenger compartment
RKhM-4-02	Upgraded RKhM-4 NBC reconnaissance vehicle	BTR-80 VSF (Hungary)	NBC reconnaissance vehicle
SPR-2 Wide Band Jamming System	Turretless w/ large telescopic antenna to neutralize artillery shells with proximity fuses	TAB Zimbru (B33) (Romania)	BTR-80 w/ 268-hp Model 1240 V8-DTS engine, Romanian radios, & more 12.7-mm ammo storage space
UNSh	Standardized name for expanded chassis, but called Kusheta-B, ACRV, & BMM	Zimbru 2000 (Romania)	Proposed improved TAB Zimbru with enlarged hull & 285-hp engine
"Tajfun"	Prototype proposed for base security forces with a 7.62-mm MG & the Kredo-1 radar	Saur 1 (Romania)	2006 prototype with 275-hp Cummins engine, rear entry/exit doors & new turret
ZS-88	Loudspeakers for PSYOP operations and riot control	Saur 2 (Romania)	Improved Saur 1 prototype
ZS-96	PSYOP variant w/ loudspeakers	BTR-80 "Caribe" (Columbia)	Columbian designation for BTR-80 with 12.7-mm machine gun
Kliver Turret System	Prototype with the Kliver turret (see separate entry)		

NOTES

SOURCES: ACE-THREATS BTR HANDBOOK, MILITARY PERISCOPE, MILITARY FACTORY, ARMY RECOGNITION. SOME ANALYSTS AND DOCUMENTS LIST THE BTR-80A AS AN IFV, BUT IT LACKS SUFFICIENT PROTECTION TO WARRANT THAT CLASSIFICAITON. THE MODULAR WEAPON SYSTEM IS OFFERED FOR EXPORT TO UPGRADE A WIDE VARIETY OF VEHICLES TO A BTR-80A STANDARD. THE BTR-80A CAN MOUNT K1-126 BULLET-RESISTANT TIRES. SEE SEPARATE ENTRY FOR INFORMATION ON THE KLIVER TURRET. SEE THE ACE-THREATS BTR HANDBOOK PUBLISHED IN 2014 FOR DETAILED INFORMATION ON ALL BTR-80 VARIANTS.

RUSSIAN ARMORED PERSONNEL CARRIER BTR-82A



BTR-82A at the factory



BTR-82A on parade

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	See Variants	Name:	2A72
Date of introduction:	2009	Caliber/length (mm):	30
Proliferation: Vehicles: Countries:	2100+ 5+	Type:	Automatic Gun
Description:	Upgraded BTR-80A with more crew protection & improved weapons systems. 7 firing ports (3 on right, 3 on left, 1 right front) for 7 passengers.	Ammo (Rounds): AP-T, APDS: Frag-HEI, Frag-T:	150 150
Crew (driver, commander & gunner:	3	Max Effective Range (m): AP-T & APDS Frag-HEI/Frag-T Night (Passive): Night (Active): Air (Slant angle up to 2000 m in altitude)	 2000 3600 800 1100 2500
Combat weight (mt):	16	Armor penetration: 1000 m 2000 m	55 45
Chassis length overall (m):	7.58	Muzzle velocity (m/s):	960
Height overall (m):	2.725	Name:	PKTM
Width overall (m):	2.985	Caliber/length (mm):	7.62
Ground pressure (kg/cm²):	INA	Type:	Turret Coaxial
Automotive performance:	300-hp KamAZ 740.13-300	Ammo (Rounds): Light Ball, Ball-T, Heavy Ball, API, APIT-, Incendiary	2000
Engine type:	Turbocharged V8 diesel	Max Effective Range (m): Day: Night (Passive) Night (Active)	 1500 800 1000
Cruising range (km): Road Unpaved Roads:	700+ 200-500	Armor penetration (mm RHA at 500 m):	8
Speed (km/h): Max road: Max off-road: Average cross-country:	80+ 40 40	Muzzle velocity (m/s):	850

Max Swim:	9		
Fording depths (m):	Amphibious	VARIANTS	SPECIFICATIONS
Radio:	R-168-25U-2 30-108 MHz (VHF), voice, data, retrans, 17-20 km	BTR-82	14.5-mm machine gun instead of the 2A72 automatic gun. Unlike BTR-80s, the MG is stabilized to fire on the move
Protection:	Spall liner on inner walls and roof. Laminate armor in blast attenuating hull bottom. Blast attenuating seating for crew.	BTR-82AM	Converted original to BTR-82A standards plus KAMAZ 740.14-300 engine, transmission, & heavy duty suspension
Armor, turret front (mm): Can Defeat Rounds:	12.7	BTR-82A1	BTR-82 with a remotely controlled weapon station (CRI Petrel) with 30-mm automatic cannon and 7.62-mm MG capable of being fired by the gunner or commander
Applique armor (mm):	Yes	Taifun-M Recon Vehicle	Russian strategic missile forces escort vehicle
Explosive reactive armor(mm):	No		
Active Protection System:	N/A		
Self-entrenching blade:	NO		
NBC protection system:	Collective		
Smoke equipment (81-mm Smoke grenade launchers):	6		
Survivability equipment:	Automatic Fire Suppression System with manual override		

NOTES

SOURCES: ACE THREATS BTR HANDBOOK, MILITARY PERISCIOPE, MILITARY FACTORY, MILITARY TODAY, TANKS ENCYCLOPEDIA, GLOBAL SECURITY, JANES, ARMY RECOGNITION, INFORMNAPALM, THE DIPLOMAT, AND TANK NUT DAVE. ALL PHOTOS FROM WIKIMEDIA COMMONS.

RUSSIAN ARMORED PERSONNEL CARRIER BTR-90



BTR-90

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	See Variants	Name:	2A42
Date of introduction:	1994	Caliber/length (mm):	30
Proliferation: Vehicles: Countries:	INA 1+	Type:	Automatic Gun
Description:	8 X 8 wheeled APC with side exit doors; 4 firing ports on the right side & 3 firing ports on left	Ammo (Rounds carried): HEI-T, Frag-HE-T: APFSDS-T, FAPDS:	500 340 160
Crew (driver, commander & gunner):	3	Max Effective Range (m); Frag-HE Day: Night: Anti-Aircraft: AAPFSDS-T (M929) Day: Night: Anti-Aircraft:	 4000 2500 4000 2500 2500 2500
Combat weight (mt):	20.92	Armor penetration:	INA
Chassis length overall (m):	7.64	Muzzle velocity (m/s):	825
Height overall (m):	2.975	Name:	PKT
Width overall (m):	3.20	Caliber/length (mm):	7.62
Ground pressure (kg/cm²):	INA	Type:	Turret Coaxial
Automotive performance:		Ammo (Rounds carried): Light Ball, Ball-T; Heavy Ball, API, API-T, Incendiary	2000
Engine type:	Turbo-charged diesel (multi-fuel)	Max Effective Range (m): Day: On the move: Night:	 1000 400-500 INA
Cruising range (km):	800	Armor penetration (mm RHA at 500 m:	8
Speed (km/h): Max road: Average road:	100 50+	Muzzle velocity (m/s):	825

Max off-road: Average cross-country: Max Swim:	INA INA 9		
Fording depths (m):	Amphibious	Name:	9P135M1 or 9P135M3
Radio:	R-163-50U VHF, R-163-UP receiver, R-174 intercom	Caliber/length (mm):	135
Protection:		Type:	AT-5 Konkurs; AT-5B Konkurs-M; AT-4 Fagot (less likely); AT-4b Faktoriya (less likely)
Armor, turret front (mm; can defeat 12.7 to 20-mm rounds with applique armor)):	INA	Ammo (SACLOS-Rounds carried):	INA
Applique armor (mm):	Available	Max Effective Range (m): AT-5 Konkurs: AT-5b Konkurs-M AT-4 Fagot: AT-4b Faktoriyal:	 4000 4000 2000 2500
Explosive reactive armor(mm):	Available	Armor penetration (mm): AT-5 Konkurs (RHA): AT-5b(Konkurs-M (CE RHA) AT-4 Fagot (RHA): AT-4b Faktoriya (RHA):	 650 925 480 550
Active Protection System:	Available	Muzzle velocity (m/s): AT-5 Konkurs: AT-5b Konkurs-M AT-4 Fagot: AT-4b Faktoriyal:	2 200 200 186 186
Self-entrenching blade:	No	VARIANTS	SPECIFICATIONS
NBC protection system:	Collective	BTR-90M/BTR-90 Rostock	BMP-3 turret with 100-mm 2A70 gun, 30-mm 2A72 cannon, & 7.6-2mm PKT machine gun
Smoke equipment (81-mm Smoke grenade launchers):	6	Arzamas Upgrade	30-mm automatic gun, 7.-62-mm coaxial MG, 30-mm AGL, & ATGM range to 4000 m
Survivability equipment:	Mine protected hull	Krymsk Hybrid-Electric APC	Prototype operates on a battery-driven electric motor & can be controlled remotely with a top speed of 97 km/h

NOTES

SOURCES: ACE-THREATS BTR HANDBOOK, MILITARY PERISCOPE & MILITARY FACTORY. SOME EARLY VERSIONS LACK THE ATGM. BECAUSE THE BTR-90 HAS A MEDIUM CANNON & CAN MOUNT AN ATGM LAUNCHER, IT CAN BE CLASSED AS AN IFV. WHEN AN ATGM IS USED, CHANGE THE ORGANIZATION STRUCTURE TO IFV. DESIGNATED COMPANY/BATTALION FSVS HAVE RACKS FOR 2 MISSILE LAUNCHERS & 12-14 MISSILES IN STORAGE. OTHER MUNITIONS ARE AVAILABLE SUCH AS FAPDS, HEI-T ROUNDS, OR MILAN-ER ATGMS.

AMERICAN ARMORED PERSONNEL CARRIER M113A1



M113A1



M113A1 Armored Artillery Observation Vehicle

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	See variants	Name:	M2HB
Date of introduction:	1964	Caliber/length (mm):	12.7
Proliferation: Vehicles: Countries:	34176+ 50+	Type:	Machine Gun
Description:	Tracked APC with rear ramp (door also) for 11 soldiers to dismount. Soldiers must expose themselves through the roof of the vehicle to fire their weapons. No firing ports.	Ammo (Rounds carried): Ball, Tracer, AP, API, API-T, AP Hardcore, Multipurpose, SLAP, SLAPT	2000
Crew (driver & commander):	2	Max Effective Range (m): Day: Night:	 2000 INA
Combat weight (mt; changes based on variant):	11.2	Armor penetration: AP at 30˚ at 1500 m: Ball at 100 m:	 11 20
Chassis length overall (m):	4.90	Muzzle velocity (m/s): M33 Ball: SLAPT (Tracer):	 890 1215
Height overall (m):	1.80	VARIANTS	SPECIFICATIONS
Width overall (m):	2.70	M113	Original gasoline version
Ground pressure (kg/cm²):	0.55	M113A1	Diesel production model
Automotive performance (M13A2):	6V53	M113A1 Armored Cavalry Assault Vehicle (ACAV)	Armor around the commander's position & 2 extra M-60 MGs
Engine type:	Detroit Diesel water-cooled, 2-stroke, V-6	M113A2	Improved engine cooling, better rear fuel cells, & new suspension system
Cruising range (km):	483	M113A2 ARV	Armored Recovery Vehicle with a 1361 kg auxiliary crane
Speed (km/h): Max road: Max off-road: Average cross-country: Max Swim:	64 35 INA 5.8	Stretched M113A2	Prototype with an extra road wheel

Fording depths (m):	Amphibious	M113A3	Bigger engine, yoke steering, Kevlar spall liner, applique liner, external fuel cells
Radio:	Varies depending on model	M113A3 M/R	Maintenance/Recovery vehicle with 9000 kg winch & 1360 kg crane
Protection:		M58 Wolf Smoker Generator Carrier	Vehicle dedicated to produce smoke
Armor, turret front (mm; turretless, but defeats 7.62 X 39-mm round):	INA	M106	M113 with M30 (107-mm) mortar in back with 88-93 rounds
Applique armor (mm):	Yes	M125	M113 with M29 (81-mm) mortar in back with 114 rounds
Explosive reactive armor(mm):	Available	M163	M113A1 with turret with M61A1 Vulcan 20-mm 6-barrel Gatling cannon
Active Protection System:	No	M548	Unarmored cargo carrier
Self-entrenching blade:	Available	M577	Command post carrier with built-up rear area & telescopic antenna
NBC protection system:	No	M577A3	M113A3 engine with extended hull & 6 road wheels
Smoke equipment:	No	M901	Improved TOW Vehicle with an Emerson ITV turret with 2 TOW tubes with an additional 10 missiles
Survivability equipment:	Anti-mine armor on bottom	M981	Fire Support Vehicle (FSV) with laser designator & improved commo gear
VARIANTS	SPECIFICATIONS	M1059 Lynx	M113A2 with M157 smoke generator system
M113 Ambulance	Various versions available	M1064A3	M113A3 with Soltan (120-mm) mortar with 60 rounds
M113 with Dozer Blade	M113s with trim vane removed to be fitted with a bulldozer kit	M1068A3	Modified M113 into the Standard Integrated Command Post (SICP)
M113 HAZMAT	Stretched M113A3 for spills		

NOTES

SOURCES: 2014 WEG, MILITARY FACTORY, TM 43-0001-27, AND MILITARY PERISCOPE. OVER 100 DIFFERENT VARIANTS HAVE BEEN PRODUCED. THESE INCLUDE RECOILESS RIFLE CARRIERS, MILAN ATGM CARRIERS, ENGINEER VARIANTS, RECONAISSANCE VEHICLES, AIR DEFENSE VEHICLES WITH AA MACHINE GUNS, & THOSE ADAPTED TO MOUNT THE COUNTRY'S MACHINE GUNS AND/OR ANTI-TANK WEAPONS.

SLOVENIAN ARMORED PERSONNEL CARRIER BOV-M



BOV-M10



BOV-86M (Serbia)

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	See variants	Name:	M86
Date of introduction:	1971	Caliber/length (mm):	7.62
Proliferation: Vehicles: Countries:	139+ 4+	Type:	Machine Gun
Description:	4 X 4 APC built originally by Yugoslavia with space for 8 soldiers to exit through side doors: 3 firing ports on each side & an additional one to the right of the commander's vision block	Ammo (Rounds carried-Est): Ball-T, API, API-T Other available: Light Ball, Ball-T, Heavy Ball, Incendiary	2000
Crew (driver & commander):	2	Max Effective Range (m): Day: On the Move: Night: Tactical Anti-Aircraft:	 1000 400-500 200-800 1000
Combat weight (mt; depends on variant): Max: Min:	 7.0 9.0	Armor penetration (RHA at 500 m):	8
Chassis length overall (m):	6.0	Muzzle velocity (m/s):	825
Height overall (m; top of the cabin):	2.34	VARIANTS	SPECIFICATIONS
Width overall (m):	2.53	BOV-M (Slovenia)	Some built with 12.7-mm MGs
Ground pressure (kg/cm^2):	INA	BOV-VP	Security version with swing out gates to direct crowds
Automotive performance:	F6l413F	BOV-1/Polo M-83	Sans troop compartment with 2 ATGM launcher pods with 3 AT-3 launchers each with machine gun mounted before the two AT-3s
Engine type:	German Deutz 6-cyclinder diesel	BOV-3	3 turret-mounted 20-mm cannons for air defense
Cruising range (km):	500	BOV-30	2 turret-mounted 30-mm cannons for air defense
Speed (km/h): Max road: Max off-road: Average cross-country:	95 INA 40	BOV-SN	Ambulance

Max Swim:	N/A		
Fording depths (m):	1.10	LOV (Croatia)	No raised compartment, increased hull protection, but with a 12.7-mm machine gun
Radio:	INA	Yugo import BOV variants	Serbia has a variants that include SP AA vehicles with the Igla or Stinger missiles or the ZU-23; AT vehicles with the AT-5 Spandrel; or an armored reconnaissance vehicle with a 20-mm M55 cannon, 7.62-mm PKT machine gun with twin AT-3 Sagger AT launchers or a single Spandrel system
Protection:			
Armor, turret front (mm; defeats 7.62-mm AP at 300 m):	6-10		
Applique armor (mm):	Available on sides for variants		
Explosive reactive armor(mm):	No		
Active Protection System:	No		
Self-entrenching blade:	No		
NBC protection system:	Available		
Smoke equipment (Smoke grenade launchers):	6		
Survivability equipment:	Grill armor over windows		

NOTES

SOURCES: 2014 WEG AND MILITARY PERISCOPE. THE MG86 MACHINE GUN IS A LICENSE-BUILT COPY OF THE RUSSIAN PKT. THE BOV-M HAS A CENTRAL TIRE INFLATION SYSTEM. MANY OF THE BOV-MS VEHICLES HAVE STEEL MESH SCRENS MOUNTED OVER THE VEHICLE'S WINDOWS

FRENCH ARMORED CARRIER/TACTICAL UTILITY VEHICLE VBL



VBL with open rear



VBL with M2HB MG and protective plates

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	Vehicule Blinde Leger, Ultrav, M11	Name:	M2HB
Date of introduction:	1984	Caliber/length (mm):	12.7
Proliferation: Vehicles: Countries:	1948+ 17+	Type:	Machine Gun
Description:	4 X 4 armored vehicle carrier serves in a variety of roles. Some variants can carry more than the crew.	Ammo (Rounds carried): Ball, Tracer, AP, API, API-T, AP Hardcore, Multipurpose, SLAP, SLAPT	1200
Crew (driver, commander, & gunner):	3	Max Effective Range (m): Day: Night:	 2000 INA
Combat weight (mt):	3.55	Armor penetration: AP at 30˚ & 1500 m: Ball at 100 m:	 11 20
Chassis length overall (m):	3.70	Muzzle velocity (m/s): M33 Ball: SLAPT (Tracer):	 890 1215
Height overall (m): To the top of the MG:	1.70 2.14	Name:	Milan (on some variants)
Width overall (m):	2.02	Caliber/length (mm):	115
Ground pressure (kg/cm²):	INA	Type:	ATGM
Automotive performance:	XD 3T	Ammo (Tandem HEAT-SACLOS on some variants):	6
Engine type:	Peugeot liquid-cooled, turbo-charged, in-line, 4-cylinder diesel	Max Effective Range (m): Milan: Milan Minimum range: Milan ER:	 2000 25 3000
Cruising range (km): Max improved fuel variant: With external tanks:	600 800 1000	Armor penetration (Milan 3): ERA (mm): Reinforced concrete (mm):	 1000 3000
Speed (km/h): Max road: Max off-road: Average cross-country: Max Swim:	95 INA INA 5.4	Muzzle velocity (m/s):	200

Fording depths (m):	Amphibious		
Radio:	INA	VARIANTS	SPECIFICATIONS
Protection:		VBL Samantha	Griffon surveillance radar to designate targets
Armor, turret front (mm):	5-11.5	VBL Anti-Tank	HOT or TOW turret; or Kornet or Ingwe missile systems
Applique armor (mm):	No	VBL Albi	Fires Mistral/Mistral 2 SAMs
Explosive reactive armor(mm):	No	VBL with PL127 Turret	12.7-mm MG or 40-mm AGL
Active Protection System:	No	VBL SOURCE	Upgraded optics
Self-entrenching blade:	No	VBL Information	Improved target designation
NBC protection system:	Collective	VAP Deep Penetration Vehicle	Long wheel-base
Smoke equipment:	Available	ULTRAV M11	Stretched for NBC detection
Survivability equipment:	Increased mine protection; Kevlar blankets	Wasp Milan ER	Remote weapon station w/ ATGM & 7.62-mm MG
VARIANTS	SPECIFICATIONS	VBL Canon	20-mm remote turret
VBL AT4CS	A54CS 84-mm ATGM carrier; 250 km range w/ 7.62-mm MG	VBL Ingwe (South Africa)	Armed Long Range Recon Turret w. 4 Ingwe ATGMs
VBL Eryx	Short-range (600 m) AT carrier with secondary 7.62-mm machine gun	MPCV (Multi-purpose Combat Vehicle)	VBR chassis with 4 rail missile launcher turret with 8 missiles & 12.7-mm machine gun
VB2L Poste de Commandement	Command version with extra radios, map board, & 7.62-mm MG for self-protection	VBL Tourelle Fermee	Remote turret that can fire a 12.7-mm MG, 7.62-mm MG, or 40-mm AGL
VBL TOW (Greece)	Single tube with 4 rounds with range to 3,750 m	VBR	Stretch variant can carry 5 soldiers; remote weapon station with M2HB MG
VBL Milan	1 Milan firing unit with 6 missiles with range to 2 km		

NOTES

SOURCES: 2014 WEG, ARMY RECOGNITION, AND MILITARY PERISCOPE. SOME VBLS WILL CARRY A 7.62-MM MACHINE GUN AS A SECONDARY WEAPON. THIS COULD BE COAXIAL MOUNTED ON AN ATGM PLATFORM SYSTEM OR ON A RING MOUNT. LRAC ANTI-TANK LAUNCHERS ARE ALSO AVAILABLE AS AN OPTION

TURKISH LIGHT ARMORED VEHICLE COBRA



Cobra

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	None	Name: (For APC Variant)	M2HB
Date of introduction:	1998	Caliber/length (mm):	12.7
Proliferation: Vehicles: Countries:	13+ 12+	Type:	Machine Gun
Description:	4 X 4 light; 10 troops besides the crew; 4 side doors, rear door, & 2 roof hatches; 3 firing ports on each side of vehicle & 1 in rear door	Ammo (Rounds carried): Ball, Tracer, AP, API, API-T, AP Hardcore, Multipurpose, SLAP, SLAPT	1000
Crew (driver & commander):	2	Max Effective Range (m): AP/Ball Day (Estimate): AP/Ball Night (Estimate):	 1500 1200
Combat weight (mt):	6.2	Armor penetration (mm): AP at 30˚ at 1500 m: Ball at 100 m:	 11 20
Chassis length overall (m): With winch:	5.0 5.23	Muzzle velocity (m/s): M33 Ball: SLAPT (Tracer): 1215	 890 1215
Height overall (m; to cabin top):	2.10	VARIANTS	SPECIFICATIONS
Width overall (m):	2.20	APC	Basic variant; carries 8-12 troops & 12.7-mm MG; open or turret-mounted 40-mm AGL, 25-mm cannon, or 30-mm cannon.
Ground pressure (kg/cm^2):	INA	Armored Reconnaissance Vehicle	Crew of 4 in vehicle with a 25-mm cannon & FLIR
Automotive performance:		Armored C2 Vehicle	Command & control vehicle with crew of 6 armed with 7.62-mm MG

Engine type:	General Motors V-8, water-cooled, turbo-charged diesel	Armored Ambulance	Evacuates 4 litter or 6 seated patients, plus medical gear
Cruising range (km):	725	TOW Missile Carrier	Crew of 5 with a TOW ATGM with range to 3750 m or Rafael overhead weapons system with Spike AT missiles
Speed (km/h): Max road: Max off-road: Average cross-country: Max Swim:	115 INA INA 8	Cobra EOD Vehicle	Designed for explosive ordnance disposal with controlled blade on front of vehicle operated by driver
Fording depths (m):	Amphibious	Cobra Reconnaissance/ Surveillance Vehicle	Target acquisition for higher unit commands
Radio:	Varies depending on the customer's needs	Cobra Twin-Turret	Rotating turret with 40-mm AGL & 12.7-mm machine gun
Protection:		Cobra Amphibious Vehicle	Allows vehicle to enter water without any preparation
Armor, turret front (mm; against 7.62-mm rounds):	INA	NBC Reconnaissance Vehicle	Equipped with NBC sensors
Applique armor (mm):	Available		
Explosive reactive armor(mm):	Available		
Active Protection System:	No		
Self-entrenching blade:	No		
NBC protection system:	Available		
Smoke equipment (Smoke grenade launchers):	Yes		
Survivability equipment:	Electrical self-recovery winch; fire suppression system		

NOTES

SOURCES: 2014 WEG AND MILITARY PERISCOPE. THE NUMBER OF COBRAS OPERATIONAL WORLDWIDE IS MORE NUMEROUS THAN LISTED AS MOST COUNTRIES: THAT HAVE THEM HAVE NOT RELEASED THEIR ON-HAND FIGURES.

AMERICAN LIGHT ARMORED VEHICLE V-150



USMC V-150 Commando



Portuguese V-150 Commando

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	LAV-150 Commando	Name:	FN MAG
Date of introduction:	1971	Caliber/length (mm):	7.62
Proliferation: Vehicles: Countries:	4205+ 30+	Type:	Cupola Machine Gun
Description:	4 X 4 light armored vehicle with an exit door on both sides of the vehicle for 2 soldiers with no firing ports	Ammo (Rounds carried): Ball-T, Match, API, API-T	3200
Crew (driver, commander & gunner):	3	Max Effective Range (m): Day: Night:	 1500 INA
Combat weight (mt; V-150):	9.89	Armor penetration:	INA
Chassis length overall (m; longer for V-150S & M1117)	5.69	Muzzle velocity (m/s):	840
Height overall (m): V-150: M1117	1.98 2.59	VARIANTS	SPECIFICATIONS
Width overall (m): V-150: M1117	2.26 2.56	LAV-150 Commando V-100	Original model with gasoline engine with top speed of 100 km/h. Variants included APCs, 81-mm mortar carriers, command vehicles, Dragon missile carrier, TOW missile carrier, police & fire variants, & turreted versions with various weapons
Ground pressure (kg/cm²):	INA	LAV-150 Command V-150	Diesel engine with top speed of 89 km/h
Automotive performance (V-150):	V-504	LAV-150 Command V-150S	Stretched by an additional 0.46 m, improved cross-country performance, & higher payload capacity
Engine type:	Cummins liquid cooled, V-8 diesel (other models have different engines)	LAV-150 Command V-150ST	Stretched variant with a turbo-charged engine with bottom of side hatch forming a step to dismount

Cruising range (km): V-150: M1117:	800 718	LAV-150 Commando V-200 (Singapore)	Chrysler gasoline engine with different variants (20-mm turret, 90-mm turret, RBS-70 SAM system for air defense, recovery vehicle, & 120-mm mortar carrier)
Speed (km/h): V-150 Max road: M1117 Max road: Max off-road: Average cross-country: Max Swim:	 89 100 INA INA 5	LAV-150 V-300	6 X 6 variant with 9-10 troops, 3 crew, 105 km/h speed, & amphibious
Fording depths (m): All Others: M1117	 Amphibious 1.5	DN-III/V Caballo (Mexico)	DN-88 has 7.62-mm MG in turret; DN-V has 12.7-mm MG; both have mount for RM-12 light MG in rear
Radio:	INA	Malaysian Upgraded V-150	Proposed version to covert Malaysian army V-150s from gasoline to diesel engines
Protection:		M1117 ASV/ASV-150	Bridges the gap between the HMMWV & APC with a turret featuring a MK-19 40-mm AGL & a 14.7 (.50 caliber) machine gun
Armor, turret front (mm; against 7.62 ball ammo)):	INA	M707 Armored Knight	Artillery support vehicle
Applique armor (mm):	No	Mobile Strike Force Vehicle (MSFV) (Afghanistan)	3 variants (APC with gunner protective kit, APC with turret, & ambulance) additional protection using off-the-shelf parts
Explosive reactive armor(mm):	No	Tactical Armored Patrol Vehicle (Canada)	When fielded, it will use the Kongsberg Protector remotely operation weapons station
Active Protection System:	No	Commando Advanced APC	Extended vehicle to increase troop capacity with V-shaped hull to deflect mine blasts
Self-entrenching blade:	No		
NBC protection system:	No		
Smoke equipment:	Available		
Survivability equipment:	V-shaped hull available		

NOTES

SOURCES: 2014 WEG, TM 43-0001-27 TM 43-0001-27 AND MILITARY PERISCOPE. MANY LAVS HAVE ADDED A 40-MM MK-19 AGL TO ITS WEAPONRY.

AMERICAN MINE-RESISTANT VEHICLE COUGAR



Cougar Mine-Resistant Vehicle

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	Cougar H Series	Name:	None on base version
Date of introduction:	2004	Caliber/length (mm):	N/A
Proliferation: Vehicles: Countries:	3993+ 9+	Type:	N/A
Description:	4 X 4 medium mine-protected vehicle can carry 4 soldiers plus crew; many variants	Ammo:	N/A
Crew (driver & commander):	2	Max Effective Range (m)	N/A
Combat weight (mt): 4 X 4: 6 X 6:	 19.5 29.3	Armor penetration:	IN/A
Chassis length overall (m): 4 X 4: 6 X 6:	 5.64 6.81	Muzzle velocity (m/s):	N/A
Height overall (m):	2.62	VARIANTS	SPECIFICATIONS
Width overall (m):	2.59	Cougar 6 X 6	Identical performance to 4 X 4, but with room for 12 soldiers in rear
Ground pressure (kg/cm^2):	INA	Mastiff Protected Patrol Vehicle (PPV) (UK)	UK version of the 6 X 6 Cougar
Automotive performance:		Mastiff 2 PPV (UK)	Upgraded UK 6 X 6 Cougar
Engine type:	Caterpillar C7 diesel	Ridgeback (UK)	British 4 X 4 Cougar with Bowman communication system, ECM, night-vision & camera; many variants
Cruising range (km):	5966	Wolfhound Tactical Support Variant (UK)	British 4 X 4 for logistics support with a cargo capacity of 4.5 tons
Speed (km/h): Max road: Max off-road:	105 INA	Joint Explosive Rapid Response Vehicle (JERRV)	Cougar modified for EOD duties

Average cross-country: Max Swim:	INA N/A		
Fording depths (m):	1.0	Iraqi/International Light Armored Vehicle (ILAV)	Also known as the Badger, supports the transition efforts of the Iraqi forces
Radio:	INA	Timberwolf	Like Wolfhound with a driver, 5 Soldiers, & a remote controlled weapons station with a 7.62-mm MG, 12.7-mm MG, or a 40-mm AGL
Protection:			
Armor, turret front (mm; against 7.62 X 51-mm/54-mm AP rounds):	INA		
Applique armor (mm):	Standard		
Explosive reactive armor(mm):	No		
Active Protection System:	Available (Electronic countermeasures-ECM)		
Self-entrenching blade:	No		
NBC protection system:	MDH Overpressure with M998 filters		
Smoke equipment:	No		
Survivability equipment (prevents blast attacks up to 13.6 kg TNT equivalent under wheel & 6.8 kg under hull/engineer):	Internal Modular Side Plates, External Roof Plates, Stand-Off Armor, Flexible Lower Side-Skirt Armor		

NOTES

SOURCES: MILITARY PERISCOPE. ALSO USED BY PRIVATE SECURITY COMPANIES IN IRAQ SUCH AS BLACKWATER USA. MORE THAN 200 COUGARS TOOK 100 HITS FROM EXPLOSIVE DEVICES WITHOUT LOSS OF LIFE DURING ONE PERIOD OF TIME.

SOUTH AFRICAN MINE-RESISTANT VEHICLE RG-31



RG-31 Mine-Protected Vehicle

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	RG-31 Nyala (South Africa) RG-31 Charger (US)	Name:	None on base version
Date of introduction:	1971	Caliber/length (mm):	N/A
Proliferation: Vehicles: Countries:	3296+ 7+	Type:	N/A
Description:	4 X 4 armored vehicle; 8 troops protected from small-arms fire & mines/explosives	Ammo:	N/A
Crew (driver & commander):	3	Max Effective Range (m)	N/A
Combat weight (mt): Mk 3: Mk 5: Mk 5EHM:	8.4 14.2 18.6	Armor penetration:	INA
Chassis length overall (m): Mk 3: Mk 5: Mk 5EHM:	 5.74 6.6 7.0	Muzzle velocity (m/s):	N/A
Height overall (m): Mk 3: Mk 5: Mk 5EHM:	2.57 2.72 2.80	VARIANTS	SPECIFICATIONS
Width overall (m): Mk 3: Mk 5: Mk 5EHM:	2.20 2.48 2.50	RG-31 Mk 3	Speed increased to 120 k/hr
Ground pressure (kg/cm^2):	INA	RG-31 Quick Intervention Vehicle (Scorpion)	Weapons platform for a variety of weapons (crew of 4)

Automotive performance:	**RG-31 Mk 3**	**RG-31 Mk 3 Ambulance**	**Crew of 4 can accommodate 4 stretcher patients**
Engine type:	**HR 694 Hi3, water-cooled, 6-cylinder, in-line diesel**	**RG-31 Mk 5EHM**	**Speed up to 100 k/hr**
Cruising range (km): Mk 5	**805**	**RG-31 Mk 5**	**2-man crew; 6 soldiers armed with 5.65-mm, 7.62-mm, or 12.7-mm MGs; or Mk 19 AGL; Speed up to 113 k/hr**
Speed (km/h): Mk 3 **Max road:** **Max off-road:** **Average cross-country:** **Max Swim:**	 **120** **INA** **INA** **N/A**	**RG-31 Mk 6**	**Longer wheelbase, greater payload capacity, improved ballistic protection with applique passive armor & spall liners; Australian Platt protected weapons station**
Fording depths (m): Mk 5 w/o preparation)	**.91**		
Radio:	**INA**		
Protection:			
Armor, turret front (mm; against 5.56-mm rounds):	**INA**		
Applique armor (mm):	**Available on Mk 6**		
Explosive reactive armor(mm):	**No**		
Active Protection System:	**Available (EMS)**		
Self-entrenching blade:	**No**		
NBC protection system:	**No**		
Smoke equipment:	**No**		
Survivability equipment:	**Hull can withstand a double TM57 level mine explosion (14 kg of TNT) under any wheel or a single detonation (7 kg of TNT) under the central vehicle**		

NOTES

SOURCES: MILITARY PERISCOPE. ONE OF THE EARLY MINE-PROTECTED VEHICLES USED IN IRAQ. WHILE BASIC MODEL IS UNARMED & USED TO TRANSPORT SUPPLIES, OTHER VERSIONS CAN BE ARMED WITH A VARIETY OF WEAPONS INCLUDING THE PLATT WEAPONS STATION WITH 5.56-MM, 7.62-MM, OR 12.7-MM MGS OR MK-17 AGS

GERMAN ALL-PROTECTED VEHICLE DINGO



Dingo

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	Multi-Purpose Protected Vehicle (MPPV) (Belgium)	Name:	Rheinmetall
Date of introduction:	2004	Caliber/length (mm):	7.62
Proliferation: Vehicles: Countries:	604+ 7+	Type:	Machine Gun
Description:	Modular design 4 X 4 APC with space for 6 soldiers; 4 sides doors with rear storage area; no firing ports	Ammo (Rounds carried): M59 Ball; M61 AP; M62 Tracer; M80 Lead Free; M992 AP; L2A1 Ball; L5A1 Tracer; L44A1 Ball; Patrone AB22 DM 111 *Weichkern* Ball; Patrone DM111A1 Ball; DM18A1B1 *Übung*	INA
Crew (driver & commander):	2	Max Effective Range (m): Day: Night:	 1500 INA
Combat weight (mt; plus the payload):	12.5	Armor penetration:	INA
Chassis length overall (m): Short variant: Long & Large Volume Variant:	 5.50 6.10	Muzzle velocity (m/s):	INA
Height overall (m): Short & Long Variants: Large Volume Variant:	 2.60 2.60-2.80	VARIANTS	SPECIFICATIONS
Width overall (m):	2.40	Dingo 2 Short	Upgraded variant with crew of 2 & 3 passengers
Ground pressure (kg/cm^2):	INA	Dingo 2 Long	Upgraded version with crew of 2 & 6 passengers
Automotive performance:		Dingo 2 Large Volume	Upgraded variant with crew of 2 & 8 soldiers or larger payload

Engine type:	215 horsepower with EPS/EAS transmission	Dingo HD	Heavy duty with payload up to 3 tons with an increased vehicle weight to 14.5 mt
Cruising range (km): Large Volume:	1000\ 700	Dingo 2 NBC	NBC recon & surveillance vehicle
Speed (km/h): Max road: Max off-road: Average cross-country: Max Swim:	100 INA INA N/A	Dingo 2 GSR	Ground surveillance radar vehicle
Fording depths (m):	1.0	Dingo 2 Patrol	Remote turret with either a 7.62-mm or 12.7-mm machine gun
Radio (As needed by customer):	INA	Dingo 2 Ambulance	Medical transport vehicle
Protection:		Dingo 2 Pick Up	Cargo carrier ILO of passenger compartment in back
Armor, turret front (mm; against hand-held weapons & artillery fragments to 155-mm):	INA	Dingo 2 GSI	Armored recovery & repair vehicle
Applique armor (mm):	INA	Dingo 2 ARV	Armored recovery vehicle with dismounted crane
Explosive reactive armor(mm):	INA		
Active Protection System:	INA		
Self-entrenching blade:	No		
NBC protection system:	Yes		
Smoke equipment:	INA		
Survivability equipment:	Double hull against fragments & internal belly pan against mines		

NOTES
SOURCES: 2014 WEG AND MILITARY PERISCOPE. OTHER VARIANTS CAN MOUNT A 12.7-MM MACHINE GUN OR THE 40-MM AUTOMATIC GRENADE LAUNCHER

RUSSIAN IMPROVED LIGHT TACTICAL VEHICLE TIGR-M



Tigr-M

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	Gaz-2330 SPM-1/SPM-2	Name:	Pecheneg
Date of introduction:	2004	Caliber/length (mm):	7.62
Proliferation: Vehicles: Countries:	INA 8+	Type:	Machine Gun
Description:	4 X 4 utility vehicle similar to the HWWMV based on the GAZ-2330 chassis; can carry 5 to 10 total personnel based on variant; firing ports in police version only	Ammo (Rounds carried): Ball; AP; Trace; API; Sniper	INA
Crew (driver & commander):	2	Max Effective Range (m): Day: Night (Estimate):	 1500 1200
Combat weight (mt):	7.80	Armor penetration: 57-N-323S Ball at 520 m & body armor at 110 m: 7N13 AP at 660 m & body armor at 800 m:	 6 6
Chassis length overall (m):	5.70	Muzzle velocity (m/s):	825
Height overall (m):	2.40	VARIANTS	SPECIFICATIONS
Width overall (m):	2.40	2330	Standard with 5 doors, closed cargo compartment & 4 seats
Ground pressure (kg/cm^2):	INA	2975	Police
Automotive performance:	B215		
Engine type:	Diesel (or Cummins B-180 or YaMZ-536)	SPM-1 (233034)	Police with 2 crew members & 7 passengers
Cruising range (km):	900		
Speed (km/h): Max road:	140	SPM-2 (233036)	SPM-1 with window firing ports

Max off-road: Average cross-country: Max Swim:	INA INA N/A		
Fording depths (m):	1.30	SPM-2 Tigr Alpha BB	Level 5 ballistic protection
Radio (As needed by customer):	INA	233301 & 233011	Unarmored pickup truck with 4 doors, 4 seats & closed rear
Protection:		233002 & 233012	2-door pickup model
Armor, turret front (mm): With spall liner (Armor variants-against 7.62-mm rounds)	5.0	233003 & 233013	3-door SUV with sedan body
Applique armor (mm):	INA	233014-000186 & 233014-000184	Armored variants
Explosive reactive armor(mm):	INA	233114	Upgraded engine & armor
Active Protection System:	INA	Tigr-AR Assault Ramp Vehicle	Scales vertical obstacles to 8 m in height & special cutting tools
Self-entrenching blade:	No	R-145MBA	C2 vehicle with commo equipment
NBC protection system:	No	Kornet-D/EM	Tigr with 2 launches for 8 missiles
Smoke equipment:	No	MKTK REI PP	Mobile electronic warfare vehicle
Survivability equipment:	Spall liner	Scout Vehicle	With telescopic antenna
VARIANTS	SPECIFICATIONS	Tigr-M	YaMZ-534 diesel engine with seats for 9 passengers instead of 8
		MK-BLA-01	UAV carrier vehicle
Remote control Gun Platform	In testing in 2016	SP46	2-Door parade vehicle with cabriolet body (folding roof)

NOTES
SOURCES: 2014 WEG AND MILITARY PERISCOPE. OTHER VARIANTS CAN MOUNT A 12.7-MM MACHING UN; 30-MM AGL; OR THE KORNET-EM MULTI-PURPOSE MISSILE SYSTEM.

RUSSIAN TACTICAL UTILITY VEHICLE UAZ-469



UAZ-469 Tactical Utility Vehicle



UAZ-469 with top and windows down

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	UAZ-3151 Upgrade *Kozlik* (Goat)	Name:	None on base model
Date of introduction:	1971 (Upgrade-1985)	Caliber/length (mm):	N/A
Proliferation: Vehicles: Countries (widespread, especially among former WARSAW Pact countries & old Soviet allies):	INA INA	Type:	N/A
Description:	4 X 4 off-road vehicle can carry up to 6 passengers plus the driver	Ammo:	N/A
Crew (driver):	1	Max Effective Range (m)	N/A
Combat weight (mt):	2.35	Armor penetration:	N/A
Chassis length overall (m):	4.025	Muzzle velocity (m/s):	N/A
Height overall (m):	1.99	VARIANTS	SPECIFICATIONS
Width overall (m):	1.785	UAZ-469	Initial model fielded in 1973 with 70 horsepower UMZ 451 MI engine with inferior road performance & crew features
Ground pressure (kg/cm²):	INA	UAZ-469B	Export version with lower off-road performance capabilities
Automotive performance:		UAZ-3151 Upgrade	Improved vehicle first produced in 1985
Engine type:	92 horsepower gasoline	Ambulance	Space for driver, one medic, & 1 stretcher patient
Cruising range (km):	482	BJ-212	Chinese UAZ-469 variant
Speed (km/h): Max road: Max off-road: Average cross-country: Max Swim:	110 INA INA N/A		
Fording depths (m):	0.8		
Radio:	INA		
Protection:			

Armor, turret front (mm):	**INA**		
Applique armor (mm):	**No**		
Explosive reactive armor(mm):	**No**		
Active Protection System:	**No**		
Self-entrenching blade:	**No**		
NBC protection system:	**No**		
Smoke equipment:	**No**		
Survivability equipment:	**Optional winch**		

NOTES

SOURCES: 2014 WEG. 600 KG PAYLOAD CAPACITY. CARGO SPACE IS 1.6 SQUARE METERS, 1400 MM X 1000 M X 400 MM. OFTEN UNARMED, BUT SOME FEATURE A PINTLE-MOUNTED 7.62-MM OR 12.7-MM MACHINE GUN OR A W-87 AUTOMATIC GRENADE LAUNCHER. AIR DEFENSE OR ANTI-TANK UNITS MAY HVE OTHER ROLE-SPECIFIC WEAPON SYSTEMS.

BRITISH ALL-TERRAIN VEHICLE SUPACAT



Supacat

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	All-Terrain Mobile Platform (ATMP)	Name:	PKT
Date of introduction:	By 1982	Caliber/length (mm):	7.62
Proliferation: Vehicles: Countries:	INA 43+	Type:	PKT machine gun
Description:	6 X 6 rough terrain vehicle can carry 2 to personnel with gear or 4 personnel with less gear; vehicle is open & provides no protection to its occupants	Ammo (Rounds carried-Est): At Gun: Ready Boxes: Light Ball, Ball-T; Heavy Ball, API, API-T, Incendiary:	800 200 600
Crew (driver):	1	Max Effective Range (m): Day: On the move: Night:	 1000 400-500 INA
Combat weight (mt): Mk III	2.70 3.50	Armor penetration (mm RHA at 500 m):	8
Chassis length overall (m; with winch):	3.44	Muzzle velocity (m/s):	825
Height overall (m):	1.90	VARIANTS	SPECIFICATIONS
Width overall (m):	2.00	ATMP	Basic Model
Ground pressure (kg/cm²):	INA	FLPT	Fork Lift Pallet Trailer can handle pallets up to 1.6 mt
Automotive performance:	VW ADE	SLLPT	Self-Loading Lightweight Pallet Trailer
Engine type:	Turbo-charged diesel	Fuel Cat	Carries & pumps up to 1000 liters of aviation fuel & carries an engine start system. It can also carry an Air Portable Fuel Container (APFC)
Cruising range (km):	INA	Mounted Crane	Crane used for light maintenance operations

Speed (km/h): Max road: Max off-road: Average cross-country: Max Swim:	64 INA INA < 5	Aircraft Crash Recovery Vehicle	Designed to get to difficult crash sites to recover bodies & investigate the crash
Fording depths (m):	Amphibious	Radio Rebroadcast Stations	Can be used to relay radio signals
Radio (Vehicle/man pack to meet customer's needs):	INA	Casualty Evacuation	Used to get patients from difficult terrain to aid stations/hospitals
Protection:		AGTM Launcher	Fitted with Milan
Armor, turret front (mm; against 7.62-mm rounds, but most of the vehicle is open & without protection):	INA	Mortar Carrier	Can carry an 81-mm mortar
Applique armor (mm):	No	Howitzer Tow Vehicle	Can tow a 105-mm howitzer & ammunition trailers in artillery units
Explosive reactive armor(mm):	No	Engineer Vehicle	Used by engineers to conduct operations
Active Protection System:	No		
Self-entrenching blade:	No		
NBC protection system:	No		
Smoke equipment:	INA		
Survivability equipment:	INA		

NOTES

SOURCES: 2014 WEG. THE 7.62 MACHINE GUN IS THE MOST COMMON WEAPON, BUT OTHER OPTIONS INCLUDE A 12.78-MM MACHING GUN, A 30/35/40-MM AUTOMATIC GRENADE LAUNCHER, OR AN ATGM LAUNCHER. PINTLE MOUNTS ON ROLL BAR ALLOW FOR OTHER WEAPONS. THE PINTLE MOUNT CAN EVEN HOLD A FARA-1 GROUND SURVEILLANCE RADAR WHEN THE SUPACAT IS STATIONARY

RUSSIAN BATTLEFIELD SUPPORT VEHICLE LUAZ-967



LuAz-967M Battlefield Support Vehicle

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	See Variants	Name (Weapons carrier only):	AGS-17
Date of introduction:	1961	Caliber/length (mm):	30
Proliferation: Vehicles produced: Countries (Russia has some in storage):	20,000 INA	Type:	Automatic Grenade Launcher (AGL)
Description:	4 X 4 off-road vehicle similar to the American Jeep with space for 4 soldiers	Ammo (Rounds carried-Est): HE; HEDP	116
Crew (driver):	1	Max Effective Range (m):	1700
Combat weight (mt):	0.93	Armor penetration:	INA
Chassis length overall (m):	3.68	Muzzle velocity (m/s):	185
Height overall (m):	1.63	VARIANTS	SPECIFICATIONS
Width overall (m):	1.74	LuAZ-967A	37-hp engine with top speed of 75 km/h that can tow trailers & light artillery up to 300 kg
Ground pressure (kg/cm²):	INA	LuAZ-967M	Final production model until 1991 with same engine as the LuAZ-967A
Automotive performance:	MeMZ-965	Geolog	6 X 6 version never produced
Engine type:	27-hp gasoline	Evacuation Role	2 stretcher & 2 seated
Cruising range (km):	285		
Speed (km/h): Max road: Max off-road: Average cross-country: Max Swim:	65 INA INA 3		
Fording depths (m):	Amphibious		
Radio:	INA		
Protection:			
Armor, turret front (mm):	INA		
Applique armor (mm):	No		

Explosive reactive armor(mm):	**No**		
Active Protection System:	**No**		
Self-entrenching blade:	**No**		
NBC protection system:	**No**		
Smoke equipment:	**No**		
Survivability equipment:	**200 kg winch available for self-recovery**		

NOTES

SOURCES: 2014 WEG, MILITARY TODAY, MILITARY FACTORY, MINOTOR-SERVICE & PAUL MULCAHY'S PAGES. THIS VEHICLE CAN ALSO BE FITTED WITH A FATO ATGM OR 82-MM RECOILLSS RIFLE. THE SEAT CAN BE ADJUSTED SO THE DRIVER'S SEAT CAN BE FOLDED DOWN SO THE DRIVER CAN OPERATE THE VEHICLE WHILE LAYING FLAT. THE VEHICLE CAN CARRY UP TO 320 KG OF SUPPLIES, BUT MAXIMUM PAYLOAD CAPACITY IS 420 KG.

SINGAPORE LIGHT STRIKE VEHICLE SPIDER



Spider Light Strike Vehicle

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	None	Name:	CIS-50
Date of introduction:	2008	Caliber/length (mm):	12.7
Proliferation: Vehicles: Countries (Similar to vehicles in 9+ countries):	INA 9+	Type:	Machine Gun
Description:	4 X 4 dune buggy type vehicle with rollover frame can hold up to 6 passengers in addition to the crew.	Ammo (Rounds carried-Est): API, API-T, Incendiary, I-T	 1200
Crew(driver, commander & gunner):	3	Max Effective Range (m): AP & Ball Day (Est): AP & Ball Night (Est):	 1500 1200
Combat weight (mt):	1.60	Armor penetration: AP at 30˚ at 1500 m: Ball at 100 m:	 11 20
Chassis length overall (m):	4.50	Muzzle velocity (m/s): APDS-T: API-T: CAN: HEI, HEI-T:	 1150 1100 1055 1045
Height overall (m):	1.90	VARIANTS	SPECIFICATIONS
Width overall (m):	2.0	SRAMS	120-mm Super Rapid Advanced Mortar System (SRAMS) with an auto-loader & 6 rounds on vehicle

Ground pressure (kg/cm²):	INA	Ammo Carrier	Accompanies the SRAMS with additional crew member
Automotive performance:	Peugeot	Spider with Spike ATGM	Anti-tank weapons carrier
Engine type:	In-line 4, turbo-charged diesel		
Cruising range (km):	700		
Speed (km/h): Max road: Max off-road: Average cross-country: Max Swim:	120 80 INA N/A		
Fording depths (m):	0.60		
Radio (man-portable/vehicle as needed by the customer):	INA		
Protection:			
Armor, turret front (mm; relies on its speed):	None		
Applique armor (mm):	No		
Explosive reactive armor(mm):	No		
Active Protection System:	No		
Self-entrenching blade:	No		
NBC protection system:	No		
Smoke equipment:	INA		
Survivability equipment:	Mobility, speed, 360°crew fire, & quick dismount		

NOTES

SOURCES: 2014 WEG AND MILITARY PERISCOPE. OTHER WEAPON OPTIONS INCLUDE A 5.56-MM MACHINE GUN, 7.62-MM MACHINE GUN WITH 3000 ROUNDS, AN AUTOMATIC GRENADE LAUNCHER WITH 300 ROUNDS, OR A SPIKE-LR AGTM WITH 6 ROUNDS. VARIOUS USES INCLUDE AS A WEAPONS TEAM VEHICLE, FIRE SUPPORT VEHICLE, ANTI-TANK WEAPONS CARRIER, MAN-PORTABLE SAM VIHICLE, OR AS A RISTA/SECURITY TEAM VEHICLE.

RUSSIAN HEAVY APC/HEAVY CSV BTR-T



BTR-T Heavy Armored Personnel Carrier/Heavy Combat Support Vehicle

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	None	Name:	2A42
Date of introduction:	1997	Caliber/length (mm):	30
Proliferation: Vehicles: Countries (Developed & marketed for export, but no purchasers yet):	INA 0+	Type:	Automatic Gun
Description:	Tracked T-55 tank hull with overhead weapons system with 4 dismounted soldiers. Limited troop capacity & no firing ports makes it more of a CSV than an APC	Ammo (Rounds carried): HEI-T, Frag-HE: APFSDS-T:	200 100 100
Crew (driver, commander & gunner):	3	Max Effective Range (m): Frag-HE Day: Frag-HE Night: APFSDS-T M929 Day: APFSDS-T M929 Night:	 4000 800-1300 2500 800-1300
Combat weight (mt):	38.5	Armor penetration: APFSDS-T M929 KE at 1000 m: KE at 2000 m:	 55 45
Chassis length overall (m):	6.20	Muzzle velocity (m/s):	825
Height overall (m):	2.40	Name:	9P135M2 (options: Trigan & MILAN)
Width overall (m):	3.27	Caliber/length (mm):	135
Ground pressure (kg/cm^2):	INA	Type:	SACLOS AT-5B/Konkurs-M ATGM
Automotive performance:		Ammo (Rounds carried-HEAT):	3
Engine type:	Diesel	Max Effective Range (m) AT-5b Day: AT-5b Night: Trigan Flame-G Day/Night: Milan 3 Flame G Day/Night:	 4000 2500 2500 1290
Cruising range (km):	500	Armor penetration: AT-5b CE (RHA):	 925

		Trigan CE (RHA): Milan 3 CE (RHA):	1300 880
Speed (km/h): Max road: Max off-road: Average cross-country: Max Swim:	50 INA INA N/A	Muzzle velocity (m/s~):	820
Fording depths (m): With snorkel:	1.4 5.0		
Radio:	R-173; R-173P	VARIANTS	SPECIFICATIONS
Protection:		Machine Gun Overhead Weapons Station	12.7-mm machine gun, with AGL or ATGM launchers
Armor, turret front (mm; no turret, but hull can withstand K/600 CE):	200	30-mm Gun Overhead Weapons Station	Twin 30-mm automatic gun, or 30-mm with ATGM, or 30-mm with AGL
Applique armor (mm):	No	Scout-Patrol Vehicle (DPM)	Recon vehicle with 12.7-mm MG
Explosive reactive armor(mm):	Yes		
Active Protection System:	No		
Self-entrenching blade:	KMT-8 Mine plow available		
NBC protection system:	Collective		
Smoke equipment (Smoke grenade launchers:	12 VEESS		
Survivability equipment:	Grill armor in hull		

NOTES

SOURCES: 2014 WEG. VEHICLE MAY HAVE BEEN RESPONSE TO THE RUSSIAN EXPERIENCE IN CHECHNYA AS A SPECIAL ROLE APC FOR ACCOMPANY TANKS & INFANTRY IN URBAN CONFLICTS. SEVERAL LIMITATIONS FOR THIS VEHICLE AS AN APC: (1) DISMOUNT CAPACITY IS LESS THAN A FULL SQUAD; (2) SOLDIERS OTHER THAN THE CREW MUST EXIT VROM 2 HATCHES ON THE TOP AT THE REAR AND EXPOSES THEM TO DIRECT FIRE; (3) INTIIAL CONFIGURATIONS LACK ANTI-PERSONNEL WEAPONS & REMOTE WEAPONS FOR 360° PROTECTION; & (4) MOBILITY IS INFERIOR TO MOST MODERN TANKS. VEHICLE DOES FIT WELL INTO TIGHTLY CONGESTED AREAS SUCH AS FOREST TRAILS. A VARIETY OF ATGM SYSTEMS CAN BE MOUNTED ON THE VEHICLE SUCHT AS THE AT-4 FAGOT (9P135), AT-5 KONKURS, TRIGAN, & MILAN. THE MOST LETHAL OF THESE OPTIONS IS THE TRIGAN THAT MOUNTS ONTO A MILAN LAUNCHER ADAPTER.

RUSSIAN ARMORED PERSONNEL CARRIER MT-LB



Medic MT-LB



MT-LB Air Defense Vehicle



MT-LB Anti-Tank Vehicle

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	MT-LB-T (Prime mover	Name:	PKT
Date of introduction:	1970	Caliber/length (mm):	7.62
Proliferation: Vehicles: Countries:	7170+ 16+	Type:	2 PKT machine guns
Description:	General-purpose carrier & prime mover; some used as an APC with up to 11 dismounts	Ammo (Rounds carried): Light Ball, Ball-T; Heavy Ball, API, API-T, Incendiary	2000
Crew (driver & commander):	2	Max Effective Range (m): Day: On the move: Night:	 1000 400-500 INA
Combat weight (mt):	11.90	Armor penetration (mm RHA at 500 m):	8
Chassis length overall (m):	6.35	Muzzle velocity (m/s):	825
Height overall (m without weapons):	1.87	VARIANTS	SPECIFICATIONS
Width overall (m):	2.85	MT-LB “Blade”	Dozer version
Ground pressure (kg/cm²): Standard track: Wide track:	 0.46 0.28	MT-LBu	Raised hull area for improved carrying capacity in 50+ of 60+ MT-LB variants
Automotive performance:	YaMZ 238V	2S1	122-mm SP howitzer
Engine type:	Liquid-cooled, V-8 diesel	BMP-23 (Bulgaria)	IFV on MT-LB chassis with 23-mm BMP-2 auto cannon
Cruising range (km):	500	BTP-LB	Technical support vehicle
Speed (km/h): Max road: Max off-road: Average cross-country: Max Swim:	61.5 30 INA 5-6	MT-SON	Ground surveillance radar (GSR) with the Pork Trough/SNAR-2 radar system
Fording depths (m):	Amphibious	RKhM	Chemical recon vehicle

Speed (km/h): Modernized Max road: Max off-road: Average cross-country: Max Swim:	 70 45 INA 5-6	SA-13	SAM launcher vehicle at the regimental level
Radio:	R-123 or R-123M or R-173	SNAR-10	GSR with Big Fred radar
Protection:		9P149/Shturm-S	ATGM with AT-60 autoloader
Armor, turret front (mm):	7-14	MT-LBV (Ukraine)	MT-LB or MT-LBu upgrades
Applique armor (mm):	No	MT-LBVM	Modern 12.7-mm MG
Explosive reactive armor(mm):	No	MT-LB Upgrade (Ukraine)	30-mm auto cannon, night sights, & other improvements
Active Protection System:	INA	MT-LB6MA (Russia)	Twin 14.5-mm MGs with 7.62-mm machine gun
Self-entrenching blade:	Yes	MT-LB6MB (Russia)	Modular Weapon Station includes the 30-mm cannon, 30-mmAGL, & 7.62-mm MG
NBC protection system:	Collective	MT-LB6MB3 (Russia)	FSV/APC with AA 23-mm GSh-23L twin cannons, 30-mm AGL & 7.62-mm machine gun
Smoke equipment:	No	MT-LB6MB5 (Russia)	APC/IFSV with Gsh-30K twin 30-mm anti-aircraft guns, 12.7-mm MG, 30-mm AGL & space for a single squad
Survivability equipment:	INA		

NOTES

SOURCES: 2014 WEG AND MILITARY PERISCOPE. THE WIDE TRACK MAKES IT ONE OF THE WORLD'S BEST LAVS FOR ICE, SNOW, MARSHES, & SAND. BASIC MODEL CARRIES ONE 7.62-MM MACHINE GUN. OTHER WEAPONS SYSTEMS CAN BE MOUNTED ON THE VEHICLE FOR A VARIETY OF PURPOSES. MT-LB HAS BEEN CONVERTED BY THEIR USERS INTO A NUMBER OF SUPPORT ROLES INCLUDING BEING USED AS AN AMBULANCE TO EVACUATE THE WOUNDED FROM THE BATTLEFIELD.

RUSSIAN IFV/APC/INFANTRY FIRE SUPPORT VEHICLE TURRET KLIVER



Kliver Turret with 2A72 Automatic Gun and 4-RAIL ATGM system. COAX MG hidden to the 2A72's right.

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	TKB-799	Name:	2A72
Date of introduction:	First displayed in 1996	Caliber/length (mm):	30
Proliferation: Vehicles: Countries:	N/A 1+	Type:	Automatic Gun
Description:	1-man turret for use on a number of vehicles	Ammo (Rounds carried): HEI-T, Frag-HE, Frangible, APFSDS-T	300
Crew (Gunner, but the vehicle will need a driver & commander):	1	Max Effective Range (m): Frag-HE Day: Frag-HE Night: APFSDS-T M929: Day/Night:	 400 3500 2500+
Combat weight (mt): High: Low	1.5 2.5	Armor penetration: Frag-HE: APFSDS-T M929 at 1000 m: APFSDS-T M929 at 2000 m	Frag-HE: INA 55 45
Chassis length overall (m):	Depends on chassis	Muzzle velocity (m/s):	INA
Height overall (m):	Depends on vehicle	Name:	Turret coaxial
Width overall (m):	Depends on vehicle	Caliber/length (mm):	7.62
Ground pressure (kg/cm²):	Depends on vehicle	Type:	PKT machine gun
Automotive performance:	Depends on vehicle	Ammo (Rounds carried): Tracer, AP, API, Incendiary	2000
Engine type:	Depends on vehicle	Max Effective Range (m): Day: Night:	 1500 1000
Cruising range (km):	Depends on vehicle	Armor penetration:	INA
Speed (km/h): Max road: Max off-road: Average cross-country: Max Swim:	Depends on vehicle Depends on vehicle Depends on vehicle Depends on vehicle	Muzzle velocity (m/s~):	830
Fording depths (m):	Amphibious vehicle capability is retained with new turret	Name:	9M133 (NATO-AT-14 Spriggan)
Radio:	Depends on vehicle	Caliber/length (mm):	152
Protection:		Type:	SACLOS Kornet LR

Armor, turret front (mm):	Depends on vehicle	Ammo (Rounds carried-depends; HEAT or LR-HE (Thermobaric, 9M113F):	2-8
Applique armor (mm):	Depends on vehicle	Max Effective Range (m): Kornet-E Day: Kornet-E Night: Kornet-E Minimum range: Kornet-LR HE Day:	 5500 3500 100 10,000
Explosive reactive armor(mm):	Depends on vehicle	Armor penetration(mm) Kornet-E CE:	 1000
Active Protection System:	Depends on vehicle	Muzzle velocity (m/s):	INA
Self-entrenching blade:	Depends on vehicle	VARIANTS	SPECIFICATIONS
NBC protection system:	Depends on vehicle	BTR Chassis	Turret can be mounted on any 1.5-2.5 vehicle with turret capacity; hull rework required
Smoke equipment (Not on prototype, but could be added:	INA	BMP-1M	IFV with Kliver upgrade. See BMP-1 for additional information. Name in OPFOR organizations is BMP/Kliver
Survivability equipment:	Depends on vehicle	Other Kliver-based IFVs	Turret can be added to an APC or IFV, considered APC for simulations
		BMP-3F	IFV exported to at least 1 country
		BMD-3	A1 turret & A2 chassis w/ a PERI-Z59 sight
		Infantry Fire Support Vehicle (FSV); Air Defense/Anti-Tank (AD/AT)	Carries AGTMs & MANPADS with 2 dismount teams. Weapon mix dependent on vehicle's role

NOTES

SOURCES: 2014 WEG AND MILITARY PERISCOPE. VEHICLE DATA SHEETS DO NOT CHANGE WITH THE ADDITION OF THE KLIVER TURRET. FAIRLY EXPENSIVE UPGRADE, BUT LESS THAN REPLACING ENTIRE VEHICLE. INFANTRY FORCE COULD DO A PARTIAL UPGRADE WITH 1 PER PLATOON OR 3-4 PER COMPANY.

RUSSIAN MOTORCYLE GEAR UP



Gear Up Motorcycle with PKT Machine Gun & Side Car



Gear Up Motorcycle with Anti-Tank Weapon

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	IMZ-8.107, IMZ-8.103	Name:	PKT
Date of introduction:	By 1999	Caliber/length (mm):	7.62
Proliferation: Vehicles: Countries (many countries have similar models):	INA 3+	Type:	Machine Gun
Description:	Motorcycle with optional sidecar.	Ammo (Rounds carried): Tracer, AP, API, Incendiary	INA
Crew (driver): With sidecar: Total of 3 if a 3rd rides behind motorcycle driver	1 2	Max Effective Range (m): Day: Night:	 1500 1000
Combat weight (kg:	315	Armor penetration:	INA
Chassis length overall (m):	2.56	Muzzle velocity (m/s ~):	830
Height overall (m):	1.10	Name:	DShK (Degtyaryov-Shpagin Large-Caliber)
Width overall (m):	1.70	Caliber/length (mm):	12.7
Ground pressure (kg/cm²):	INA	Type:	DShK Machine Gun
Automotive performance:		Ammo:	INA
Engine type:	2-cylinder, 4-cycle, 45 horsepower gasoline	Max Effective Range (m):	2000
Cruising range (km): With an additional gas tank:	240 365	Armor penetration:	INA
Speed (km/h): Max road: Max off-road: Average cross-country: Max Swim:	105 INA INA N/A	Muzzle velocity (m/s):	850
Fording depths (m; float capable with air pump available for pontoon inflation or wood float attachments):	INA	Name:	AGS-17
Radio (man-packed available):	INA	Caliber/length (mm):	30
Protection:	INA	Type:	Automatic grenade launcher
Armor, turret front (mm):	None	Ammo:	INA
Applique armor (mm):	No	Max Effective Range (m)”	18--
Explosive reactive armor(mm):	No	Armor penetration:	INA
Active Protection System:	No	Muzzle velocity (m/s):	185

Self-entrenching blade:	No	Name:	AT-5B (Konkurs-M/9P135M2)
NBC protection system:	No	Caliber/length (mm):	135
Smoke equipment:	No	Type:	ATGM-SACLOS
Survivability equipment:	INA	Ammo:	INA
VARIANTS	SPECIFICATIONS	Max Effective Range (m): Minimum range:	4000 70
NM3-8.107	Earlier version	Armor penetration (MM RHA):	7
Chang Jiang 750	Chinese version with sidecar capability	Muzzle velocity (m/s):	200
		Name:	Varies (such as SA-18 Grouse or SA-16 Gimlet)
		Caliber/length (mm):	Varies depending on type
		Type:	Surface-to-Air (SAM) missile
		Ammo:	Varies depending on type
		Max Effective Range (m)	Varies depending on type
		Armor penetration:	Varies depending on type
		Muzzle velocity (m/s):	2 Varies depending on type

NOTES

SOURCES: 2014 WEG. THIS MOTORCYCLE IS DERVIED FROM THE GERMAN BMW MOTORCYCLE DESIGN FROM WORLD WAR II. THERE ARE CIVILIAN VERSIONS OF THIS MOTORCYCLE SUCH AS THE SOLO AND TOURIST, BOTH WITHOUT A SIDE CAR, AND THE SPORTSMAN WITH A SIDECAR. MOTORCYLES CAN BE USED BY AIRBORNE UNITS, ESPECIALLY INFANTRY; SNIPERS; SECURITY PERSONNEL; RECONAISSANCE ELEMENTS, ANTI-TANK TEAMS, LIASION OFFICERS, SIGNAL UNITS, AND OTHER UNITS. THE SIDECAR CAN BE REMOVED. (PICTURES FROM 2014 WEG)

BRITISH LIGHT ARMORED CAR S55



British S55 Mk1 Light Armored Car

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	FV18061; S5 Shorland	Name:	L7A2
Date of introduction:	1963 (original); 1990s (Mk 5)	Caliber/length (mm):	7.62
Proliferation: Vehicles: Countries:	237+ 21+	Type:	Machine Gun
Description:	4 X 4 light armored car with 2 side exit doors & rear door on some models; 3 firing ports on each side & 2 in the rear doors; capacity for 8 soldiers in raised roof personnel carrier model; run-flat tires	Ammo (Rounds carried): Ball; Ball-T; API; API-T	1500
Crew (driver, command & gunner):	3	Max Effective Range (m): Day: Night:	 800 INA
Combat weight (mt):	3.6	Armor penetration:	INA
Chassis length overall (m):	4.51	Muzzle velocity (m/s):	838
Height overall (m): With turret:	1.85 2.29	VARIANTS	SPECIFICATIONS
Width overall (m):	1.80	Mk 1	Initial vehicle with 7.25-mm armor & 67-hp engine
Ground pressure (kg/cm^2):	INA	Mk 2	Upgraded variant with 8.25-mm armor & 77-hp engine
Automotive performance:		Mk 3	Upgraded engine to 91-hp
Engine type:	114-hp gasoline	Mk 4	Upgraded version with 11-mm armor & 114-hp engine
Cruising range (km):	514	Mk 5	Latest upgrade with improved suspension & wider wheelbase
Speed (km/h) (Mk 5) Max road: Max off-road: Average cross-country: Max Swim:	 105 48 INA N/A	S53 Mobile Air Defense Vehicle	Anti-aircraft missile carrier vehicle with 3 missiles ready to fire & 6 more stowed for reload

Fording depths (m):	**0.5**	**S54 Anti-Hijack Vehicle**	**Special-Purpose Vehicle with special rifle marksman turret**
Radio:	**INA**		
Protection:			
Armor, turret front (mm; 7.62-mm ball at 26 m):	**11**		
Applique armor (mm):	**INA**		
Explosive reactive armor(mm):	**INA**		
Active Protection System:	**INA**		
Self-entrenching blade:	**No**		
NBC protection system:	**No**		
Smoke equipment (Smoke grenade launchers):	**8**		
Survivability equipment:	**Grass-reinforced plastic flooring; air conditioning available**		

NOTES

SOURCES: 2014 WEG. VEHICLE USES A LAND ROVER CHASSIS. PRIMARY USE IS BY THE MILITARY FOR SITE SECURITY & AS AN INTERNAL SECURITY VEHICLE FOR POLICE & BORDER FORCES.

DEC
2016

Worldwide Equipment Guide

Chapter 4: Main Battle Tanks



TRADOC G-2 ACE–Threats Integration
Ft. Leavenworth, KS

Distribution Statement: Approved for public release; distribution is unlimited.

Chapter 4: Main Battle Tanks

Chapter 4 provides the basic characteristics of selected main battle tanks (MBT) either in use or readily available to the OPFOR and therefore likely to be encountered by US forces in varying levels of conflict.

This data in this chapter focusses primarily on the three functional categories of major subsystems to gauge overall MBT effectiveness:

- Mobility.
- Survivability.
- Lethality.

Mobility is the relationship between improved automotive performance efficiency and the combat-load weight. The operating range of MBTs is typically between 450 and 600 kilometers (km), with differences in fuel capacity and terrain being traversed. Diesel is the most common fuel among modern MBT although some have a multi-fuel engine which can run on kerosene, diesel, or specific types of benzene. Vehicles with an auxiliary power unit (APU) improve MBT fuel economy during temporary halts or operating in stationary positions. MBT weights can range from 40 to 70 tons.

Survivability is the aggregate of protective measures which allow the MBT to complete its mission. This includes physical mean such as armor and engineer equipment, camouflaging and obscurants, and nuclear-chemical-biological (NBC) protection.

Armor protection may include mine-protection appliqué, active-reactive and/or passive appliqué armor for the turret, glacis, flanks, and rear. MBTs may also implement stand-off caging or mesh screens that degrade the effect of antitank weapon hits and armor penetration. Appliqué armor and explosive reactive armor (ERA), have become common for improving protection, but at the cost of substantial increases in weight. Engineer enhancements include entrenching blades, mine-clearing plows, and mine rollers.

Camouflage and obscurant systems include methods for reducing detection by optical, infrared, and radar technologies. MBTs may employ smoke emission systems, and aerosol or smoke-obscurant grenade launcher systems.

Pressurized nuclear-chemical-biological (NBC) systems provides a measure of crew protection for NBC-contaminated environments. Air conditioning in some MBTs enhance overall systems performance and sustainment of crew readiness in heat-extreme climates.

Lethality incorporates factors relevant to gun optics, gun-to-target precision, type of gun mount, and specific round caliber ballistics as components of maximum aimed range and maximum effective range. It includes the main gun and auxiliary weapons, as well as command and fire control systems, thermal viewfinders, laser rangefinders, and digital communications. Critical considerations to upgrades include linking fire-on-the-move capability to MBT stabilization systems, rate of fire, integrated sights, target acquisition ranges, and weapons ranges to include aimed effective range and maximum range.

Lethality may be enhanced with improved munitions including kinetic energy (KE) rounds with a dart-like penetrator (armor-piercing, fin-stabilized, discarding sabot (APFSDS) and high-explosive antitank (HEAT) multi-purpose (MP) rounds that use a shaped-charge for armor penetration.

Summary. Improvements in MBT capabilities are typically upgrade packages rather than new tank models for production. Current evidence underscores increasing fiscal costs for research and development, testing, and production of MBT systems. Visual identification may be difficult due to the variance in upgrades to internal systems of an MBT. However, a significant MBT development is the ongoing testing and develop trials of the Russian Federation *Armata* family of armored chassis vehicles. The T-14 MBT within this modernization initiative provides major improvements to MBT capabilities that were constrained previously due to the vintage T-72 series hull, turret, automotive, and weapon system configurations.

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RUSSIAN FEDERATION MAIN BATTLE TANK T-90A T-90S



"Clamshell-type" armor applique, front applique armor, turret top and side skirt armor plates

SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative designations:	See notes.	Armament-Main Gun:	Smoothbore gun
Date of introduction:	circa 2002	Caliber, type, name:	125mm 2A46M-4
Proliferation:	2	Rate of Fire (rd/min):	7
Crew:	3	Loader Type:	Autoloader
Combat weight (mt):	47	Ready main gun rounds:	22 in autoloader carousel
Chassis length overall (m):	6.85	Stowed rounds:	15/6 stowed
Height overall (m):	2.25	Elevation (°):	-6 to +14
Width overall (m):	3.8	Fire on Move:	Yes
Ground pressure (kg/cm2):		Turret-coax to main gun	
AUTOMOTIVE		Caliber, type, name:	7.62-mm (7.62x 54R) PKT
Engine type (hp):	Diesel 840 V-84 (multifuel)	Max eff range-day (m):	1,500-2,000
Engine type (hp): Upgrade	Diesel 1100 V-96	Max eff range-night (m):	1,500-2,000
Cruising range (km):	550 km/650 km w/aux fuel	Fire on move:	Yes
Max road speed (kph):	65	Rate of fire (rd/min):	250 practical /650 cyclic
Max off-road speed (kph):	45	Armament-Aux Weapon:	Turret-TC cupola
Average cross-country (kph):	35	Caliber, type, name:	12.7-mm (12.7x108) NSVT
Max swim:	N/A	Max aimed range-day (m):	2,000
Fording depth (m):	1.7 unprep, 5.0 w/snorkel	Max eff range-night (m):	2,000
COMMUNICATIONS		Fire on move:	Yes w/reduced accuracy
Radio:	R-173	Rate of fire (rd/min):	210 practical/800 air targets
External Intercom device	INA	ATGM Launcher	
		Missile name-nomenclature:	AT-11 Sniper
PROTECTION		Launch method:	2A46M-4 gun-launcher
Applique armor:	Turret roof; track skirt	Missile guidance:	SACLOS laser
Explosive reactive armor:	Kontakt-5 2d gen ERA	Launch rate (msl/min):	2-3
Active prot system:	Shtora TshU1-7.	FIRE CONTROL	
Mine clearing:	Roller or plow (options)	FCS name:	1A45T
Self-Entrenching blade:	Yes	Thermal: TC-gunner	1A43
NBC protection system:	Yes	Main gun stabilization	2E42-4
Smoke equipment:	Gren launch 2x6; VESS	Infrared	Yes
		Sights w/magnific: day (m)	5000

		Sights w/magnific: nt (m)	INA

NOTES

VARIANTS

T-90: SUCCESSOR TO T-72BM, ORIGINALLY CALLED T-72BU, WITH FIRE CONTROL AND ARMOR UPGRADES SIMILAR TO THOSE ON THE T-80U. DESPITE USING THE LOWER COST T-72 CHASSIS, THIS TANK INCORPORATED MORE RECENT COMPONENTS THAN THE T-80U AND IS IN SOME WAYS SUPERIOR. THE ORIGINAL TANK HAD AN II NIGHT SIGHT, NOT THE THERMAL SIGHT UPGRADE, AND THE UNDER-POWERED 840-HP ENGINE. UPGRADES HAVE BEEN ADDED.

T-90A: ORIGINALLY KNOWN AS T-90SM OR T-90M, IT IS NOW ACCEPTED FOR RUSSIAN SERVICE AS THE STANDARD TANK.

T-90MS: EXPORT VARIANT: IMPROVED ARMOR PROTECTION AND ERA; REMOTE CONTROL WEAPON STATION ON TURRET ROOK WITH 12.7 MM MG; TRAVERSE FORWARD 316 DEGREES; ELEVATE -10 TO +45 DEGREE. IMPROVED FIRE CONTROL SYSTEM FOR ENGAGEMENT OF STATIONARY AND MOVING TARGETS WHILE TANK IS MOVING. TC PANORAMIC SIGHT FOR TC-GUNNER DISPLAY LINKED TO LASER RANGEFINDER; THERMAL AND 4 TELEVISION CAMERA-EACH 95 DEGREE WIDE/45 DEGREE ELEV. IMPROVED BATTLE MANAGEMENT AND LAND NAVIGATION TRACKING SYSTEM. EXTERNAL AUXILLARY DIESEL POWER UNIT FOR FUEL CONSERVATION. SOME RESERVE MAIN GUN AMMO IN BUSTLE WITH BLOWOUT PANELS. TURRET AND HULL REAR WITH BAR (LOURVE) ARMOR; ANTI-LASER WARNING AND PROTECTION. 125 MM MAIN GUN IMPROVED ACCURACY WITH 2A46M-5 RATHER THAN PRVEIOUS 2A46M IN T90S.

T-90S: EXPORT VARIANT WITH OPTION FOR UPGRADES. SEVERAL SUBSYSTEM CHANGES, SUCH AS UPGRADE FCS, NEW ENGINE, REMOVAL OF SHTORA-1, ETC., HAVE BEEN ADDED BASED ON CUSTOMER PREFERENCES, AND ARE INCLUDED IN EXPORT VERSIONS OF THE TANK. SOME EARLY T-90S HAVE BEEN UPGRADED TO THIS STANDARD. MOST OF THESE ARE BEING SOLD TO INDIA, WITH THE 1,000 HP ENGINE UPGRADE, AND WITH ADDITION OF AIR CONDITIONING.

T-90SK: T-90S COMMAND VARIANT

BHISHMA: INDIAN VARIANT PRODUCED FROM T-90A KNOCKDOWN KITS. IT DOES NOT USE THE SHTORA-1 IRCM SYSTEM. ENGINE IS T-90A UPGRADE. THE TANK IS SOMETIMES ERRONEOUSLY CALLED T-90S. VARIOUS STAGES OF UPGRADES WILL BE EMPLOYED IN INDIAN FORCES. RUSSIA HAS PROVIDED T-90S TANKS WITH INDIAN INTENT TO UPGRADE ALMOST ALL OF ITS T-90 AND T-90S REMAINING VERSIONS IN KNOCK-DOWN KITS WITH UPGRADES TO MEET THE BHISHMA STANDARD. AN ISSUE REMAINS OF NO AIR CONDITIONING SYSTEM IN SOME EXPORT MBT TO INDIA CAUSE OVERHEATING OF SYSTEM COMPONENTS AND DEBILITATING ENVIRONMENT FOR TANK CREW IN SOME ENVIRONMENTS.

PROJECT RHINO: MOST T-90 AND T-90S TANKS IMPORTED BY INDIA TO BE UPGRADED AS BHISHMA UNDER THIS PROGRAM AND AGREEMENT WITH RUSSIA.

OTHER UPGRADE VERSIONS OF THE T-72 INCLUDE FEATURES OF THE T-90A SUCH AS THE IMPROVED GUN STABILIZATION, IMPROVED FIRE CONTROL SYSTEM, IMPROVED ENGINE, AND IMPROVED AMMUNITION SUCH AS THE AINET AND THE INVAR. OTHER TANKS WHICH PROVIDE SIMILAR CAPABILITIES ARE THE UKRAINIAN T-72AG AND T-72MP. THE CZECH T-72CZM4 ALSO HAS A 2ND GEN THERMAL SIGHT. RECENT RUSSIAN TANK UPGRADE PACKAGES FOR THE T-72 ARE THE T-72M1, AND THE T-72M1M. THE ABOVE RUSSIAN UPGRADES ARE FOR MODERNIZING OLDER TANKS, VERSUS T-90/T-90A, WHICH ARE NEWLY PRODUCED TANKS. UPGRADED T-80U, T-80UK, AND T-84 TANKS ALSO HAVE SIMILAR CAPABILITIES.

WEAPONS & AMMUNITION TYPES AND TYPICAL COMBAT LOAD

125-MM SMOOTHBORE GUN (EST)	43
APFSDS-T	14
HEAT-MP/HEAT	3

FRAG-HE 12
FOCUSED FRAG AINET (AVAILABLE) 8
ATGM 6

MAIN ARMAMENT AMMUNITION
CALIBER, TYPE, NAME:
125-MM APFSDS-T, BM-42M
MAXIMUM AIMED RANGE (M): 3,000-4,000
MAX EFFECTIVE RANGE (M):
DAY: 3,000-4000
NIGHT: 2,600
ARMOR PENETRATION (MM KE): 590-630 AT 2,000 METERS

125-MM HEAT-MP, BK-29M
MAXIMUM AIMED RANGE (M): 4,000
MAX EFFECTIVE RANGE (M):
DAY: 4,000
NIGHT: 2,600
ARMOR PENETRATION (MM CE): 650-750 IT HAS SOME HE EFFECTS SIMILAR TO FRAG-HE ROUNDS AGAINST PERSONNEL
AND MATERIEL TARGETS.

125-MM HEAT, BK-27
MAXIMUM AIMED RANGE (M): 4,000
MAX EFFECTIVE RANGE (M):
DAY: 3,000+
NIGHT: 2,600
ARMOR PENETRATION (MM CE): 700-800

125-MM HE-SHRAPNEL FOCUSED-FRAGMENTATION, AINET
MAXIMUM AIMED RANGE (M): 5,200
MAX EFFECTIVE RANGE (M):
DAY: 5,000
NIGHT: 2,600
TACTICAL AA RANGE: 4,000-5,000
ARMOR PENETRATION (MM): CAN DEFEAT IFV AND APC

125-MM FRAG-HE-T, OF-26
MAXIMUM AIMED RANGE (M): 5,000
MAX EFFECTIVE RANGE (M):
DAY: 5,000
NIGHT: 2,600
ARMOR PENETRATION (MM): CAN DEFEAT IFV AND APC. A NEAR MISS WILL SERIOUSLY DAMAGE OR DESTROY MOST
IFVS AND APCS.

OTHER AMMUNITION TYPES: FRENCH GIAT 125G1 APFSDS-T, RUSSIAN BM-42 AND BM-32 APFSDS-T. NOTE: THE RUSSIANS MAY HAVE A VERSION OF THE BM-42M WITH A DU PENETRATOR. RUSSIAN BM-48 APFSDS-T PENETRATES 650-700 MM
SOKOL-1 GUIDED ANTITANK ROUND

ANTITANK GUIDED MISSILES:
AT-11B/INVAR
WARHEAD TYPE: TANDEM SHAPED CHARGE (HEAT)
ARMOR PENETRATION (MM CE): 900, 850 BEHIND ERA
RANGE (M): 5,000 DAY, 2,600 NIGHT
AT-11/REFLEKS: MISSILE WITH FRAG-HE WARHEAD TO 5,000 M

NOTES
T-90AM: THE RUSSIAN MILITARY DECIDED AGAINST T90A FOR ITS FORCES. IN SEP 2011, THEY DISPLAYED T-90AM AS A DEEP MODERNIZATION OF T-90A. THEY INCLUDE A LOW-PROFILE TURRET WITH A BUSTLE AUTOLOADER AND BLOW-OUT PANELS. THE NEW 2A82 GUN FIRES A LONGER (700+ MM EST) AND HEAVIER APFSDS-T ROUND TO 3,500+ M
THE ORIGINAL VERSION OF THE TANK HAS AN 840-HP DIESEL ENGINE. THE ENGINE IN SUBSEQUENT MODELS IS UPGRADED. ENGINE OPTIONS INCLUDE 950, 1,000 AND 1,100 HP.
THE ORIGINAL TANK HAD AN II SIGHT FROM THE T-80 SERIES (BURAN-PA, 800-1300 METERS RANGE). HOWEVER, MARKETING MATERIALS FEATURE THE AGAVA-2 THERMAL SIGHT. RECENT GEN^3 SIGHTS ARE AVAILABLE. THESE NIGHT SIGHTS PERMIT NIGHT LAUNCH OF ATGMS.
RELIKT 3d GEN ERA IS OFFERED TO REPLACE KONTAKT-5 IN SEVERAL UPGRADE PACKAGES, OR AS A SEPARATE UPGRADE. THE ERA ADDS UP TO 600 MM CE PROTECTION AND 300 MM KE TO TURRET BASE ARMOR PROTECTION, OR ABOUT 150 MM MORE THAN KONTAKT-5.
ARENA APS IS AVAILABLE. ACTIVE PROTECTION SYSTEMS. DEFENSIVE AIDES SUITE IS SHTORA-1 (LASER WARNING RECEIVER WITH GUN AUTO-SLEW, LWR-DIRECTED SMOKE GRENADE LAUNCHERS, AND EO-IR JAMMER), OR PARTIAL PACKAGE EXCLUDING IR JAMMERS. NONE IS ON BHISHMA. THE SHTORA-1 IR ATGM COUNTERMEASURE ILLUMINATORS CAN BE DETECTED WITH NIGHT SIGHTS. SHTORA-1 HAS NO EFFECT AGAINST MOST MODERN ATGM SYSTEMS, WITH ENCODED TRACKER BEACONS. EXCLUSION OF SHTORA-1 OFFERS MORE ERA ON THE TURRET FRONT AND REDUCES COSTS. PROTECTION PROBABLY INCLUDES RADAR-ABSORBENT MATERIALS AND IR-RESISTANT PAINT
THE T-90 MAY BE FIELDED WITH FULL SHTORA-1 PACKAGE (LASER WARNING RECEIVER WITH AUTO-SLEW GUN CAPABILITY, LWR-DIRECTED SMOKE GRENADE LAUNCHERS, AND EO-IR JAMMER), WITH A PARTIAL PACKAGE, OR WITHOUT SHTORA-1. SHTORA-1 ILLUMINATORS CAN BE USED FOR NIGHT ILLUMINATION.
AN IMPROVED GUN, 2A46M-4, WITH IMPROVED ACCURACY AND USE LIFE IS AVAILABLE FOR FITTING TO THE T-90.
THE BK-29 ROUND, WITH A HARD PENETRATOR IN THE NOSE IS DESIGNED FOR USE AGAINST REACTIVE ARMOR, AND AS AN MP ROUND HAS FRAGMENTATION EFFECTS. THE BK-27 HEAT ROUND OFFERS A TRIPLE-SHAPED CHARGE WARHEAD AND 50 MM MORE PENETRATION.THE 12.7-MM MG NSVT HAS BOTH REMOTE ELECTRONICALLY OPERATED SIGHT PZU-5 WITH VERTICAL STABILIZATION, NIGHT ACQUISITION, AND A GUN-MOUNTED K10-T REFLEX SIGHT.

RUSSIAN FEDERATION MAIN BATTLE TANK T-80B T-80U



"Clamshell-type" turret armor applique and skirts, front applique armor, turret top plates, and side armor skirts

SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative designations	-	Armament-Main Gun:	Smoothbore gun
Date of introduction	1976/1987	Caliber, type, name:	125mm 2A46-2
Proliferation	1 and 3	Rate of Fire (rd/min):	6-8
Crew	3	Loader Type:	Autoloader; manual
Combat weight (mt)	44.5/46.0	Ready main gun rounds:	28 carousel
Chassis length overall (m)	6.98/7.01	Stowed rounds:	17
Height overall (m)	2.20/2.22	Elevation (°):	-7 to +14
Width overall (m)	3.60	Fire on Move:	Yes
Ground pressure (kg/cm2)	0.87/.0.92	Armament-Aux Weapon:	Turret-coax to main gun
AUTOMOTIVE		Caliber, type, name:	7.62mm PKT
Engine type (hp)	Gas turbine diesel (multi)	Max eff range-day (m):	1000
Engine type (hp) Upgrade	1000/1250	Max eff range-night (m):	850
Cruising range (km)	370/550 w extra fuel tanks	Fire on move:	Yes
Max road speed (kph)	70	Rate of fire (rd/min):	210
Max off-road speed (kph)	45	Armament-Aux Weapon:	Turret-TC cupola
Average cross-country (kph)	40	Caliber, type, name:	12.7mm
Max swim:	NA	Max aimed range-day (m):	1500
Fording depth (m)	1.8 unprep; 5.0 snorkel	Max eff range-night (m):	800
COMMUNICATIONS		Fire on move:	Yes
Radio	R-173; R-174	Rate of fire (rd/min):	210
External Intercom device	No	ATGM LAUNCHER:	
		Missile name-nomenclature:	AT-11 Refleks
PROTECTION		Launch method:	Gun
Applique armor:	NA/Hull side; track skirts	Missile guidance:	laser
Explosive reactive armor:	Kontakt-5	Launch rate (msl/min):	2-3
Active system:	Arena available	FIRE CONTROL	
Mine clearing:	Roller-plow available	FCS name:	1A332A/1A42
Self-Entrenching blade:	Yes	Thermal: TC-gunner	yes
NBC protection system:	Yes	Main gun stabilization	2E26M/2E42; 2-plane
Smoke equipment:	grenlaunch 4x2; VESS	Infrared	Yes
		Sights w/magnific: day (m)	5000
		Sights w/magnific: nt (m)	1000/2600

NOTES

VARIANTS

T-80A: 1982 VARIANT WITH A DIFFERENT TURRET AND FCS TO FIRE THE SVIR ATGM USED BY THE T-72B.

T-80B: VARIANT HAS PARTIAL ERA MOUNTED; THE FEW ORIGINAL T-80S RETAINED WERE UPGRADED TO THIS STANDARD.

T-80UK: COMMAND VERSION WITH R-163-50K AND R-163-U RADIOS, TNA-4 LAND NAVIGATION SYSTEM, AND AN ELECTRONIC FUZE-SETTING DEVICE THAT PERMITS USE OF AINET SHRAPNEL ROUND. THE AGAVA THERMAL SIGHT PROVIDES A 2600-METER NIGHT ACQUISITION RANGE.

T-80UM1/BARS: UPGRADE VARIANT DEVELOPED FOR RUSSIAN TANK COMPETITION. IT FEATURES AN IMPROVED 1A45 HUNTER-KILLER FCS, 2A46M-4 MAIN GUN, SHTORA-1ATGM IR COUNTERMEASURE SYSTEM, OPTIONAL ARENA ACTIVE PROTECTION SYSTEM (T-80UM2), AND OTHER UPGRADE OPTIONS. IT IS OFFERED; BUT THERE IS NO RECORD OF PRODUCTION.

T-80UD: UKRAINIAN VERSION WITH A 1000-HP DIESEL ENGINE VERSUS THE TURBINE ENGINE, NEW FCS WITH 1A45 SIGHT, AND 1ST GENERATION ERA.

T-84: UKRAINIAN UPGRADE OF T-80UD, WITH A WELDED TURRET, 6TD-2 1200-HP DIESEL ENGINE, KBA-3 125-MM MAIN GUN, AND NEW FCS
WITH A SAGEM THERMAL SIGHT. IT FIRES A COMBAT GUN-LAUNCH ATGM TO 5 KM. IT ENTERED SERVICE IN THE UKRAINE IN 1999, WITH 320 EXPORTED TO PAKISTAN. A T-72 UPGRADE PACKAGE TO THIS STANDARD IS T-72AG. **T-84U** ADDS WIDER TRACK, SHTORA-1 ACTIVE IR ATGM JAMMER SYSTEM, IMPROVED ARMOR, AND OTHER UPGRADES.

OPLOT: UKRAINIAN T-84 UPGRADE WITH A WELDED COMPARTMENTED TURRET, BUSTLE AUTOLOADER, CDR'S INDEPENDENT SIGHT, FRENCH ALIS 2ND GEN THERMAL SIGHT, 1200-HP DIESEL ENGINE, NEW CONFORMAL 3RD GEN ERA, OPTIONAL USE OF ARENA ACTIVE PROTECTION SYSTEM (APS) AND SHTORA-1. THE TANK IS ADOPTED BY UKRAINIAN FORCES FOR FIELDING AND AVAILABLE FOR EXPORT. THE NEW ARTEMIS GUN-LAUNCH ATGM IS AVAILABLE.

YATAGAN/KERN2-120/T-84-120: UKRAINIAN OPLOT VARIANT WITH A 120-MM SMOOTHBORE CANNON, BUSTLE AUTOLOADER, AND ABILITY TO FIRE NATO-COMPATIBLE AMMUNITION, INCLUDING AN APFSDS-T ROUND SIMILAR TO THE FRENCH GIAT 125G1. THE GUN-LAUNCHES A UKRAINIAN LASER-GUIDED ATGM WITH A TANDEM WARHEAD.

WEAPONS & AMMUNITION TYPES AND TYPICAL COMBAT LOAD

125-MM SMOOTHBORE GUN (MIX EST)	45	T-80U
APFSDS-T	15	
HEAT-MP/HEAT	3	
FRAG-HE	21	
ATGM	6	

MAIN ARMAMENT AMMUNITION

CALIBER, TYPE, NAME:

125-MM APFSDS-T, BM-42M
- MAXIMUM AIMED RANGE (M): 3000-4000
- MAX EFFECTIVE RANGE (M):
  - DAY: 2500-3000
  - NIGHT: 800-1300
- ARMOR PENETRATION (MM KE): 590-630 AT 2000 METERS

125-MM FRAG-HE-T, OF-26
- MAXIMUM AIMED RANGE (M): 5000

MAX EFFECTIVE RANGE (M):
DAY: 5000
NIGHT: 800-1300
ARMOR PENETRATION (MM): CAN DEFEAT IFV AND APC.

125-MM HEAT-MP, BK-29M
MAXIMUM AIMED RANGE (M): 4000
MAX EFFECTIVE RANGE (M):
DAY: 3000
NIGHT: 800-1300
ARMOR PENETRATION (MM CE): 650-750. IT HAS SOME HE EFFECTS.

125-MM HEAT, BK-27
MAXIMUM AIMED RANGE (M): 3000
MAX EFFECTIVE RANGE (M):
DAY: 2000-3000
NIGHT: 800-1300
ARMOR PENETRATION (MM CE): 700-800

OTHER AMMUNITION TYPES: GIAT 125G1 APFSDS-T, RUSSIAN BM-42 AND BM-32 APFSDS-T. THE RUSSIANS MAY HAVE A VERSION OF THE BM-42M WITH A DU PENETRATOR.

ANTITANK GUIDED MISSILE:
NAME: AT-8/SONGSTER/KOBRA
WARHEAD TYPE: SHAPED CHARGE (HEAT)
ARMOR PENETRATION (MM CE): 700 (RHA), 200 BEHIND ERA
RANGE (M): 4000 DAY ONLY

NAME: AT-11B/INVAR/9M119M
WARHEAD TYPE: TANDEM SHAPED CHARGE (HEAT)
ARMOR PENETRATION (MM CE): 900, 850 BEHIND ERA
RANGE (M): 5000 DAY; 2600 NIGHT

NAME: AT-11C/INVAR-M/9M119M1
WARHEAD TYPE: TANDEM SHAPED CHARGE (HEAT)
ARMOR PENETRATION (MM CE): 900, 850 BEHIND ERA
RANGE (M): 5000 DAY; 2600 NIGHT

NOTES
FORDING DEPTHS (M): 12.0 WITH BROD-M SYSTEM
THE NIGHT SIGHT CANNOT BE USED TO LAUNCH THE ATGM. THE DAY SIGHT CAN BE USED AT NIGHT FOR LAUNCHING ATGMS IF THE TARGET IS ILLUMINATED.
A VARIETY OF THERMAL SIGHTS ARE AVAILABLE. THEY INCLUDE THE RUSSIAN AGAVA-2, FRENCH SAGEM-PRODUCED ALIS AND NAMUT SIGHT FROM PELENG. THERE ARE THERMAL SIGHTS AVAILABLE FOR INSTALLATION, WHICH PERMIT NIGHT LAUNCH OF ATGMS.
THE 12.7-MM MG NSVT HAS BOTH REMOTE ELECTRONICALLY OPERATED SIGHT PZU-5 AND GUN-MOUNTED K10-T REFLEX SIGHT.

THE MORE RECENT BK-27 HEAT ROUND OFFERS A TRIPLE-SHAPED CHARGE WARHEAD AND INCREASED PENETRATION AGAINST CONVENTIONAL ARMORS AND ERA. THE BK-29 ROUND, WITH A HARD PENETRATOR IN THE NOSE IS DESIGNED FOR USE AGAINST REACTIVE ARMOR, AND AS AN MP ROUND HAS FRAGMENTATION EFFECTS. IF THE BK-29 HEAT-MP IS USED, IT MAY SUBSTITUTE FOR FRAG-HE (AS WITH NATO COUNTRIES) OR COMPLEMENT FRAG-HE. WITH THREE ROUND NATURES (APFSDS-T, HEAT-MP, ATGMS) IN THE AUTOLOADER VERSUS FOUR, MORE ANTITANK ROUNDS WOULD AVAILABLE FOR THE HIGHER RATE OF FIRE.
THE ATGM MAY BE LAUNCHED WHILE MOVING SLOWLY (NFI). THE AT-8 CAN BE AUTO-LOADED WITH THE TWO HALVES MATED DURING RAMMING; BUT THE STUB CHARGE IS MANUALLY LOADED.
GTA-18A AUXILIARY POWER UNIT IS USED WHEN THE ENGINE IS OFF.
FORDING DEPTHS (M): 12.0 WITH BROD-M SYSTEM
ORIGINAL NIGHT SIGHT IS THE II BURAN-PA (800-1300 METERS RANGE). THE BURAN-PA CANNOT BE USED TO LAUNCH THE ATGM. THE 1G46 DAY SIGHT CAN BE USED AT NIGHT FOR LAUNCHING ATGMS IF THE TARGET IS ILLUMINATED. A VARIETY OF THERMAL SIGHTS ARE AVAILABLE. THEY INCLUDE THE RUSSIAN SANOET, FRENCH SAGEM-PRODUCED ALIS AND NAMUT SIGHT FROM BELORUSSIAN PELENG.

RUSSIAN FEDERATION MAIN BATTLE TANK T-72BM



Explosive reactive armor (ERA) tiles applique



"Bra"-type armor applique on turret front-plates on top

SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative designations:	Object 187	Armament-Main Gun:	Smoothbore gun
Date of introduction:	1973/1992	Caliber, type, name:	125mm 2A46M/D-81TM
Proliferation: [at least]	3	Rate of Fire (rd/min):	8
Crew:	3	Loader Type:	Autoloader; manual
Combat weight (mt):	46	Ready main gun rounds:	22
Chassis length overall (m):	6.95	Stowed rounds:	23
Height overall (m):	2.25	Elevation (°):	-6 to +14
Width overall (m):	3.6	Fire on Move:	Yes-main gun
Ground pressure (kg/cm2):	0.90	Armament-Aux Weapon:	Turret-coax to main gun
AUTOMOTIVE	SPECIFICATIONS	Caliber, type, name:	7.62mm PKT
Engine type (hp):	Diesel SV-84	Max eff range-day (m):	1000
Engine type (hp): Upgrade	840	Max eff range-night (m):	800
Cruising range (km):	480; 550 w extra fuel tanks	Fire on move:	Yes
Max road speed (kph):	60	Rate of fire (rd/min):	250
Max off-road speed (kph):	45	Armament-Aux Weapon:	Turret-TC cupola
Average cross-country (kph)	35	Caliber, type, name:	12.7mm
Max swim:	NA	Max aimed range-day (m):	1500
Fording depth (m):	1.8 unprep; 5.0 snorkel	Max eff range-night (m):	INA
COMMUNICATIONS	SPECIFICATIONS	Fire on move:	Yes
Radio:	Digital	Rate of fire (rd/min):	200
External Intercom device	NA	ATGM Launcher:	
		Missile name-nomenclature:	AT-11 Svir
PROTECTION	SPECIFICATIONS	Launch method:	Gun
Applique armor:	Turret top; track skirts	Missile guidance:	SACLOS, laser
Explosive reactive armor:	Kontakt-5	Launch rate (msl/min):	2-3
Active system:	Arena available	FIRE CONTROL	SPECIFICATIONS
Mine clearing:	Roller-plow available	FCS name:	1A40-1
Self-Entrenching blade:	Yes	Thermal: TC-gunner	1K13-49
NBC protection system:	Yes	Main gun stabilization	2Eh42-2, 2-plane
Smoke equipment:	Grenlaunch 8x; VESS	Infrared	Yes
		Sights w/magnific: day (m)	5000
		Sights w/magnific: nt (m)	1000

NOTES

VARIANTS

T-72B: SECOND RUSSIAN MAIN VARIANT OF THE T-72 AFTER T-72A.

T-72B1, IN 1986 A LIMITED PRODUCTION VARIANT WAS WITHOUT ATGM LAUNCH CAPABILITY; SOME DO NOT HAVE ERA.

T-72BK IS THE COMMANDER'S VARIANT WITH ADDITIONAL RADIOS.

T-72BM: RUSSIAN T-72B UPGRADE WITH 2ND GEN ERA. THE SYSTEM IS FIELDED, AVAILABLE FOR EXPORT, AND UPGRADED. TIER 2 AND SOME TIER 3 TANKS CAN CHALLENGE US FORCES UNDER FAVORABLE CONDITIONS WHEN USING MODERN AMMUNITION AND EMPLOYED BY WELL-TRAINED UNITS WITH SOUND TACTICS. A VARIETY OF UPGRADES ARE AVAILABLE FOR THE T-72B. THEY INCLUDE PROTECTION UPGRADES, SUCH AS IMPROVED ERA, APS, DEFENSIVE AIDS SUITES WITH IR JAMMERS, PLATE ARMOR, WELDED TURRET, AND GRILL ARMOR AROUND TRACKS AND GRILL.

MOBILITY UPGRADES INCLUDE A NEW POWER TRAIN, IMPROVED STEERING, IMPROVED MINE PLOWS AND ROLLERS, AND ELECTRONIC MINE SPOOFING SYSTEM. FIRE CONTROL SYSTEM UPGRADES INCLUDE NEW SIGHTS, GUN, AMMUNITION, AND IMPROVED STABILIZATION. WITH THE EXPANDING NUMBER OF UPGRADES OFFERED BY FORMER WARSAW PACT, ASIAN, ISRAELI, AND OTHER FIRMS, MOST T-72-TYPE TANKS HAVE SOME LEVEL OF UPGRADE FROM THE BASIC T-72 MBT.

THE MORE AFFORDABLE UPGRADE APPROACH FOR MOST COUNTRIES IS TO EXECUTE SPECIFIC UPGRADES DURING MAINTENANCE WORK. BUT THIS APPROACH MAY RESULT IN ONLY PARTIALLY MODERNIZED TANKS AT ANY ONE POINT IN THE LIFE OF THE VEHICLE, AND WHICH ARE NOT AS MODERN AS MORE RECENT COMPETITORS. AN ALTERNATIVE IS TO PRODUCE MODERNIZED TANKS IN SMALL NUMBERS, RESULTING IN HIGH PER-UNIT PRODUCTION COSTS.

T-72BU: UPGRADE VARIANT WITH THE FIRE CONTROL SYSTEM FROM THE T-80U, AS WELL AS A VARIETY OF OTHER CHANGES. T-72BU RENAMED T-90.

WITH THE LIMITED MARKET FOR NEW TANKS, THE WORLD TANK INDUSTRY HAS DEVELOPED UPGRADES AND WHOLE VEHICLE UPGRADE PACKAGES TO TAP INTO THE MARKET. OLDER T-72 TANKS CAN BE BROUGHT UP TO THE T-72B STANDARD. SOME APPROACH THE T-90 STANDARD. MOST T-72-TYPE TANKS FIELDED REFLECT SOME LEVEL OF UPGRADE. UPGRADE OPTIONS ARE EXPANDING FROM FORMER WARSAW PACT, ASIAN, ISRAELI, AND OTHER INTERNATIONAL FIRMS.

THE FOLLOWING SHOW OTHER COUNTRIES' COMPARABLE UPGRADE TANKS.

T-72S/SHILDEN: RUSSIAN EXPORT T-72A UPGRADED TO THE T-72B STANDARD. ALTHOUGH VISUALLY SIMILAR TO T-72B, IT HAS SLIGHTLY LESS CHASSIS AND TURRET PROTECTION. FORMER WP COUNTRIES SUCH AS SLOVAKIA HAVE UPGRADED THEIR TANKS TO THE T-72S STANDARD.

M-84AB1: YUGOSLAV UPGRADE TO THE M-84, BRINGING IT CLOSE TO T-90, AND THE LATEST T-72B IMPROVED TANKS.

M-95 DEGMAN: CROATIAN M-84 UPGRADE WITH BOX COMPOSITE ARMOR, ERA, 1,200 HP, AND THERMAL FCS. AN EXPORT UPGRADE CONVERSION, AKA M-84D, IS OFFERED FOR KUWAITI M-84A TANKS.

PT-91: POLISH UPGRADE TANKS WITH ERA, DRAWA IMPROVED FCS, SAVAN-5 THERMAL SIGHT, IMPROVED GUN STABILIZATION, AND COUNTERMEASURES.

PT-91M HAS A 1,000-HP ENGINE, NEW GUNS AND FCS, ARMOR CHANGES, AND OTHER IMPROVEMENTS. PT-91M EXPORTED TO SINGAPORE. PT-91P IS DESIGNED FOR EXPORT TO PERU.

T-72M1 DEMONSTRATOR WITH 2ND GEN ERA AND OTHER UPGRADES WERE DISPLAYED AT MILITARY SHOWS.

T-72M1M INCLUDES 3RD GEN RELIKT ERA AND OPTIONAL ARENA ACTIVE PROTECTION SYSTEM (APS).

ALTERNATIVE DESIGNATIONS: ROGATKA AND SMT M1988. IT IS ALMOST THE SAME AS T-72S (EXPORT), EXCEPT MORE ERA ON THE SIDE SKIRTS.

AJEYA MK 2. INDIA IS UPGRADING T-72A TANKS CLOSE TO A BHISHMA (T-90S) STANDARD.

WEAPONS & AMMUNITION TYPES AND TYPICAL COMBAT LOAD

125-MM SMOOTHBORE GUN (MIX EST)	45
APFSDS-T	14
HEAT-MP/HEAT	4
FRAG-HE	21
ATGM	6

MAIN ARMAMENT AMMUNITION

CALIBER, TYPE, NAME:

125-MM APFSDS-T, BM-42M

MAXIMUM AIMED RANGE (M): 3000

MAX EFFECTIVE RANGE (M):

DAY: 3000

NIGHT: 2600

ARMOR PENETRATION (MM KE): 590-630 AT 2000 METERS

125-MM FRAG-HE-T, OF-26

MAXIMUM AIMED RANGE (M): 5000

MAX EFFECTIVE RANGE (M):

DAY: 5000

NIGHT: 2600

ARMOR PENETRATION (MM): CAN DEFEAT IFV AND APC. A NEAR MISS WILL SERIOUSLY DAMAGE OR DESTROY MOST IFVS AND APCS.

125-MM HEAT-MP, BK-29M

MAXIMUM AIMED RANGE (M): 4000

MAX EFFECTIVE RANGE (M):

DAY: 3000-4000

NIGHT: 2600

ARMOR PENETRATION (MM CE): 650-750. IT HAS SOME HE EFFECTS.

125-MM HEAT, BK-27

MAXIMUM AIMED RANGE (M): 3000

MAX EFFECTIVE RANGE (M):

DAY: 3000

NIGHT: 2600

ARMOR PENETRATION (MM CE): 700-800

THE MORE RECENT BK-27 HEAT ROUND OFFERS A TRIPLE-SHAPED CHARGE WARHEAD AND INCREASED PENETRATION AGAINST CONVENTIONAL ARMORS AND ERA. THE BK-29 ROUND, WITH A HARD PENETRATOR IN THE NOSE IS DESIGNED FOR USE AGAINST REACTIVE ARMOR, AND AS AN MP ROUND HAS FRAGMENTATION EFFECTS. IF THE BK-29 HEAT-MP IS USED, IT MAY SUBSTITUTE FOR FRAG-HE OR COMPLEMENT FRAG-HE. THE BENEFIT OF HEAT-MP IS THAT THREE ROUND NATURES (APFSDS-T, HEAT-MP, ATGMS) IN THE AUTOLOADER VERSUS FOUR, MEANS MORE ANTITANK ROUNDS AVAILABLE. HOWEVER, A CAPABILITY LOSS IS HEAT-MP LETHAL RADIUS AGAINST SOFT TARGETS IS MUCH LESS. OTHER AMMUNITION TYPES: GIAT 125G1 APFSDS-T, RUSSIAN BM-42 AND BM-32 APFSDS-T. THE RUSSIANS MAY HAVE A VERSION OF THE BM-42M WITH A DU PENETRATOR. RUSSIAN BM-48 APFSDS-T ROUND PENETRATES 650-700 MM.

ANTITANK GUIDED MISSILES:
NAME: AT-11B/INVAR
WARHEAD TYPE: TANDEM SHAPED CHARGE (HEAT)
ARMOR PENETRATION (MM CE): 900, 850 BEHIND ERA
RANGE (M): 5000

ANTITANK GUIDED MISSILES:
NAME: AT-11/SVIR (ORIGINAL ROUND)
WARHEAD TYPE: SHAPED CHARGE (HEAT)
ARMOR PENETRATION (MM): 770, 270 BEHIND ERA
RANGE (M): 4000

NOTES

A VARIETY OF THERMAL SIGHTS IS AVAILABLE. THEY INCLUDE THE RUSSIAN AGAVA-2, NAMUT SIGHT FROM PELENG, AND FRENCH SAGEM-PRODUCED ALIS. SOME THERMAL NIGHT SIGHTS PERMIT NIGHT LAUNCH OF ATGMS. UNIFIED FIRE CONTROL SYSTEM ADAPTS TO T-72B. THE 12X STABILIZED TV DAY SIGHT WITH AN IR AUTO-TRACKER IS MATCHED TO A STABILIZED 2ND GEN FLIR NIGHT SIGHT WITH ACQUISITION RANGE UP TO 7,000 M. ATGM FCS ACQUISITION RANGE TO 6,000 M.
OTHER POSSIBLE UPGRADES INCLUDE IMPROVED ARMOR, MORE POWERFUL ENGINE, AND IMPROVED AMMUNITIONS, SUCH AS THE AINET (HE-SHRAPNEL) ELECTRONICALLY FUZED ROUND. RELIKT 3RD GEN ERA IS OFFERED TO REPLACE KONTAKT-5 IN SEVERAL UPGRADE PACKAGES, OR AS A SEPARATE UPGRADE. THE ERA ADDS UP TO 600 MM CE PROTECTION AND 300 MM KE TO TURRET BASE ARMOR PROTECTION, ABOUT 150 MM MORE THAN KONTAKT-5.

RUSSIAN FEDERATION MAIN BATTLE TANK T-64B



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative designations:	INA	Armament-Main Gun:	Smoothbore gun
Date of introduction:	1966/1979	Caliber, type, name:	125mm 2A26M2
Proliferation: [at least]	2	Rate of Fire (rd/min):	6-8
Crew:	3	Loader Type:	Autoloader; ATGM manual
Combat weight (mt):	40.3	Ready main gun rounds:	24 carousel
Chassis length overall (m):	6.45	Stowed rounds:	7/6 ATGM
Height overall (m):	2.17	Elevation (°):	-6 to +14
Width overall (m):	3.41	Fire on Move:	Yes-main gun
Ground pressure (kg/cm2):	0.86	Armament-Aux Weapon:	Turret-coax to main gun
AUTOMOTIVE	SPECIFICATIONS	Caliber, type, name:	7.62mm PKT
Engine type (hp):	Diesel(multifuel) 5DTF	Max eff range-day (m):	1000
Engine type (hp): Upgrade	720	Max eff range-night (m):	850
Cruising range (km):	500 w extra fuel tanks	Fire on move:	Yes
Max road speed (kph):	60	Rate of fire (rd/min):	250
Max off-road speed (kph):	INA	Armament-Aux Weapon:	Turret-TC cupola
Average cross-country (kph)	INA	Caliber, type, name:	12.7mm
Max swim:	NA	Max aimed range-day (m):	1500
Fording depth (m):	1.8 unprep; 5.0 snorkel	Max eff range-night (m):	800
COMMUNICATIONS	SPECIFICATIONS	R-123M/R-124	Fire on move:
Radio:	NA	Rate of fire (rd/min):	Yes
External Intercom device		ATGM Launcher:	210
PROTECTION	SPECIFICATIONS	Missile name-nomenclature:	AT-8 Songster
Applique armor:	Kontakt-5	Launch rate (msl/min):	2-3
Explosive reactive armor:	Available		
Active system:	Roller-plow available	FIRE CONTROL	SPECIFICATIONS
Mine clearing:	Yes	FCS name:	INA
Self-Entrenching blade:	Yes	Thermal: TC-gunner	No
NBC protection system:	Grenlaunch 4x2; VESS	Main gun stabilization	2-plane
Smoke equipment:		Infrared	Yes
		Sights w/magnific: day (m)	4000
		Sights w/magnific: nt (m)	800

NOTES

VARIANTS

T-64A: PRODUCTION VERSION OF BASE TANK. TANK HAS A HISTORY OF RELIABILITY PROBLEMS, AND LACKS THE HIGH ARMOR PROTECTION, TRACK SKIRTS, A FCS AND ATGM LAUNCH CAPABILITY FOR T-64B.

T-64BK: COMMAND TANK VERSION, WITH 10-M WHIP ANTENNA.

T-64B1: VERSION OF -B TANK WITHOUT ATGM LAUNCH CAPABILITY.

T-64BV: VARIANT HAS KONTAKT ERA MOUNTED. COMBAT WEIGHT (MT): 42.5 FOR T-64BV WITH EXPLOSIVE REACTIVE ARMOR (MM): STANDARD ON T-64BV

T-64U/T-64BM2: UPGRADE SERIES MARKETED BY UKRAINIAN MALYSHEV IN 2001. T-64U PROTOTYPE FEATURED 2ND GEN ERA, COMPOSITE ARMOR, AND FIRE SUPPRESSION EQUIPMENT. VARIANT ADDED T-80U FIRE CONTROL (1A42 GUNNER DAY SIGHT) AND THERMAL NIGHT SIGHT-PERMITS IT TO REPLACE RF-GUIDED AT-8/KOBRA ATGM WITH BETTER REFLEKS SERIES (SVIR/INVAR) LASER-BEAM RIDER ATGMS. UKRAINIAN-DEVELOPED LBR-GUIDED ATGM KOMBAT SIMILAR TO REFLEKS. A LATER VARIANT CHANGED THE FCS TO T-80UD/T-90 TYPE, WITH 1A45 DAY SIGHT, AND AGAT THERMAL NIGHT SIGHT.

BM BULAT: THIS 45 MT UPGRADE VARIANT IS CURRENTLY BEING ADVERTISED. IT INCLUDES AN 850-HP ENGINE, FCS WITH 1G46M LRF-BASED SIGHT AND CATHERINE-BASED THERMAL NIGHT SIGHT. REMOTE FIRED 12.7-MM MG AND 5,000 M ATGM ARE INCLUDED. PROTECTION INCLUDES 2ND GEN ERA.

WEAPONS & AMMUNITION TYPES AND TYPICAL COMBAT LOAD

125-MM SMOOTHBORE GUN (MIX EST)	36
APFSDS-T	12
HEAT-MP/HEAT	2
FRAG-HE	16
ATGM	6

MAIN ARMAMENT AMMUNITION

CALIBER, TYPE, NAME:

125-MM APFSDS-T, BM-42M

- MAXIMUM AIMED RANGE (M): 3,000-4,000
- MAX EFFECTIVE RANGE (M):
  - DAY: 2000-3000
  - NIGHT: 800-1300
- ARMOR PENETRATION (MM KE): 590-630 AT 2000 METERS

125-MM FRAG-HE-T, OF-26

- MAXIMUM AIMED RANGE (M): 5,000
- MAX EFFECTIVE RANGE (M):
  - DAY: 5000
  - NIGHT: 800-1300
  - ARMOR PENETRATION (MM): CAN DEFEAT IFV AND APC.

125-MM HEAT-MP, BK-29M

- MAXIMUM AIMED RANGE (M): 4,000
- MAX EFFECTIVE RANGE (M):
  - DAY: 3000
  - NIGHT: 800-1300
- ARMOR PENETRATION (MM CE): 650-750 IT HAS SOME HE EFFECTS.

125-MM HEAT, BK-27
- **MAXIMUM AIMED RANGE (M): 4,000**
- **MAX EFFECTIVE RANGE (M):**
  - **DAY: 2,000-3000**
  - **NIGHT: 800-1300**
- **ARMOR PENETRATION (MM CE): 700-800**

OTHER AMMUNITION TYPES: GIAT 125G1 APFSDS-T, RUSSIAN BM-42 AND BM-32 APFSDS-T. THE RUSSIANS MAY HAVE A VERSION OF THE BM-42M WITH A DU PENETRATOR.

ANTITANK GUIDED MISSILE:
NAME: AT-8/SONGSTER/KOBRA
WARHEAD TYPE: SHAPED CHARGE (HEAT)
ARMOR PENETRATION (MM CE): 700 (RHA), 200 BEHIND ERA
RANGE (M): 4000

THE NIGHT SIGHT CANNOT BE USED TO LAUNCH THE ATGM. THE DAY SIGHT CAN BE USED AT NIGHT FOR LAUNCHING ATGMS IF THE TARGET IS ILLUMINATED. A VARIETY OF THERMAL SIGHTS ARE AVAILABLE. THEY INCLUDE THE RUSSIAN AGAVA-2, FRENCH SAGEM-PRODUCED ALIS AND NAMUT SIGHT FROM PELENG. THERE ARE THERMAL SIGHTS AVAILABLE FOR INSTALLATION, WHICH PERMITS NIGHT LAUNCH OF ATGMS.
THE MORE RECENT BK-27 HEAT ROUND OFFERS A TRIPLE-SHAPED CHARGE WARHEAD AND INCREASED PENETRATION AGAINST CONVENTIONAL ARMORS AND ERA. THE BK-29 ROUND, WITH A HARD PENETRATOR IN THE NOSE IS DESIGNED FOR USE AGAINST REACTIVE ARMOR, AND AS AN MP ROUND HAS FRAGMENTATION EFFECTS. IF THE BK-29 HEAT-MP IS USED, IT MAY SUBSTITUTE FOR FRAG-HE (AS WITH NATO COUNTRIES) OR COMPLEMENT FRAG-HE. WITH THREE ROUND NATURES (APFSDS-T, HEAT-MP, ATGMS) IN THE AUTOLOADER VERSUS FOUR, MORE ANTITANK ROUNDS WOULD AVAILABLE FOR THE HIGHER RATE OF FIRE.

RUSSIAN FEDERATION MAIN BATTLE TANK T-62AM




"Bra-type" armor applique to turret front

SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative designations:	INA	Armament-Main Gun:	
Date of introduction:	1965/1983	Caliber, type, name:	115mm, 2A20
Proliferation: [at least]	1	Rate of Fire (rd/min):	3-5
Crew:	4	Loader Type:	Manual
Combat weight (mt):	41.5	Ready main gun rounds:	INA
Chassis length overall (m):	6.5	Stowed rounds:	INA
Height overall (m):	2.4	Elevation (°):	-6 to +16
Width overall (m):	3.4	Fire on Move:	Yes-main gun only
Ground pressure (kg/cm2):	.77	Armament-Aux Weapon:	Turret-coax to main gun
AUTOMOTIVE	SPECIFICATIONS	Caliber, type, name:	7.62mm PKT
Engine type (hp):	Diesel V-55U	Max eff range-day (m):	800
Engine type (hp): Upgrade	620	Max eff range-night (m):	800
Cruising range (km):	450; 650 w extra fuel tanks	Fire on move:	Yes
Max road speed (kph):	45	Rate of fire (rd/min):	250
Max off-road speed (kph):	INA	Armament-Aux Weapon:	Turret-TC cupola
Average cross-country (kph)	INA	Caliber, type, name:	12.7mm DskKM
Max swim:	NA	Max aimed range-day (m):	1500
Fording depth (m):	1.4 unprep; 5.5 snorkel	Max eff range-night (m):	INA
COMMUNICATIONS	SPECIFICATIONS	Fire on move:	Yes
Radio:	R-173/R-173P/R-124	Rate of fire (rd/min):	250
External Intercom device	INA	ATGM Launcher:	
		Missile name-nomenclature:	AT-10 Skeksna
PROTECTION	SPECIFICATIONS	Launch method:	gun
Applique armor:	Bra applique; track skirts	Missile guidance:	SACLOS, laser
Explosive reactive armor:	Available	Launch rate (msl/min):	2
Active system:	Drozd APS available	FIRE CONTROL	SPECIFICATIONS
Mine clearing:	Roller-plow available	FCS name:	Volna
Self-Entrenching blade:	No	Thermal: TC-gunner	INA
NBC protection system:	Radiation only	Main gun stabilization	M1 Tsklon, 2plane
Smoke equipment:	grenlaunch 2x4; VESS	Infrared	Yes
		Sights w/magnific: day (m)	4000
		Sights w/magnific: nt (m)	800-1300

NOTES

VARIANTS

T-62 VARIANTS WITH A V-46 T-72-TYPE ENGINE ADD -1 TO THEIR DESIGNATION.
T-62A: ADDED A 12.7-MM MG.
T-62M ADDS BDD BRA PROTECTION, FCS AND ATGM CAPABILITY.
T-62M1: VARIANT WITH VOLNA FCS BUT NO MISSILE-LAUNCH CAPABILITY.
T-62MK: COMMAND VARIANT.
T-62MV: VERSION WITH ERA IN PLACE OF THE BDD ARMOR. THE ERA INCLUDES KONTAKT ERA AND KONTAKT-5 2D-GENERATION ERA.
T-62D: VARIANT OF T-62M WITH THE DROZD APS VS ERA.
T-55AGM: UKRAINIAN UPGRADE CAN USE T-62 CHASSIS.

WEAPONS & AMMUNITION TYPES AND TYPICAL COMBAT LOAD

115-MM RIFLED GUN (MIX EST)	40
APFSDS-T	12
HEAT	3
FRAG-HE	20
ATGM	5

MAIN ARMAMENT AMMUNITION

CALIBER, TYPE, NAME:
115-MM APFSDS-T, BD/36-2
MAXIMUM AIMED RANGE (M): 3,000
MAX EFFECTIVE RANGE (M):
DAY: 1,800
NIGHT: 850-1,300
ARMOR PENETRATION (MM KE): 520 (RHA, 71° ANGLE) AT 1,000 M

115-MM APFSDS-T, BM-6 RUSSIAN
MAXIMUM AIMED RANGE (M): 3,000
MAX EFFECTIVE RANGE (M):
DAY: 1,800
NIGHT: 850-1,300
ARMOR PENETRATION (MM KE): 237 (RHA) AT 1,000 M
115-MM HEAT, BK-4
MAXIMUM AIMED RANGE (M): 1,500 (EST)
MAX EFFECTIVE RANGE (M):
DAY: 1,500
NIGHT: 850-1,200
ARMOR PENETRATION (MM CE): 495 (RHA)

115-MM FRAG-HE-T, OF-27
MAXIMUM AIMED RANGE (M): 4,000
MAX EFFECTIVE RANGE (M):
DAY: 4,000 ADJUST USING 1K13-1 FOR ADJUSTMENT
NIGHT: 850-1,300
ARMOR PENETRATION (MM): CAN DEFEAT IFV AND APC.

OTHER AMMUNITION TYPES: BM-3 APFSDS, BM-4 APFSDS, BK-4M HEAT, BK-15 HEAT, OF-11 FRAG-HE, OF-18 FRAG-HE
ANTITANK GUIDED MISSILES
NAME: AT-10/SHEKSNA
WARHEAD TYPE: SHAPED CHARGE (HEAT)
ARMOR PENETRATION (MM CE): 750, 250 BEHIND ERA
RANGE (M): 4,000 DAY ONLY

NAME: AT-10B/9M117M2
WARHEAD TYPE: TANDEM SHAPED CHARGE
ARMOR PENETRATION (MM CE): 800, 750 BEHIND ERA
RANGE (M): 4,000 DAY ONLY

NOTES
THE 1K13 SIGHT IS BOTH NIGHT SIGHT AND ATGM LAUNCHER SIGHT; HOWEVER, IT CANNOT BE USED FOR BOTH FUNCTIONS SIMULTANEOUSLY. WITH A SIMPLE UPGRADE, THE SIGHT CAN ACCOMMODATE A RANGE INCREASE TO THE MISSILE RANGE. FOR MOST TIER 3 AND TIER 4 OPFOR PORTRAYALS, THE UPGRADE IS NOT LIKELY, BUT THE OPTION IS A COST-EFFECTIVE ONE.
OPTIONAL SIGHTS AND FIRE CONTROL SYSTEMS INCLUDE THE ISRAELI EL-OP RED TIGER AND MATADOR FCS, SWEDISH NOBELTECH T-SERIES SIGHT, AND GERMAN ATLAS MOLF. THE BRITISH MARCONI DIGITAL FCS, SOUTH AFRICAN TIGER, AND BELGIAN SABCA TITAN OFFER UPGRADED FUNCTION. ONE OF THE BEST IS THE SLOVENIAN EFCS-3 INTEGRATED FCS.
A VARIETY OF THERMAL SIGHTS IS AVAILABLE. THEY INCLUDE THE RUSSIAN AGAVA, FRENCH SAGEM-PRODUCED ALIS AND NAMUT SIGHT FROM PELENG. THERE ARE THERMAL SIGHTS AVAILABLE FOR INSTALLATION, WHICH PERMITS NIGHT LAUNCH OF ATGMS.
OTHER IMPROVEMENTS AVAILABLE INCLUDE A HULL BOTTOM REINFORCED AGAINST MINES, RUBBER TRACK PADS, AND A THERMAL SLEEVE FOR THE GUN.

RUSSIAN FEDERATION MAIN BATTLE TANK T-55AMV



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative designations:	INA	Armament-Main Gun:	Rifled gun
Date of introduction:	1970/1983	Caliber, type, name:	100mm, D-10T2S
Proliferation: [at least]	3	Rate of Fire (rd/min):	5
Crew:	4	Loader Type:	Manual
Combat weight (mt):	40.5	Ready main gun rounds:	43 total
Chassis length overall (m):	6.2	Stowed rounds:	INA
Height overall (m):	2.4	Elevation (°):	-5 to +18
Width overall (m):	3.30	Fire on Move:	Yes main gun
Ground pressure (kg/cm2):	0.85	Armament-Aux Weapon:	Turret-coax to main gun
AUTOMOTIVE	SPECIFICATIONS	Caliber, type, name:	7.62mm, PKT-T
Engine type (hp):	Diesel V-46-5M	Max eff range-day (m):	800
Engine type (hp): Upgrade	690	Max eff range-night (m):	INA
Cruising range (km):	450/650 w extra fuel tanks	Fire on move:	Yes
Max road speed (kph):	50	Rate of fire (rd/min):	250
Max off-road speed (kph):	35	Armament-Aux Weapon:	Turret-TC cupola
Average cross-country (kph)	25	Caliber, type, name:	12.7mm DshKM
Max swim:	1.4 unprep; 5.5 snorkel	Max aimed range-day (m):	1500
Fording depth (m):		Max eff range-night (m):	INA
COMMUNICATIONS	SPECIFICATIONS	Fire on move:	Yes
Radio:	R-173	Rate of fire (rd/min):	100
External Intercom device	NA	ATGM Launcher:	
		Missile name-nomenclature:	AT-10 Bastion
PROTECTION	SPECIFICATIONS	Launch method:	gun
Applique armor:	Box armor/rubber screens	Missile guidance:	SACLOS, laser
Explosive reactive armor:	See notes	Launch rate (msl/min):	2-3
Active system:	Drozd APS available	FIRE CONTROL	SPECIFICATIONS
Mine clearing:	Roller-plow available	FCS name:	Volna
Self-Entrenching blade:	No	Thermal: TC-gunner	No
NBC protection system:	Yes	Main gun stabilization	M1 Tsiklon, 2 plane
Smoke equipment:	grenlaunch/eng smk sys	Infrared	L-4
		Sights w/magnific: day (m)	4000
		Sights w magnific: night (m)	800-1300

NOTES

VARIANTS

T-55AMV IS DERIVED FROM A LINE OF VARIANTS OF T-55 MBT. THE -AMV UPGRADE MEANS SUBSTITUTION OF ERA FOR BDD (AKA EYEBROW OR BRA) ARMOR. VARIANTS ENDING WITH -1 DENOTE THE ENGINE REPLACED W/V-46 FROM T-72 MBT.

T-55A ADDED AN NBC PROTECTION SYSTEM.

T-55M ADDED THE VOLNA FIRE CONTROL SYSTEM (WITH ATGM LAUNCHER), IMPROVED GUN STABILIZATION AND SIGHTS, IMPROVED ENGINE, NEW RADIO, AND INCREASED PROTECTION THAT INCLUDED SIDE SKIRTS, SMOKE GRENADE LAUNCHERS, APPLIQUE ARMOR, AND FIRE PROTECTION.

T-55AM ADDED BDD (AKA EYEBROW OR BRA) ARMOR, AN ARMOR BAND AROUND THE TURRET FOR 180° COVERAGE.

T-55AM2: CZECH OR EAST GERMAN, OR POLISH VERSION OF T-55AM WITHOUT ATGM

T-55AM2B: CZECH OR EAST GERMAN VERSION OF T-55AM WITH KLADIVO FIRE CONTROL

T-55AM2P: POLISH T-55AM WITH MERIDA FCS AND ATGM

T-55AMD: VARIANT WITH THE DROZD APS INSTEAD OF ERA.

T-55AD DROZD: VARIANT WITH DROZD BUT NOT VOLNA FCS AND ERA.

OTHER T-54/T-55 UPGRADES:

SEVERAL FORMER WARSAW PACT COUNTRIES PRODUCED TANKS WHICH ARE SIMILAR TO THE T-55AMV. OTHER COUNTRIES HAVE INDIGENOUS VARIANTS. MANY COUNTRIES HAVE UPGRADED TO A LARGER MM MAIN GUN. MORE THAN A DOZEN COUNTRIES HAVE PRODUCED UPGRADED T-54 AND T-55 VARIANTS WITH SIMILAR CAPABILITIES IN PROTECTION AND LETHALITY UPGRADE PROGRAMS WHICH HAVE RESULTED IN DIFFERENT BUT CAPABLE CONFIGURATIONS. HERE ARE A FEW OF THESE CONFIGURATIONS.

AL ZARRAR: PAKISTANI MODERNIZED TYPE 59 CHINESE COPY OF T-55. THE TANK HAS A 125 SMOOTH-BORE GUN, IMAGE-STABILIZED FIRE CONTROL SYSTEM (ISFCS), THERMAL SIGHT, 730-HP ENGINE, ERA, INCLUDING ON THE SKIRTS AND IMPROVED APFSDS-T (SABOT) ROUND.

TYPE 59-II TANK: IT HAS 105-MM RIFLED GUN AND OTHER IMPROVEMENTS. OTHER TANKS BASED ON THE TYPE 59 INCLUDE:

TYPE 69 AND TYPE 79 DESIGNS. A NORINCO TYPE 59 RETROFIT PACKAGE IS COMPATIBLE WITH T-55 AND TYPE 59 UPGRADES.

M-55 SI: SLOVENIAN T-54/55 UPGRADE WITH ASSISTANCE FROM ISRAELI ELBIT CORPORATION. IT FEATURES AN L7 105-MM RIFLED GUN, COMPUTER FCS WITH LRF, STABILIZED DAY/NIGHT II SIGHT, AND HUNTER-KILLER FIRE CONTROL. A THERMAL SIGHT IS AVAILABLE. SURVIVABILITY IMPROVEMENTS ARE ERA PLATES, TRACK SKIRTS, LWR-TRIGGERED SMOKE GRENADES, AND HALON FIRE SUPPRESSION. NEW ENGINE, TRACKS, AND COMMS WERE ADDED.

T-72Z/SAFIR 74: IRANIAN UPGRADE VARIANT OF T-54/55 AND TYPE 59. THIS CONSTITUTES STATE-OF-THE-ART FOR UPGRADED 50S-GENERATION FORMER WARSAW PACT TANKS. THIS TANK HAS A 780-HP DIESEL ENGINE, TRACK SKIRTS, AND SMOKE GRENADE LAUNCHERS. AN IRANIAN ERA PACKAGE IS FITTED. ARMAMENT INCLUDES AN M68 105-MM RIFLED GUN, 7.62-MM TYPE 59T (PKT) MG, AND A 12.7-MM TYPE 59 (DSHKM) MG. THE CANNON CAN LAUNCH AT-10/ BASTION ATGMS TO 4,000 METERS, AND FIRE A BROAD RANGE OF NATO 105-MM AMMUNITION. FIRE CONTROL INCLUDES THE ROBUST SLOVENIAN EFCS-3-55 FIRE CONTROL SYSTEM WITH A BALLISTIC COMPUTER, STABILIZATION, AND A LASER RANGEFINDER. THE FCS INCLUDES A COMMANDER'S INDEPENDENT VIEWER AND TARGET DESIGNATION SYSTEM, AND GUNNER NIGHT SIGHTS. UNDER THE ZULFIQAR PROGRAM, SUBSYSTEM UPGRADES FROM THIS VEHICLE PACKAGE COULD BE ADDED.

CZECH UPGRADE: A PROTOTYPE WAS DISPLAYED WITH 2ND GEN ERA, AND A NEW LRF FIRE CONTROL SYSTEM.

T-55M: RUSSIAN UPGRADE, WITH 2ND GEN ERA, T-80U SIDE SKIRTS, NEW FCS, 125-MM SMOOTHBORE GUN, 22-RD BUSTLE AUTO-LOADER, AND IMPROVED ENGINE AND SUSPENSION. THERE IS ALSO FIRE SUPPRESSION, SMOKE GRENADES, IR-ABSORBING PAINT AND SCREENS, AND COMMS.

T-55AGM: UKRAINIAN 48MT MODERNIZED TANK (BASED ON T-54/55/62 OR TYPE 59 SERIES). IMPROVEMENTS INCLUDE 120-MM OR 125-MM GUN, NEW HUNTER-KILLER FCS, THERMAL SIGHT, REMOTE AD MG, AND AUTO-LOADER. THERE IS ALSO IMPROVED ERA, NEW ENGINE, IMPROVED RUNNING GEAR, COUNTERMEASURES, AND NEW FIRE SUPPRESSION. CBT WT: APPROX 46 MT.

WEAPONS & AMMUNITION TYPES AND TYPICAL COMBAT LOAD

100-MM RIFLED GUN (MIX EST)	43
APFSDS-T	14
HEAT-MP/HEAT	3
FRAG-HE	12
FOCUSED FRAG AINET	8
ATGM (WHEN CONFIGURED)	5

MAIN ARMAMENT AMMUNITION

CALIBER, TYPE, NAME:

100-MM APFSDS-T, BM-412M
- MAXIMUM AIMED RANGE (M): 2,500
- MAX EFFECTIVE RANGE (M):
  - DAY: 2,000-2,500
  - NIGHT: 800-1,300
- ARMOR PENETRATION (MM KE): 418 AT 2,000 M, 380 AT 3,000 M

100-MM APFSDS-T, M1000, BELGIAN
- MAXIMUM AIMED RANGE (M): 2,500
- MAX EFFECTIVE RANGE (M):
  - DAY: 2,500 (EST)
  - NIGHT: 800-1,300
- ARMOR PENETRATION (MM): NATO TRIPLE HEAVY TARGET, 4,500 M

100-MM HEAT, BK-17
- MAXIMUM AIMED RANGE (M): 2,500
- MAX EFFECTIVE RANGE (M):
  - DAY: 1,000 (EST)
  - NIGHT: 800-1,000 (EST)
  - ARMOR PENETRATION (MM CE): 380

100-MM FRAG-HE, OF-32
- MAXIMUM AIMED RANGE (M): 4,000
- MAX EFFECTIVE RANGE (M):
  - DAY: 2,500-4,000
  - NIGHT: 800-1,300
  - ARMOR PENETRATION (MM): CAN DEFEAT IFV AND APC

OTHER AMMUNITION TYPES: ORIGINAL TANK BM-8 SABOT ROUND WITH EFFECTIVE RANGE OF 1,500 M CAN ONLY PENETRATE 200M AT 1000M. THE LATER BM-25 APFSDS-T ROUND HAS AN EFFECTIVE RANGE OF 2000-2500M WITH PENETRATION INA. A VARIETY OF OTHER ROUNDS WITHIN THE RANGE NOTED ABOVE ARE AVAILABLE. THEY INCLUDE THE GIAT NR 322/NR 352 APFSDS-T AND SLOVAK JPRSV AP-T WITH RANGES BEYOND 2000 M.

ANTITANK GUIDED MISSILES:
NAME: AT-10/BASTION
WARHEAD TYPE: SHAPED CHARGE (HEAT)
ARMOR PENETRATION (MM CE): 650 (RHA), 150 BEHIND ERA
RANGE (M): 4,000 (DAY ONLY, SEE NOTES)

NAME: AT-10B/BASTION-M
WARHEAD TYPE: TANDEM SHAPED CHARGE
ARMOR PENETRATION (MM CE): 750 (RHA), 700 BEHIND ERA
RANGE (M): 4,000 (DAY ONLY, SEE NOTES)

PROTECTION:
ARMOR, TURRET FRONT (MM): 200 (BASE T-55 ARMOR)
APPLIQUE ARMOR (MM): RUBBER SCREENS AND BOX ARMOR
EXPLOSIVE REACTIVE ARMOR (MM): 1ST GEN RAISES CE ONLY TO 700-800 AGAINST HEAT; 2ND GEN RAISES TO 350-480 KE/700-900 HEAT.
ACTIVE PROTECTIVE SYSTEM: RUSSIAN DROZD APS AVAILABLE
THE BRITISH L7 105-MM RIFLED GUN HAS BEEN USED IN SEVERAL T-54/55/TYPE 59 TANK UPGRADE PROGRAMS. SEVERAL MORE RECENT 105-MM ROUNDS AND TANK FIRE CONTROL SYSTEMS HAVE BEEN DEVELOPED, TO INCREASE EFFECTIVENESS OF 105-MM TANK GUNS. THERE ARE ALSO NOW 120-MM LOW-RECOIL SMOOTHBORE TANK GUNS, SUCH AS THE COMPACT TANK GUN (CTG), WHICH FIRE STANDARD UNITARY ROUNDS, FOR T-54/55/TYPE 59 UPGRADE PROGRAMS.
OPTIONAL SIGHTS AND FIRE CONTROL SYSTEMS INCLUDE THE ISRAELI EL-OP RED TIGER AND MATADOR FCS, SWEDISH NOBELTECH T-SERIES SIGHT, AND GERMAN ATLAS MOLF. THE SERBIAN SUV-T55A FCS, BRITISH MARCONI DIGITAL FCS, SOUTH AFRICAN TIGER, AND BELGIAN SABCA TITAN OFFER UPGRADED FUNCTION. ONE OF THE BEST IS THE SLOVENIAN EFCS-3 INTEGRATED FCS. A ROMANIAN/FRENCH FCS UPGRADE PACKAGE FROM TR-85M1 TANK CAN BE USED ON T-55 TYPE TANKS. IT HAS HUNTER-KILLER FC, AND THERMAL GUNNER SIGHT. A VARIETY OF THERMAL SIGHTS ARE AVAILABLE, INCLUDING THE RUSSIAN/FRENCH ALIS AND NAMUT-TYPE SIGHT FROM PELENG. THERE ARE ALSO THERMAL SIGHTS WHICH PERMIT NIGHT LAUNCH OF ATGMS.
T-55 WITH BDD OR "BRA ARMOR" (SEMI-CIRCULAR ADD-ON ARMOR) HAVE TURRET PROTECTION INCREASED TO 330 MM (KE) AND 400-450 MM (CE). OTHER IMPROVEMENTS AVAILABLE INCLUDE A HULL BOTTOM REINFORCED AGAINST MINES, BETTER ENGINES, RUBBER TRACK PADS, AND A THERMAL SLEEVE FOR THE GUN. SOME FORCES HAVE ADDED ERA, APPLIQUE, OR BOX ARMOR TO T-55 TANKS. THESE PROTECTION IMPROVEMENTS MAY GIVE MARGINAL IMPROVEMENT AGAINST OLDER ROUNDS UP TO 105 MM, BUT DO NOT PROTECT SUFFICIENTLY TO DEFEAT MOST 120-125 MM APFSDS-T ROUNDS AT 2000 M. THEY OFFER SOME DEGREE OF PROTECTION AGAINST SOME TIER 4 AND A FEW TIER 3 ATGL WARHEADS AND ATGMS, BUT NOT AGAINST MORE MODERN AT WEAPONS.

PRC MAIN BATTLE TANK TYPE 98 TYPE 99A2



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative designations:	ZTZ-99; Type 98Gai; 98G	Armament-Main Gun:	Smoothbore gun
Date of introduction:	2001; 2003	Caliber, type, name:	125mm
Proliferation: [at least]	1	Rate of Fire (rd/min):	8
Crew:	3	Loader Type:	Autoloader; manual
Combat weight (mt):	53	Ready main gun rounds:	22
Chassis length overall (m):	7.7	Stowed rounds:	20
Height overall (m):	2.5	Elevation (°):	INA
Width overall (m):	3.5	Fire on Move:	Yes
Ground pressure (kg/cm2):	INA	Armament-Aux Weapon:	Turret-coax to main gun
AUTOMOTIVE		Caliber, type, name:	7.62mm Type 59
Engine type (hp):	Diesel	Max eff range-day (m):	1000
Engine type (hp): Upgrade	1200; upgrade 1500	Max eff range-night (m):	800
Cruising range (km):	500/650w extra fuel tanks	Fire on move:	Yes
Max road speed (kph):	80	Rate of fire (rd/min):	250
Max off-road speed (kph):	60	Armament-Aux Weapon:	Turret-TC cupola
Average cross-country(kph)	INA	Caliber, type, name:	12.7mm W85/Type 88
Max swim:	NA	Max aimed range-day (m):	2000
Fording depth (m):	INA	Max eff range-night (m):	INA
COMMUNICATIONS		Fire on move:	Yes
Radio:	INA	Rate of fire (rd/min):	100
External Intercom device	INA	ATGM Launcher:	
		Missile name	AT-11/Svir/Invar
PROTECTION		Launch method:	Gun
Applique armor:	Track skirts	Missile guidance:	SACLOS
Explosive reactive armor:	2d or 3d gen ERA	Launch rate (msl/min):	2-3
Active system:	No	FIRE CONTROL	
Mine clearing:	Roller-plow available	FCS name:	ISFCS-212
Self-Entrenching blade:	No	Thermal: TC-gunner	Yes
NBC protection system:	Yes	Main gun stabilization	2-plane
Smoke equipment:	grenlaunch 12x; VESS	Infrared	Yes
		Sights w/magnific: day (m)	5000
		Sights w/magnific: nt (m)	INA

NOTES

VARIANTS

TYPE 98: EARLY VERSION CAME WITH OR WITHOUT 1ST GEN ERA.

TYPE 99: TYPE 98 UPGRADE WITH ADVANCED CONFORMAL ERA, 2ND GEN THERMAL SIGHT, COUNTERMEASURE LASER DAZZLER, AND A MORE POWERFUL ENGINE. THIS IS THE LATEST FIELDED CHINESE TANK BASED ON THE THIRD GENERATION TANK TYPE 90-II/P-90 CHASSIS.

TYPE 99A2: IMPROVED VERSION WITH 3 GEN RELIKT TYPE 3RD GEN ERA, AND A MORE EFFECTIVE GUN. THE ERA AND COMPOSITE ARMOR WILL DEFEAT VIRTUALLY ALL MODERN VEHICLE FIRED KE ROUNDS AND MISSILES. THE ATGM IS A TANDEM-WARHEAD TYPE SIMILAR TO INVAR. AN ACTIVE PROTECTION SYSTEM IS EMPLOYED ON IT. IT IS LIKELY THAT THE STANDARD FIELDED VERSION OF TYPE 99 IS TYPE 99A2 WITH PREVIOUSLY PRODUCED TYPE 99S UPDATED TO THIS STANDARD.

WEAPONS & AMMUNITION TYPES AND TYPICAL COMBAT LOAD

125-MM SMOOTHBORE GUN (MIX EST)	42
APFSDS-T	14
HEAT-MP/HEAT	2
FRAG-HE	20
ATGM	6

MAIN ARMAMENT AMMUNITION

CALIBER, TYPE, NAME:

125-MM APFSDS-T, INA
- MAXIMUM AIMED RANGE (M): 3000
- MAX EFFECTIVE RANGE (M):
  - DAY: 2500
  - NIGHT: 2500
- ARMOR PENETRATION (MM KE): 960 AT 1,000 METERS, 800+ AT 2000

125-MM APFSDS-T, TYPE II
- MAXIMUM AIMED RANGE (M): 3000
- MAX EFFECTIVE RANGE (M):
  - DAY: 2500
  - NIGHT: 2500
- ARMOR PENETRATION (MM KE): 600 AT 2000 METERS

125-MM FRAG-HE-T, OF-19
- MAXIMUM AIMED RANGE (M): 3000
- MAX EFFECTIVE RANGE (M):
  - DAY: 1500
  - NIGHT: 1500
  - ARMOR PENETRATION (MM): CAN DEFEAT IFV AND APC

125-MM HEAT, BK-27 ESTIMATED, BASED ON SIMILAR ROUNDS
- MAXIMUM AIMED RANGE (M): 3000
- MAX EFFECTIVE RANGE (M):
  - DAY: 1500
  - NIGHT: 1500
- ARMOR PENETRATION (MM CE): 500

OTHER AMMUNITION TYPES: TANK CAN USE RUSSIAN AND OTHER FORMER WARSAW PACT AMMUNITION, AS WELL AS THE FRENCH GIAT 125G1. RUSSIAN ROUNDS INCLUDE THE BM-42M AND BM-32 APFSDS-T. THE RUSSIANS MAY HAVE A VERSION OF THE BM-42M WITH A DU PENETRATOR.

OTHER RUSSIAN ROUNDS INCLUDE HEAT AND HEAT-MULTIPURPOSE ROUNDS. THE MORE RECENT BK-27 HEAT ROUND OFFERS A TRIPLE-SHAPED CHARGE WARHEAD AND INCREASED PENETRATION AGAINST CONVENTIONAL ARMORS AND ERA. THE BK-29 ROUND, WITH A HARD PENETRATOR IN THE NOSE IS DESIGNED FOR USE AGAINST REACTIVE ARMOR, AND AS AN MP ROUND
HAS FRAGMENTATION EFFECTS. IF THE BK-29 HEAT-MP IS USED, IT MAY SUBSTITUTE FOR FRAG-HE (AS WITH NATO COUNTRIES) OR COMPLEMENTFRAG-HE. THERUSSIAN OF-26 ROUND IS EFFECTIVE OUT TO 5000 M WITH AREA EFFECTS.

ANTITANK GUIDED MISSILES:
NAME: INA (SIMILAR TO AT-11 SVIR)
WARHEAD TYPE: SHAPED CHARGE (HEAT)
ARMOR PENETRATION (MM CE): 770, 270 BEHIND ERA
RANGE (M): 5,000 DAY, 4,000 NIGHT

NAME: INA (SIMILAR TO AT-11B INVAR)
WARHEAD TYPE: TANDEM SHAPED CHARGE (HEAT)
ARMOR PENETRATION (MM CE): 900, 850 BEHIND ERA
RANGE (M): 5,000 DAY, 4,000 NIGHT

NOTES
OTHER SURVIVABILITY EQUIPMENT: LASER DAZZLER COUNTERMEASURE
SYSTEM CAN TEMPORARILY BLIND ENEMY GUNNERS AT 5 KM.
LASER WARNING RECEIVER
THE TANK ALSO USES AN INERTIAL/GNSS NAVIGATION SYSTEM AND BATTLE MANAGEMENT SYSTEM.

PRC MAIN BATTLE TANK TYPE 96 TYPE 96G



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative designations:	Type 88C; ZTZ 96	Armament-Main Gun:	Smoothbore gun
Date of introduction:	1997; 2006 for Type 99G	Caliber, type, name:	125mm 2A46M/D-81TM
Proliferation: [at least]	3	Rate of Fire (rd/min):	6+
Crew:	3	Loader Type:	Autoloader; manual
Combat weight (mt):	43; 46 for Type 96G	Ready main gun rounds:	22 carousel
Chassis length overall (m):	6.33	Stowed rounds:	20
Height overall (m):	2.30	Elevation (°):	-6 to +14
Width overall (m):	3.45	Fire on Move:	Yes-main gun
Ground pressure (kg/cm2):	0.77	Armament-Aux Weapon:	Turret-coax to main gun
AUTOMOTIVE	SPECIFICATIONS	Caliber, type, name:	7.62mm Type 59
Engine type (hp):	Diesel	Max eff range-day (m):	1000
Engine type (hp): Upgrade	1000	Max eff range-night (m):	INA
Cruising range (km):	400/600 w extra fuel tanks	Fire on move:	Yes
Max road speed (kph):	65	Rate of fire (rd/min):	250
Max off-road speed (kph):	45	Armament-Aux Weapon:	Turret-TC cupola
Average cross-country (kph)	35	Caliber, type, name:	12.7mm Type 54
Max swim:	NA	Max aimed range-day (m):	1500
Fording depth (m):	1.4 unprep; 5.0 snorkel	Max eff range-night (m):	INA
COMMUNICATIONS	SPECIFICATIONS	Fire on move:	Yes
Radio:	INA	Rate of fire (rd/min):	100
External Intercom device	No	ATGM Launcher:	
		Missile name-nomenclature:	Svir/Invar
PROTECTION	SPECIFICATIONS	Launch method:	gun
Applique armor:	Track skirts	Missile guidance:	SACLOS; laser
Explosive reactive armor:	2d gen ERA	Launch rate (msl/min):	2-3
Active system:	NA	FIRE CONTROL	SPECIFICATIONS
Mine clearing:	Roller-plow available	FCS name:	ISFCS-212
Self-Entrenching blade:	NA	Thermal: TC-gunner	yes
NBC protection system:	Yes	Main gun stabilization	2-plane
Smoke equipment:	grenlaunch 12x; VESS	Infrared	Yes
		Sights w/magnific: day (m)	5000
		Sights w/magnific: nt (m)	1200; 2500 Type (6G

NOTES

VARIANTS

THESE TANKS HAVE SEEN MANY MINOR IMPROVEMENTS IN MANUFACTURE AND OPERATIONS. CHASSIS WAS UPGRADED CONSIDERABLY FROM THE ORIGINAL TYPE 80/88 CHASSIS. HEAVIER TURRET/CHASSIS UPDATES TYPE 85. WEIGHT VARIES FROM 41 TO 42 TONS, DEPENDING ON VARIANT AND IMPROVEMENTS.

TYPE 85-IIAP: FIRST SIGNIFICANTLY FIELDED TANK OF THIS CLASS WITH 125-MM GUN, AUTOLOADER, AND A MODERN FCS. EARLY VERSIONS WERE ASSEMBLED USING PARTS FROM TYPE 59S, TYPE 69-IIS AND UPGRADE KITS FOR EXPORT, OR PRODUCED IN PAKISTAN UNDER LICENSE. THOSE TANKS DISPLAYED POOR CRAFTSMANSHIP AND RELIABILITY PROBLEMS. FABRICATION IMPROVEMENTS CORRECTED MOST OF THE PROBLEMS. PAKISTAN IS CONSIDERING INDIGENOUS, CHINESE, AND OTHER FOREIGN UPGRADE PROGRAMS TO MODERNIZE THOSE TANKS. PAKISTAN NOW PRODUCES 125-MM AMMO FOR THESE TANKS, THE MORE MODERN AL KHALID, AND FOR EXPORT.

TYPE 85-III: UPGRADE PROGRAM WAS DEVELOPED FOR EXPORT UPGRADES, E.G., TYPE 85-IIAP. IT INCLUDES A 1000-HP ENGINE AND COMPOSITE ARMOR PANELS, ERA, IMPROVED FCS WITH THERMAL SIGHT, AND A GUN-LAUNCH ATGM OPTION. WT 42 MT 6.3M X 3.5M. IT WAS APPLIED TO TYPE 88 SERIES AND TYPE 96.

TYPE 96: THE ORIGINAL VERSION (TYPE 88C) HAD A 730-HP ENGINE. MANY TYPE 85-III UPGRADES ARE NOW INCORPORATED. HOWEVER, WITH TRANSITION TO TYPE 96G, ADDITIONAL UPGRADES HAVE BEEN ADDED.

TYPE 96G: THE LATEST TANK HAS CONFORMAL 2ND GEN ERA OF THE SAME DESIGN AS ON THE TYPE 99 TANK. OTHER UPGRADES FROM THE TYPE 99 INCLUDE THE GUN, AMMUNITION, AND FCS. EXPORT VERSION ALSO HAS A SHTORA-TYPE EO JAMMER SYSTEM MOUNTED ON THE TURRET SIDES.

WEAPONS & AMMUNITION TYPES AND TYPICAL COMBAT LOAD

125-MM SMOOTHBORE GUN (MIX EST)	42
APFSDS-T	15
HEAT	6
FRAG-HE	21
12.7-MM NSVT AA MG	500

MAIN ARMAMENT AMMUNITION

CALIBER, TYPE, NAME:

125-MM APFSDS-T, BM-42M ESTIMATED, BASED ON SIMILAR ROUNDS

MAXIMUM AIMED RANGE (M): 3000

MAX EFFECTIVE RANGE (M):

DAY: 2000-3000

NIGHT: 850-1300

ARMOR PENETRATION (MM KE): 590-630 AT 2,000 METERS

125-MM FRAG-HE-T, OF-26 ESTIMATED, BASED ON SIMILAR ROUNDS

MAXIMUM AIMED RANGE (M): 5000

MAX EFFECTIVE RANGE (M):

DAY: INA

NIGHT: 850-1300

ARMOR PENETRATION (MM): CAN DEFEAT IFV AND APC

125-MM HEAT, BK-27 ESTIMATED, BASED ON SIMILAR ROUNDS

MAXIMUM AIMED RANGE (M): 3,000

MAX EFFECTIVE RANGE (M):

DAY: 2000-3000

NIGHT: 850-1300
ARMOR PENETRATION (MM CE): 700-800

125-MM HEAT-MP, BK-29M ESTIMATED, BASED ON SIMILAR ROUNDS
MAXIMUM AIMED RANGE (M): 3000
MAX EFFECTIVE RANGE (M):
DAY: 2000-3000
NIGHT: 850-1300
ARMOR PENETRATION (MM CE): 650-750

OTHER AMMUNITION TYPES: GIAT 125G1 APFSDS-T, RUSSIAN BM-42 AND BM-32 APFSDS-T. NOTE: THE RUSSIANS MAY HAVE A VERSION OF THE BM-42M WITH A DU PENETRATOR.

ANTITANK GUIDED MISSILES: FOR TYPE 96G
NAME: INA
WARHEAD TYPE: SHAPED CHARGE (HEAT)
ARMOR PENETRATION (MM CE): 700+
RANGE (M): 5000 DAY, 4000 NIGHT

THE MORE RECENT BK-27 HEAT ROUND OFFERS A TRIPLE-SHAPED CHARGE WARHEAD AND INCREASED PENETRATION AGAINST CONVENTIONAL ARMORS AND ERA. THE BK-29 ROUND, WITH A HARD PENETRATOR IN THE NOSE IS DESIGNED FOR USE AGAINST REACTIVE ARMOR, AND AS AN MP ROUND HAS FRAGMENTATION EFFECTS. IF THE BK-29 HEAT-MP IS USED, IT MAY
SUBSTITUTE FOR FRAG-HE (AS WITH NATO COUNTRIES) OR COMPLEMENT FRAG-HE.

GEC-MARCONI CENTAUR FIRE CONTROL SYSTEM IS AVAILABLE. BRITISH BARR AND STROUD THERMAL BASED FCS CAN BE FITTED.

PRC MAIN BATTLE TANK TYPE 59D



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative designations:	WZ 120B	Armament-Main Gun:	Rifled gun
Date of introduction:	1958	Caliber, type, name:	105mm L7 (est)
Proliferation: [at least]	2	Rate of Fire (rd/min):	6-10
Crew:	4	Loader Type:	manual
Combat weight (mt):	38	Ready main gun rounds:	INA
Chassis length overall (m):	6.05	Stowed rounds:	INA
Height overall (m):	2.6	Elevation (°):	-4 to +17
Width overall (m):	3.3	Fire on Move:	No
Ground pressure (kg/cm2):	0.8	Armament-Aux Weapon:	Turret-coax to main gun
AUTOMOTIVE	SPECIFICATIONS	Caliber, type, name:	7.62mm Type 59T
Engine type (hp):	Diesel V-12	Max eff range-day (m):	1000
Engine type (hp): Upgrade	520	Max eff range-night (m):	800
Cruising range (km):	420/600w extra fuel tanks	Fire on move:	Yes
Max road speed (kph):	50	Rate of fire (rd/min):	250
Max off-road speed (kph):	25	Armament-Aux Weapon:	Turret-TC cupola
Average cross-country (kph)	INA	Caliber, type, name:	12.7mm Type 54
Max swim:	NA	Max aimed range-day (m):	1500
Fording depth (m):	1.4 unprep; 5.5 snorkel	Max eff range-night (m):	INA
COMMUNICATIONS	SPECIFICATIONS	Fire on move:	Yes
Radio:	INA	Rate of fire (rd/min):	100
External Intercom device	No	ATGM Launcher:	
		Missile name-nomenclature:	INA
PROTECTION	SPECIFICATIONS	Launch method:	gun
Applique armor:	Track skirts	Missile guidance:	SACLOS, laser
Explosive reactive armor:	yes	Launch rate (msl/min):	INA
Active system:	NA	FIRE CONTROL	SPECIFICATIONS
Mine clearing:	Roller-plow available	FCS name:	UI Light Spot
Self-Entrenching blade:	NA	Thermal: TC-gunner	available
NBC protection system:	Yes	Main gun stabilization	2-plane
Smoke equipment:	grenlaunch 8x; VESS	Infrared	Yes
		Sights w/magnific: day (m)	5000
		Sights w/magnific: nt (m)	1000

NOTES

VARIANTS

TYPE 59: ORIGINAL MODEL IS A COPY OF THE FORMER SOVIET T-54 MBT AND HAS A 100-MM RIFLED MAIN GUN.

TYPE 59D: MODERNIZATION UPGRADE, AKA WZ120C. IT HAS ERA, COMPUTERIZED STABILIZED FCS, THE 105-MM RIFLED GUN, AND II NIGHT SIGHTS.

TYPE 59D1 FEATURES A NEW 105-MM TYPE 83A LONGER BARREL. GUN RANGE IS 2,000 M. A THERMAL SIGHT IS AVAILABLE. THE GUN HAS ATGM LAUNCH CAPABILITY.

TYPE 69: FAMILY OF TANKS DERIVED FROM THE TYPE 59 CHASSIS.

TYPE 69-I HAS A SMOOTHBORE 100-MM GUN.

TYPE 69-II HAS A STABILIZED RIFLED 100-MM GUN AND IMPROVED FIRE CONTROL SYSTEM WITH LRF AND BALLISTIC COMPUTER. A THERMAL SLEEVE WAS ADDED TO THE GUN BARREL. LIMITED NUMBER OF TYPE 69 TANKSHAVE 105-MM GUNS.

TYPE 79-I: TYPE 69 UPGRADE HAS 105-MM GUN, THERMAL GUN SLEEVE, AND IMPROVED FCS WITH II NIGHT SIGHT. TYPE 79-II EXPORT VERSION WITH MODERNIZED FCS, IMPROVED SIDE SKIRTS, AND A NEW ENGINE.

T-72Z/ SAFIR 74: IRANIAN VARIANT WHICH CONSTITUTES STATE-OF-THE-ART FOR UPGRADED 50S-GENERATION FORMER WARSAW PACT TANKS. THIS TANK HAS A 780-HP DIESEL ENGINE, TRACK SKIRTS, AND SMOKE GRENADE LAUNCHERS. AN IRANIAN ERA PACKAGE FITS T-72Z. ARMAMENT INCLUDES AN M68 105-MM RIFLED GUN, 7.62-MM TYPE 59T (PKT) MG, AND A 12.7-MM TYPE 59 (DSHKM) MG. THE CANNON CAN LAUNCH AT-10/ BASTION ATGMS TO 4000 METERS, AND FIRE A BROAD RANGE OF NATO 105-MM AMMUNITION. FIRE CONTROL INCLUDES THE ROBUST SLOVENIAN EFCS-3-55 FIRE CONTROL SYSTEM WITH STABILIZATION, A LASER RANGEFINDER, AND A BALLISTIC COMPUTER. THE FCS INCLUDES A COMMANDER'S INDEPENDENT VIEWER AND TARGET DESIGNATION SYSTEM, AND II GUNNER NIGHT SIGHTS.

T- 55MII: PAKISTANI TYPE 59 MODERNIZATION CONDUCTED DURING OVERHAUL INCLUDES A 580-HP ENGINE, STABILIZED 105-MM RIFLED GUN, INTEGRATED COMPUTER FCS WITH GPS, AND THERMAL SIGHT, APU, ETC.

AL ZARRAR: PAKISTANI TYPE 59 UPGRADE, WITH NEW ENGINE AND ERA. ORIGINAL AL ZARRAR HAD 1ST GEN ERA. THE LATEST VERSION HAS A 730-HP ENGINE, 125-MM GUN, ISFCS HUNTER-KILLER FCS WITH CATHERINE 2ND GEN THERMAL SIGHT, AND 2ND GEN ERA. SO FAR, 300 ARE IN SERVICE.

WEAPONS & AMMUNITION TYPES AND TYPICAL COMBAT LOAD

105-MM RIFLED GUN (MIX EST)	34
APFSDS-T	12
HEAT M456	3
HESH L35	16
ATGM	INA

MAIN ARMAMENT AMMUNITION

CALIBER, TYPE, NAME:

105-MM APFSDS, H6/62

- MAXIMUM AIMED RANGE (M): 3,000
- MAX EFFECTIVE RANGE (M):
  - DAY: 2,000-3,000 (EST)
  - NIGHT: 1,000
- ARMOR PENETRATION (MM): INA

105-MM APFSDS, UI (NEW CHINESE)

- MAXIMUM AIMED RANGE (M): 3,000
- MAX EFFECTIVE RANGE (M):



DAY: 2,000-3,000 (EST)
NIGHT: 1,000
ARMOR PENETRATION (MM KE): 460 AT 2,000 M

105-MM HEAT, M456 (MULTINATIONAL)
MAXIMUM AIMED RANGE (M): 3,000
MAX EFFECTIVE RANGE (M):
DAY: 1,500-2,500 (EST)
NIGHT: 1,000
ARMOR PENETRATION (MM CE): 432, NATO SINGLE HEAVY TARGET

105-MM HESH, L35 (UK)
MAXIMUM AIMED RANGE (M): 5,000
MAX EFFECTIVE RANGE (M):
DAY: 2,000-3,000 (EST)
NIGHT: 1,000
ARMOR PENETRATION (MM): NATO SINGLE HEAVY TARGET

OTHER AMMUNITION TYPES: CHINESE TYPE 83/ UK L64/ US M735 APFSDS, UK L52 APDS, MULTINATIONAL M393 HEP-T, FRENCH OE 105-F1 HE, L39 SMOKE, CANISTER

ANTITANK GUIDED MISSILES:
NAME: AT-10/BASTION, CHINESE 105-MM VARIANT FOR TYPE 59D
WARHEAD TYPE: 105-MM SHAPED CHARGE (HEAT)
ARMOR PENETRATION (MM CE): 650 (RHA)
RANGE (M): INA (DAY ONLY)

GEC-MARCONI CENTAUR FIRE CONTROL SYSTEM AVAILABLE. BRITISH BARR AND STROUD THERMAL BASED FCS CAN BE FITTED.

GERMANY MAIN BATTLE TANK Leopard 2A4, 2A5, 2A6, 2A7+



Leopard 2A6

SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative designations:	Swiss Pz87, Stry121	Armament-Main Gun:	Smoothbore gun
Date of introduction:	1979	Caliber, type, name:	120mm L55
Proliferation: [at least]	7	Rate of Fire (rd/min):	INA
Crew:	4	Loader Type:	Manual
Combat weight (mt):	56	Ready main gun rounds:	15
Chassis length overall (m):	7.7	Stowed rounds:	27
Height overall (m):	2.8	Elevation (°):	-9 to +20
Width overall (m):	3.7	Fire on Move:	Yes
Ground pressure (kg/cm2):	0.83	Armament-Aux Weapon:	Turret-coax to main gun
AUTOMOTIVE	SPECIFICATIONS	Caliber, type, name:	7.62mm, MG3A1
Engine type (hp):	Diesel	Max eff range-day (m):	INA
Engine type (hp): Upgrade	1500	Max eff range-night (m):	INA
Cruising range (km):	550	Fire on move:	Yes
Max road speed (kph):	70	Rate of fire (rd/min):	1200
Max off-road speed (kph):	50	Armament-Aux Weapon:	Turret-TC cupola
Average cross-country (kph)	40	Caliber, type, name:	7.62mm, MG3A1
Max swim:	NA	Max aimed range-day (m):	INA
Fording depth (m):	1.0 unprep; 4.0 snorkel	Max eff range-night (m):	INA
COMMUNICATION	SPECIFICATIONS	Fire on move:	Yes
Radio:	INA	Rate of fire (rd/min):	1200
External Intercom device	INA	ATGM Launcher:	NA
PROTECTION	SPECIFICATIONS	FIRE CONTROL	SPECIFICATIONS
Applique armor:	Track skirt	FCS name:	INA
Explosive reactive armor:	INA	Thermal: TC-gunner	yes
Active system:	Galiz, Stry122	Main gun stabilization	WNA-H22, 2-plane
Mine clearing:	No	Infrared	Yes
Self-Entrenching blade:	No	Sights w/magnific: day (m)	INA
NBC protection system:	Yes	Sights w/magnific: nt (m)	INA
Smoke equipment:	grenlaunch 8x2 at turret		

NOTES

VARIANTS

LEOPARD 2 SERIES:

PZ87: SWISS VARIANT WITH INDIGENOUS MGS, COMMS, FCS, AND IMPROVED NBC EQUIPMENT.

DUTCH LEOPARD 2: USES INDIGENOUS EQUIPMENT AS NOTED ABOVE.

LEOPARD 2A5/LEOPARD 2 (IMPROVED): UPGRADE WITH SUBSTANTIALLY INCREASED SPACED ARMOR ON TURRET FRONT, HULL, AND SIDES. OTHER IMPROVEMENTS INCLUDE IMPROVED STABILIZATION, SUSPENSION, NAVIGATION, 2ND GEN THERMAL FIRE CONTROL, HATCH DESIGN, AND APFSDS-T ROUNDS. THIS IS A STANDARD GERMAN TANK AND IS WIDELY EXPORTED IN NATO.

NATO COUNTRIES USE THE FOLLOWING CUSTOM VARIANTS OF THE LEO 2A5:

LEOPARD 2A5M: CANADIAN UPGRADE VARIANT.

LEOPARD 2A6: GERMAN UPGRADE WITH 55-CALIBER L55 GUN, IMPROVED AMMO, NEW APU, BATTLE MANAGEMENT SYSTEM.

LEOPARD 2 HEL: VERSION OF 2A6 EXPORTED TO GREEK FORCES.

LEOPARD 2A6 EX IS AN EXPORT VERSION WITH EVEN MORE ARMOR PROTECTION. CUSTOMERS INCLUDE SPAIN AND THE NETHERLANDS. IT IS PROBABLY THE BEST-PROTECTED TANK IN THE WORLD.

LEOPARD 2 PSO (PEACE SUPPORT OPERATIONS): EXPORT VERSION OPTIMIZED FOR MOUT OPERATIONS.

LEOPARD 2A6M CAN: EXPORT VERSION FOR CANADIAN FORCES WITH SLAT ARMOR ADDED.

STRV 122: SWEDISH-LICENSED VARIANT RESEMBLING 2A5 WITH AN INDIGENOUS TURRET AND OTHER UPGRADES. THE TANK FEATURES FRENCH GALIX ACTIVE PROTECTION SYSTEM AND IMPROVED COMMAND AND CONTROL. SWEDEN DEVELOPED AN HE-T ROUND DESIGNED TO RANGE 2,000 METERS OR MORE FOR ITS LEOPARD-2 AND STRV-122 TANKS. WITH ADDITIONAL ARMOR, STRV 122 WILL WEIGH 62 MT.

LEOPARD 2A7+

THIS EVOLUTION OF THE LEOPARD PSO WAS INTRODUCED AT THE 2010 EUROSATORY EXHIBITION. IT HAS VERY SIMILAR CAPABILITIES TO THE PSO, AS WELL AS COMBAT ENGINEERING ATTACHMENTS FOR DOZER BLADES, MINE PLOWS AND OTHER EQUIPMENT.

IT FEATURES REDESIGNED FINAL DRIVE, TRACKS AND SUSPENSION.

THE 2A7 STANDARD PACKAGE CAN BE RETROFITTED TO EXISTING VEHICLES OR SUPPLIED AS A NEW BUILD TANK. THE UPGRADE PACKAGE IS MODULAR AND CAN BE TAILORED TO CUSTOMER REQUIREMENTS. IT IS TYPICALLY ARMED WITH THE LONGER L55 GUN. IMPROVISED EXPLOSIVE DEVICE (IED) JAMMERS AND A HARD- OR SOFT-KILL DEFENSIVE AIDS SYSTEM CAN BE FITTED.

THE DRIVER HAS A SUSPENDED AUTOFLUG SEAT AND A NEW DAY THERMAL CAMERA ON THE GLACIS PLATE WHICH FEEDS A MULTIPURPOSE SCREEN.

THE TANK COMMANDER IS EQUIPPED WITH THE CARL ZEISS RTWL-B ROOF-MOUNTED STABILIZED PANORAMIC SIGHT. THIS HAS A DIRECT OPTICAL SIGHT WITH THREE FIELDS OF VIEW PLUS A THIRD-GENERATION ATTICA THERMAL IMAGER, LASER RANGEFINDER AND DAYLIGHT CAMERA FOR HUNTER-KILLER TARGET ENGAGEMENTS. ELECTRONICS AND SYSTEMS ARE LINKED THROUGH A CAN BUS, WHICH PROVIDES INFORMATION TO ALL CREWMEMBERS ON FLAT-PANEL DISPLAYS AND CAN ALSO SHOW INFORMATION FROM A STANDARD BATTLE-MANAGEMENT SYSTEM.

AN INFANTRY TELEPHONE IS FITTED AT THE REAR, ALONG WITH A DAY/NIGHT CAMERA FEEDING A SCREEN AT THE DRIVER'S POSITION FOR DRIVING IN REVERSE. AN AIR-CONDITIONING SYSTEM IS INSTALLED IN THE TURRET BUSTLE AND SAAB'S BARRACUDA CAMOUFLAGE SYSTEM IS FITTED TO REDUCE THE THERMAL LOAD.

THE VEHICLE RETAINS THE STANDARD 1500-HP MTU MB 873 KA-501 DIESEL ENGINE COUPLED TO A RENK HSWL 354 AUTOMATIC TRANSMISSION. AN AUXILIARY POWER UNIT IS FITTED TO THE REAR RIGHT OF THE CHASSIS AND CAN SUPPORT ALL SUBSYSTEMS WITHOUT REQUIRING THE MAIN ENGINE.

A COMBAT WEIGHT OF ABOUT 67.5 TONS IN ITS URBAN OPERATIONS CONFIGURATION. THIS RESULTS IN A REDUCED POWER-TO-WEIGHT RATIO OF ABOUT 22 HP/TON. HOWEVER, THE WEIGHT INCREASE REQUIRED OTHER UPGRADES, INCLUDING MODIFIED FINAL DRIVES, NEW AND STRONGER TORSION BARS, UPGRADED BRAKES, NEW DIEHL TRACKS AND A HYDRAULIC JACK-TENSIONING SYSTEM.
IMPROVED SITUATIONAL AWARENESS IS PROVIDED THROUGH EXTRA DAY AND THERMAL CAMERAS COVERING 360-DEG AROUND THE TANK, WITH IMAGES DISPLAYED AT ALL CREWMEMBERS MONITORS.
SLAT ARMOR IS PROVIDED AROUND THE REAR OF THE TURRET AND CHASSIS TO PROTECT AGAINST ROCKET-PROPELLED GRENADES. ADDITIONAL TOP PROTECTION FOR THE FORWARD PART OF THE HULL AND TURRET IS AVAILABLE AS AN OPTION.

MAIN ARMAMENT AMMUNITION (LEOPARD 2)
CALIBER, TYPE, NAME:
120-MM APFSDS-T, DM43
MAXIMUM AIMED RANGE(M): 3500
MAX EFFECTIVE RANGE (M):
DAY: INA
NIGHT: INA
ARMOR PENETRATION (MM KE): 450 AT 2000 METERS

120-MM APFSDS-T, US OLIN GD120
MAXIMUM AIMED RANGE (M): 3500
MAX EFFECTIVE RANGE (M):
DAY: 3000
NIGHT: INA
ARMOR PENETRATION (MM KE): 520 AT 2000 METERS

120-MM HEAT-MP-T, DM-12A1/US OLIN M830
MAXIMUM AIMED RANGE (M): INA
MAX EFFECTIVE RANGE (M):
DAY: 2500
NIGHT: INA
ARMOR PENETRATION (MM): INA

OTHER AMMUNITION TYPES: US-PRODUCED M829, M829A1
APFSDS-T; US M830A1 HEAT-MP-T (MPAT), GE DM12A1 (US COPY M830) HEAT-MP-T (MPAT)

WEAPONS & AMMUNITION TYPES AND TYPICAL COMBAT LOAD (LEOPARD 2)
120-MM SMOOTHBORE GUN (MIX EST) 42
APFSDS-T INA
HEAT-MP/T INA

NOTES
A VARIETY OF UPGRADE PROGRAMS AND OPTIONS ARE AVAILABLE FOR THE LEOPARD 2. THESE INCLUDE THE ATLAS ELEKTRONIK VEHICLE INTEGRATED COMMAND AND INFORMATION SYSTEM (IFIS), A DIGITAL COMMAND AND INFORMATION SYSTEM. THE NEW LONGER GUN BARREL (L55 GUN BARREL, 1.30 METERS LONGER) IS AVAILABLE FOR EARLIER VEHICLES. IT PERMITS EFFECTIVE USE OF A NEW APFSDS-T ROUND, DM53 (LKE II), WITH A LONGER ROD PENETRATOR, AND WHICH IS UNDER DEVELOPMENT. THE GERMAN ARMY HAS DECIDED NOT TO BUY THE DM43 APFSDS-T ROUND (AKA LKE 1), RATHER WAIT AND UPGRADE TO THE DM53

ROUND. AN EXPECTED NEAR-TERM UPGRADE IS ADDITION OF THE SPEAR GUN-LAUNCH ATGM, WHICH WAS DERIVED FROM THE RUSSIAN AT-10B ARKAN.

LEOPARD 1 SERIES:
LEOPARD 1 WAS THE BASELINE TANK WITH ORIGINAL TRACKS, AND WITHOUT TRACK SKIRTS, STABILIZATION OR THERMAL SLEEVE FOR GUN.
LEOPARD 1A1 VERSION, CAN BE FITTED WITH APPLIQUE ARMOR.
LEOPARD 1A1A1 IS THE THIRD PRODUCTION LOT, WITH APPLIQUE, AIR FILTER INTAKES. EARLY TANKS HAVE BEEN UPGRADED TO THIS STANDARD.
LEOPARD 1A2: PRODUCTION BATCH AND -1A1 UPGRADE WITH A NEW CAST TURRET, IMPROVED NBC SYSTEM, II NIGHT SIGHTS, AND AIR CONDITIONING.
ITALIAN LEOPARD 1A2: UPGRADE WITH SIRIO THERMAL FCS, GUN STABILIZATION AND TURRET DRIVE.
LEOPARD 1A3: PRODUCTION SYSTEM WITH PREVIOUS IMPROVEMENTS, LARGER WELDED SPACED ARMOR TURRET, AND IMPROVED FCS (BY COUNTRY).
LEOPARD 1A4: FINAL PRODUCTION SYSTEM WITH AEG-TELEFUNKEN FCS.
LEOPARD 1A5: MORE THAN 1,300 –1A1/1A2 TANKS HAVE BEEN REFITTED WITH AN EMES-18 FCS AND THERMAL SIGHTS. LEOPARD 1A5 (BE): BELGIAN UPGRADED -1A1/1A2S, WITH NEW FCS, FN MAG 7.62-MM MGS, AND THERMAL SIGHTS.
LEOPARD 1-V: DUTCH VERSION, OF -1A1A1, WITH GERMAN EMES-12A3 FCS AND PZB II NIGHT SIGHT.
A VARIETY OF SYSTEMS USE LEOPARD 1 CHASSIS TO INCLUDE GEPARD AIR DEFENSE GUN, ENGINEER AND RECOVERY VEHICLES, AND BRIDGE LAYER.
A VARIETY OF MBT VARIANTS FROM 2A1 TO 2A4 DENOTE MINOR CHANGES, AS WELL AS FCS UPGRADES.
COMBAT SUPPORT VARIANTS INCLUDE AN ARMORED RECOVERY VEHICLE.

MAIN ARMAMENT AMMUNITION (LEOPARD 1)
CALIBER, TYPE, NAME:
105-MM APFSDS-T, DM43, GERMAN RHEINMETALL
- MAXIMUM AIMED RANGE (M): 2000+
- MAX EFFECTIVE RANGE (M):
  - DAY: 1400
  - NIGHT: 1000 IR/1,500 WHITE LIGHT/MORE WITH THERMAL
- ARMOR PENETRATION (MM): NATO TRIPLE HEAVY TARGET, 5,500 M

105-MM APFSDS-T, M413, ISRAELI MILITARY INDUSTRIES
- MAXIMUM AIMED RANGE (M): 6000
- MAX EFFECTIVE RANGE (M):
  - DAY: 1400
  - NIGHT: 1000 IR/1500 WHITE LIGHT/MORE WITH THERMAL
- ARMOR PENETRATION (MM): NATO TRIPLE HEAVY TARGET, 6000+M

105-MM HEAT-T, OCC 105 F1, FRENCH GIAT
- MAXIMUM AIMED RANGE (M): 2500
- MAX EFFECTIVE RANGE (M):
  - DAY: 1400
  - NIGHT: 1000
- ARMOR PENETRATION (MM CE): 360 AT 0°

105-MM HEAT-T, M456A2, BELGIAN MECAR
- MAXIMUM AIMED RANGE (M): 2500-3500

MAX EFFECTIVE RANGE (M):
DAY: 1400
NIGHT: 1000
ARMOR PENETRATION (MM CE): 432 AT 0°

105-MM HESH-T, DM512, RHEINMETALL
MAXIMUM AIMED RANGE (M): 4,000
MAX EFFECTIVE RANGE (M):
DAY: 1,400
NIGHT: 1,000 IR/1,500 WHITE LIGHT/MORE WITH THERMAL
ARMOR PENETRATION (MM): NATO SINGLE HEAVY TARGET

105-MM HE, OE 105 F1, FRENCH GIAT
MAXIMUM AIMED RANGE (M): 2,500
MAX EFFECTIVE RANGE (M):
DAY: 1,400
NIGHT: 1,000
ARMOR PENETRATION (MM): CAN DEFEAT AN IFV AND APC

OTHER AMMUNITION TYPES: ANY NATO-STANDARD 105-MM AMMUNITION CAN BE USED. THEY INCLUDE: CHINESE NORINCO 105, BRITISH ROYAL ORDINANCE L64A4 AND H6/6, BELGIAN MECAR M1060, FRENCH GIAT OFL 105 F1, SPANISH SANTA BARBARA C-437, US M735 AND M833 (DEPLETED URANIUM), AND CANADIAN FP105 APFSDS-T ROUNDS. OTHER TYPES AVAILABLE ARE: HE-T, SMOKE, ILLUMINATING, HESH-T, HE PLASTIC TRACER (HEP-T), AND CANISTER OR APERS-T (FLECHETTE).
A RECENT ROUND IS THE ISRAELI MILITARY INDUSTRIES APAM ROUND, WHICH
OVER-FLIES THE TARGET AND DISPERSES FRAGMENTING SUBMUNITIONS OUTWARD AND DOWNWARD OVER A MUCH WIDER KILL ZONE.
NOTES
MORE THAN A DOZEN FIRE CONTROL SYSTEMS, MANY WITH THERMAL SIGHTS, ARE AVAILABLE FOR THIS TANK. A VERSION WITH LLLTV SIGHTS IS THE LEOPARD 1A1A2. IMPROVED STABILIZATION SYSTEMS INCLUDE US HR TEXTRON, FRENCH SAMM, AND GERMAN FWM. OTHER OPTIONS INCLUDE A FRONT MOUNTED DOZER BLADE, IMPROVED AIR CONDITIONING, A 120-MM SMOOTHBORE GUN, AND OTHER SECONDARY WEAPONS.

FRENCH TROPICALIZED MAIN BATTLE TANK LECLERC EAU



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations:	AMX-56	ARMAMENT-MAIN GUN	Smoothbore gun
Date of Introduction:	1996	Caliber, type, name:	120-mm GIAT CN120-26/52
Proliferation:	France, United Arab Emirates	Rate of Fire (rd/min):	6
Crew:	3	Loader Type:	Autoloader
Combat Weight (mt):	56.95	Ready main gun rounds:	22
Chassis Length Overall (m):	7.96	Stowed rounds:	18
Height Overall (m):	3.04	Elevation (°):	-10/+20
Width Overall (m):	3.62	Fire on Move:	Yes
Ground Pressure (kg/cm2):	INA	ARMAMENT-AUX WEAPON	Turret coax to gun
AUTOMOTIVE	SPECIFICATIONS	Caliber, type, name:	12.7-mm GIAT M693
Engine Type:	V-12, 1500-hp Diesel	Max Eff Range-Day (m):	INA
Cruising Range (km):	470/620 with aux fuel tanks	Max Eff Range-Night (m):	INA
Max Road Speed (kph):	71	Fire On Move:	Yes
Max Off-Road Speed (kph)	55	Rate of Fire (rd/min):	600
Average Cross-Country kph	50	ARMAMENT-AUX WEAPON	Roof armament
Max Swim:	n/a	Caliber, type, name:	7.62-mm FN HERSTAL
Fording Depth (m):	1 (without preparation)	Max Eff Range-Day (m):	INA
COMMUNICATIONS	SPECIFICATIONS	Max Eff Range-Night (m):	INA
Radio:	Voice and data transmission	Fire On Move:	Yes
External Intercom Device:	Yes. Telephone handset	Rate of Fire (rd/min):	900
PROTECTION	SPECIFICATIONS	ARMAMENT-AUXI WEAPON	Grenade launchers
Applique Armor:	Available	Caliber, type, name:	80-mm grenade GALIX
Explosive Reactive Armor:	No	Max Eff Range-Day (m):	30-50
Active Protection System:	Yes	Max Eff Range-Night (m):	30-50
Mine Clearing:	No	Fire On Move:	Yes
Self-Entrenching Blade:	No	Rate of Fire (rd/min):	INA
NBC Protection System:	Yes	FIRE CONTROL	SPECIFICATIONS
Smoke Equipment:	Smoke grenade launchers; smoke generator	FCS Name:	Fire Control Computer (CCT)
		Thermal: TC-Gunner:	Yes (5,700 m)
		Main Gun Stabilization:	Yes
		Infrared:	Yes (video)

		Sights w/mag day (m):	5,700
		Sights w/mag nt (m):	INA

NOTES

THE LECLERC TROPICALIZED MBT IS A CLASS 69 (IN COMBAT ORDER WITH JETTISONABLE FUEL DRUMS) HEAVY TRACK–LAYING ARMORED MBT AND IS EXTREMELY MOBILE. IT CAN OPERATE IN AN NBC ENVIRONMENT AND CAN FIRE WHILE MOVING, IN ALL WEATHER, ON STATIONARY OR MOVING TARGETS. IT'S FUEL CONSUMPTION RATE IS 146 LITERS PER HOUR. SITUATIONAL AWARENESS IS MAINTAINED THROUGH THE LECLERC BATTLE MANAGEMENT EQUIPMENT (LBME). THE COMMANDER AND GUNNER HAVE LASER RANGEFINDERS RANGED TO 8,000 METERS. THE LECLERC EAU INCLUDES AN AUXILIARY POWER UNIT.

VARIANTS

LECLERC T3 THROUGH T11, AZUR, EPG, DNG, AND MARS. FUTURE UPGRADES INCLUDE THE "CONTACT" TACTICAL RADIO SYSTEM AND THE "SCORPION" INFORMATION AND COMMAND SYSTEM.

MAIN ARMAMENT AMMUNITION

CALIBER, TYPE, NAME:

120-MM APFSDS, APFSDS-T

- MAXIMUM AIMED RANGE (M): 4,000
- MAXIMUM EFFECTIVE RANGE (M):
  - DAY: INA
  - NIGHT: INA
- ARMOR PENETRATION (MM KE): INA

120-MM HEAT TP, HEAT MP

- MAXIMUM AIMED RANGE (M): 3,000
- MAXIMUM EFFECTIVE RANGE (M):
  - DAY: INA
  - NIGHT: INA
- ARMOR PENETRATION (MM KE): INA

DEC
2016

Worldwide Equipment Guide

Chapter 5: Anti-Tank and Anti-Armor Systems



TRADOC G-2 ACE–Threats Integration
Ft. Leavenworth, KS

Distribution Statement: Approved for public release; distribution is unlimited.

Chapter 5: Anti-Tank and Anti-Armor Systems

Originally intended for defeating tanks, anti-tank and anti-armor are now more broadly developed and fielded to address the range of armored combat vehicles and even some aircraft and stationary targets. The more recent term anti-armor may be more appropriate in many cases than antitank, due to the diversity of capabilities and applications other than merely heavy armored vehicles.

Antitank subunits/units are found in infantry and armor battalions, brigades, and divisions, and in other combat units as needed. The most prolific anti-armor and antitank systems are in units other than AT units. By number, most are found in infantry, mechanized infantry, tank units, and in special purpose forces units, but can also be found in irregular and hybrid forces. The focus is mostly related to portability and capabilities directly complimentary to the supported forces. Many OPFOR countries employ antitank weapons for roles other than antitank, including AT guns against personnel and soft targets, and ATGMs against rotary-wing aircraft.

Anti-armor/anti-tank (AT) systems may be broadly grouped into guns, missiles, and anti-material rifles. AT systems may be man-portable, towed, vehicle-mounted, or have dedicated vehicles.

Anti-tank guns (AT guns) include towed and self-propelled AT guns. A number of guns were designed as field guns, with multi-role capability as both artillery and antitank guns. While the modern focus on maneuver warfare has brought a slight decline in dedicated antitank guns, their cost-effectiveness flexibility have kept them relevant. Improved ammunition is critical for continued effectiveness of antitank weapons, including gun-launched antitank guided missiles (ATGMs).

The **Anti-Tank Guided Missile (ATGM)** is the singular greatest threat to tanks today. These systems are distinguished from other antitank weapons in that they are guided to the target. Target acquisition and missile guidance can vary greatly and range from active operator guidance to dynamic self-guiding ("fire and forget"). Due to the continually evolving range of countermeasures, tactics, techniques, and procedures in the anti-tank arena are critical to mission success.

Anti-materiel sniper rifles (12.7 mm or .50 cal). Although often categorized as sniper rifles (and capable of being used against personnel), they are generally employed as anti-materiel rifles. Some also fire a multi-purpose round. Approximately 25 variants of 12.7-mm sniper/anti-materiel rifles are available.

Larger-caliber Anti-materiel Rifles (14.5 to 20-mm). A trend in the past ten years has been towards lower-cost, larger-caliber anti-materiel rifles. These may be chambered for either an HE or API round.

Systems in this chapter were included based on numbers fielded and likelihood of their threat to US forces. (See also WEG Tier Table)

Recoilless Weapons. Recoilless rifles and antitank grenade launchers (ATGLs) have seen tremendous improvements, although upgrades have generally not kept pace with armor improvements. Many of those crewed AT weapons are considered obsolescent, but may be common in smaller militaries. These systems may also have selective upgrades to make them more effective.

One advantage of recoilless systems is their utility. They offer a variety of munitions, including HEAT, HE, flechette, and others, to service most battlefield targets. Some recoilless launchers (aka, recoilless guns or rifles, or mounted grenade launchers) are light enough for easy transport in light vehicles, with ability

against infantry while outranging most infantry weapons. Recoilless weapons are limited by certain design and operational considerations. The bore size limits size of rounds and their ability to penetrate modern tank armor. However, many offer sufficient penetration to defeat other armored and unarmored vehicles (which outnumber tanks on the battlefield).

A key value is in their general lethality. With a higher rate of fire than most antitank guided missile (ATGM) launchers at 5 or more rounds per minute, they are useful as a fire support asset that can augment fires of other weapons against various targets. Most lack the range of ATGMs. All lack the precision. But these multi-role systems can apply a variety rounds to defeat vehicles, then kill exiting personnel with large HE blast munitions. In a close fight or ambush, many of these weapons can kill any vehicle other than a main battle tank (MBT) from any aspect. Some can also damage or kill MBTs from the side or rear.

Other Anti-Armor Threats.

Mines and Improvised Explosive Devices (IEDs). Belly attack mines can include kinetic energy penetrator mines, which defeat even mine-resistant vehicles. Side-attack sensor-fuzed mines include Russian plate mines with aimed directional fragmentation. Other mines and IEDs have warheads which produce an explosively formed penetrator (EFP, shaped like a sabot penetrator), to defeat light to heavy armor, depending on design. Even blast effects from mines and IEDs can cause severe kinetic energy damage by flipping over vehicles, causing material to toss about inside and killing or injuring personnel.

Frangible rounds. The frangible armor-piercing discarding sabot (FAPDS) round design uses a brittle rod which can penetrate armor, then shatter after penetration, to spread varying sized fragments within the target. It exhibits similar ballistics (including range and high velocity) to a KE round, but with effects of a Frag-HE round. Although most are currently designed for anti-aircraft use against thin armors, some are effective (with tailored brittleness, size, and design) for use against improved LAVs, such as IFVs.

Programmable fuze rounds. The Swiss Oerlikon 35-mm AHEAD round for use against aircraft uses an electronic fuze that is calibrated by a laser rangefinder, the fire control computer, and an electronic setter within the gun. At the pre-set time, the round fires a volley of KE sub projectiles forward (in the manner of 00 buckshot), with overall range to 5,000 m. Technology variants are being tested against ground vehicles. The AHEAD technology is available with other sizes of rounds, such as 30-mm PMC308. Russian HEF rounds for BMP-3M (100-mm) and T-80K tank (125 mm) employ the same technology, with range to more than 7,000 m. Russian rounds also permit an adjusted trajectory, in which they over-fly the vehicle and blast fragments outward and downward against the thin top armor of armored vehicles.

Artillery-delivered KE munitions. Artillery rounds include Russian 122-mm and 152-mm cannon rounds with top-attack flechettes, which can cover a wide area. They can damage and penetrate most LAVs. Sensor-fuzed artillery rounds, e.g., Russian Motiv-M, German SMART-155, and US SADARM can fire an EFP into the vehicle top for a sure penetration and kill.

Antitank and Anti-Armor Systems: Key Technology Trends

Recent trends demonstrate upgrades to AT technology and how they are integrated into tactics. Military forces worldwide continue to field new anti-armor systems and upgrade legacy systems.

Technology trends include new ATGM technologies for increased range and lethality. The most common type of lethality upgrade is the addition of a nose precursor or tandem warhead. Other improvements include upgrades to guidance, sighting optics, resistance to countermeasures, reduced smoke/noise signatures, and increased range. Threat actors may selectively upgrade their organic AT systems to augment specific capabilities or mitigate gaps. Creative application of existing capabilities have shown the most widespread increase in AT system effectiveness.

Conclusions. Fighting vehicle developers have found a variety of upgrades to improve light armored vehicles. However, they are more useful in protecting the vehicle during travel to the combat zone. All of these innovations offer marginal increase in protection against modern anti-armor weapons in close combat. Even expensive high-technology approaches, such as active protection systems, will not protect against many KE munitions which threaten LAVs. In close terrain, high defilade and urban areas, combat vehicles (including tanks and LAVs) are very vulnerable on their flanks and rear. Many modern IFVs have lost their firing ports and have limited awareness or firepower to address those directions.

***Technical Implications**:* The vehicles need weapons and sensors to address all threats for 360°, and at high and low angles of fire. Remote weapon stations and periscopes for the dismountable infantry can be added. Additional protection can be added, for use against selected high lethality weapons, such as antitank grenade launchers. Other assets are gun shields for crewmen which are partially out of vehicles, or remote fire control systems which can be operated from the inside. Side skirts and better mine/wheel well protection are needed.

***Tactical Implications**:* The combination of advancements in armor and proliferation of AT systems has spurred tactical adaptations in AT fielding and employment tactics and techniques. Advanced systems, previously only fielded in regular military forces are being regularly observed in irregular forces. This increases the potential lethality of ambushes and other offensive actions across the spectrum of military operations. The versatility of AT systems, particularly man-portable, has led to creative uses including anti-material and even anti-personnel applications.

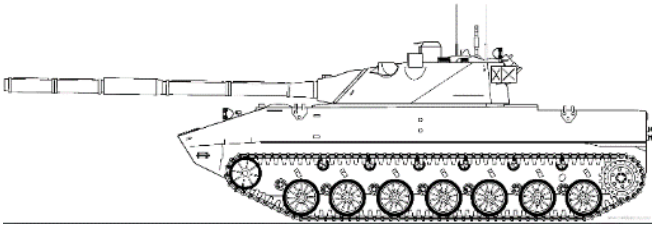
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RUSSIAN SELF-PROPELLED ANTITANK GUN 2S25





SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations	Sprut-SD	Caliber(mm), Type, Name	125mm, Smoothbore, 2A75
Date, Country of Origin	1993, RUS	Rate of Fire (prac, cyclic)	6, 8
Proliferation	Russian Ground Forces	Fire on Move	Yes
Crew	3	Elevation (deg min, max)	-5, +15
Combat Weight (mt)	18	Caliber(mm), Type, Name	7.63, Coax MG, PKT
Length (m)	6.98	Rate of Fire (prac, cyclic)	250, 650
Height (m)	2.45	Fire on Move	Yes
Width (m)	3.13	Caliber(mm), Type, Name	0, ATGM, 2A75
Ground Pressure (kg/cm^2)	0.53	Rate of Fire (prac, cyclic)	2, 3
Drive Formula	BMD-3 with 7 road wheels	Fire on Move	Yes
AUTOMOTIVE	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Engine Type	500hp UTD-29 Diesel	Caliber(mm), Type, Name	125, ATGM, BM-42M APFSDST
Cruising Range (km)	500	Max Aimed Range (m)	4000
Max On-Road (km/h)	71	Max Eff Range, Day (m)	3000
Max Off-Road (km/h)	45	Max Eff Range, Night (m)	2600
Max Swim (km/h)	10	Penetration (mm)	630, K
Fording Depth (m), note	Amphibious	Combat Load (ready, stow)	15
PROTECTION	SPECIFICATIONS	Caliber(mm), Type, Name	125, Frag- HE-T, OF-26
Radio	R-173	Max Aimed Range (m)	5000
Armor, Turret Front (mm):	12.7	Max Eff Range, Day (m)	5000
Applique Armor (mm)	Number	Max Eff Range, Night (m)	2600
Reactive Armor (mm):	French SNPE	Penetration (mm KE)	
Mobility (mine clearing, self-entrenching)		Combat Load (ready, stow)	16
NBC Protection System	Collective	Caliber(mm), Type, Name	125, HEAT-MP, BK-29M
Smoke Equipment	6 grenade launchers	Max Aimed Range (m)	4000
FIRE CONTROL	SPECIFICATIONS	Max Eff Range, Day (m)	4000
FCS Name		Max Eff Range, Night (m)	2600
Main Gun Stabilization	Yes	Penetration (mm)	650, C
Rangefinder	TPD-KIM	Caliber(mm), Type, Name	125, HEAT, BK-27
Infrared Searchlight	Yes	Max Aimed Range (m)	4000
Day Sight	LRF	Max Eff Range, Day (m)	3000
Field of View (deg)	Number	Max Eff Range, Night (m)	2600
Acquisition Range (m)	3000	Penetration (mm)	700, C

Night Sight	Thermal Sanoet 2	Caliber(mm), Type, Name	0, ATGM, AT11C Invar-M
Field of View (deg)	Number	Max Aimed Range (m)	7000
Acquisition Range (m)	2600	Penetration (mm KE)	900
		Combat Load (ready, stowed)	6

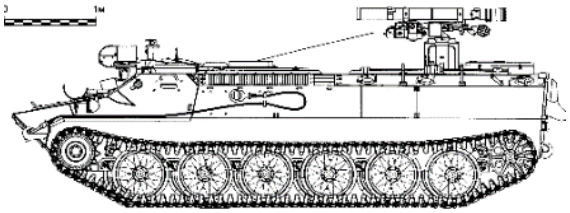
NOTES

HYDRO-PNEUMATIC SUSPENSION IS USED TO VARY HEIGHT IMMEDIATELY, LOWERING PROFILE TO REDUCE SIGNATURE, IMPROVE CROSS-COUNTRY MOBILITY, REDUCE SWIMMING PROFILE AND INCREASE STABILITY DURING FIRING. SINCE THE VEHICLE CAN ALSO FIT ABOARD AIRCRAFT, A LOWERED PROFILE FACILITIES LOADING.

AVAILABLE OPTIONS ARE IMPROVED AMMUNITION AND FCS, SPALL LINERS, AIR CONDITIONING AND A MORE POWERFUL ENGINE. THESE CAN INCLUDE STABILIZED FCS SIMILAR TO A T90A, WITH AUTOLOADER AND IMPROVED THERMAL NIGHT SIGHT. IMPROVED FCS COULD PERMIT USE IF THE AINET HE-SHRAPNEL FOCUSED FRAGMENTATION ROUND. FOR AIRBORNE AND AMPHIBIOUS FORCE THE ROUND WOULD SUPPLEMENT LIMITED AIR DEFENSE CAPABILITIES.

RUSSIAN ATGM LAUNCHER VEHICLE 9P149/SHTURM-S



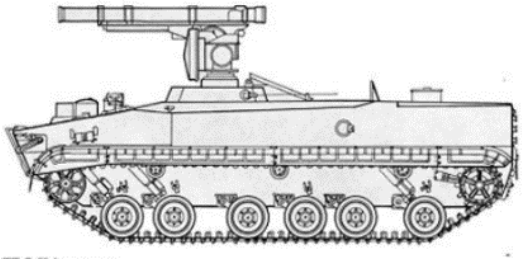


SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designations	AT-6 ground launcher AT-9	Caliber(mm), Type, Name	ATGM, 9P149A
Date, Country of Origin	1990, RUS	Rate of Fire (prac, cyclic)	2,3
Proliferation	At least 9 countries	Fire on Move	No
Crew	2	Loader Type	Automated
Combat Weight (mt)	12.3	AMMUNITION	SPECIFICATIONS
Length (m)	6.35	Missile Type, Name	ATGM, AT-9/ Ataka
Height (m)	1.8	Max Range(m)	6000
Width (m)	2.85	Minimum Range (m)	400
Platform	MT-LB	Penetration (mm), KE/CE	1100, CE
AUTOMOTIVE	SPECIFICATIONS	Warhead Type	Shaped Charge (HEAT)
Engine Type	290-hp Diesel	Missile Weight (kg)	48.3
Cruising Range (km)	500		
Max On-Road (km/h)	65		
Max Off-Road (km/h)	INA		
Max Cross-Country (km/h)	INA		
Max Swim (km/h)	4		
Fording Depth (m), note	Amphibious		
PROTECTION	SPECIFICATIONS		
Radio	R-123M or R-173		
Armor, Turret Front (mm):	14		
Applique Armor (mm)	N/A		
Reactive Armor (mm):	N/A		
Mobility (mine clearing, self-entrenching)	Entrenching blade		
NBC Protection System	Collective		
Smoke Equipment	N/A		
FIRE CONTROL	SPECIFICATIONS		
FCS Name	INA		
Beacon or Tracker Type	IR		
Rangefinder	Laser		
IR Searchlight	INA		
Day Sight	KPS-53AV		
Acquisition Range (m)	6000		
Night Sight	Sanoet-1		
Acquisition Range (m)	2600		
ATGM Guidance	SACLOS		
ATGM Command Link	Radio frequency		

NOTES
A VARIETY OF NIGHT SIGHTS ARE AVAILABLE, SUCH AS THE KORNET-T SIGHT WITH 3,500 M RANGE (4,000 FOR DETECTING HELICOPTERS). IN OPFOR TIER 1, THE 9P149 NIGHT SIGHT IS 1PN79M3 2ND GEN, AND RANGES TO 5,500 M. A MODULAR AT-6 ATGM LAUNCHER SYSTEM WITH LAUNCHER / AUTOLOADER IS AVAILABLE FOR INSTALLATION ON VEHICLES, FIXED SITES AND BOATS. AT-9 (9M120F) AND AT-6 (9M114F) THERMOBARIC HE MULTI-PURPOSE MISSILES RANGE TO 6,000 M 9A2200 (ATAKA) ANTI-HELICOPTER MISSILE. IT HAS A PROXIMITY FUZE AND AN HE/FRANGIBLE ROD WARHEAD WHICH ASSURES A KILL WITH HIT OR NEAR MISS. IT CAN ALSO BE USED AGAINST LIGHT ARMORED VEHICLES OTHER MISSILE TYPES: A VERSION OF ATAKA, 9M120-1 NOW HAS RF PLUS LASER BEAM RIDER GUIDANCE. IT CAN BE USED ON 9P149 AND P-157, AND SOME RW AIRCRAFT. UPGRADES AT-6B AND AT-6C/KOKON-M (9M114M1, 2) CAN BE LAUNCHED FROM HELICOPTERS; BUT THEIR LENGTH EXCEEDS THE 1832-MM LIMIT FOR THE SHTURM-S AUTOLOADER, PREVENTING GROUND USE.

RUSSIAN ATGM LAUNCHER VEHICLE 9P157-2/KHRIZANTEMA-S





SYSTEM	SPECIFICATIONS	FIRE CONTROL	SPECIFICATIONS
Alternative Designations	Khrizantema AT-15	FCS Name	9K123
Date, Country of Origin	1996, RUS	Rangefinder	Laser
Proliferation	At least 11 country	IR Searchlight	None
Crew	2	Day Sight	EO
Combat Weight (mt)	14.1	Acquisition Range (m)	5500
Length (m)	6.73	Night Sight	1PN80/Kornet-TP therma
Height (m)	1.77	Acquisition Range (m)	4000
Width (m)	3.15	RADAR	MMW guidance
Platform	BMP-3 hull with no turret	Acquisition Range (m)	10,000
AUTOMOTIVE	SPECIFICATIONS	ATGM Guidance	Dual-mode: MMW, EO
Engine Type	500-hp Diesel	ATGM Command Link	Radar, SACLOS rider
Cruising Range (km)	600	AMMUNITION	SPECIFICATIONS
Max On-Road (km/h)	70	Missile Type, Name	ATGM, 9M123-2
Max Off-Road (km/h)	45	Max Range(m)	6000
Max Cross-Country (km/h)	35	Minimum Range (m)	400
Max Swim (km/h)	10	Penetration (mm), KE/CE	1500, CE
Fording Depth (m), note	Amphibious	Warhead Type	Tandem Shaped Charge (HEAT)
PROTECTION	SPECIFICATIONS	Missile Weight (kg)	45.0
Radio	R-173, R-173P	Missile Type, Name	ATGM, 9M123F-2 / AT-15B
Armor, Turret Front (mm):	INA	Max Range(m)	6000
Applique Armor (mm)	INA	Minimum Range (m)	400
Reactive Armor (mm):	INA	Penetration (mm), KE/CE	INA
Mobility (mine clearing, self-entrenching)	Entrenching blade	Warhead Type	High Explosive - Thermobaric
NBC Protection System	Collective	Missile Weight (kg)	INA
Smoke Equipment	N/A		

NOTES

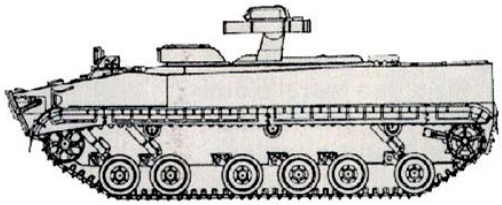
KRIZANTEMA-S LAUNCHER ASSEMBLY CAN MOUNT ON SHIPS AND VEHICLES.

ANOTHER UPGRADE PACKAGE FOR MI-28N/HAVOC HELICOPTER INCLUDES THE KHRIZANTEMA. THE TOR GYRO-STABILIZED EO POD CAN BE MOUNTED ON AIRCRAFT FOR GUIDING THE KRIZANTEMA-V AIR-LAUNCH VARIANT.

ADDITION OF AN EO AUTO-TRACKER WOULD PERMIT AN INCREASE IN THE RATE OF LAUNCH, BECAUSE THE GUNNER COULD SWITCH MORE RAPIDLY BETWEEN TARGETS. A VERSION OF AT-9/ATAKA, 9M120-1 NOW HAS RF AND LASER BEAM RIDER GUIDANCE. THUS IT CAN SUPPLEMENT KRIZANTEMA MISSILES IN THE LAUNCHER.

RUSSIAN ATGM LAUNCHER VEHICLE 9P162/KORNET-LR





SYSTEM	SPECIFICATIONS	FIRE CONTROL	SPECIFICATIONS
Alternative Designations	Kornet-T, BMP M1995	FCS Name	INA
Date, Country of Origin	1996, RUS	Beacon or Tracker Type	IR
Proliferation	2 countries	Rangefinder	Laser
Crew	2	IR Searchlight	None
Combat Weight (mt)	14.1	Day Sight	1PN80/Kornet-TP
Length (m)	6.73	Acquisition Range (m)	5500
Height (m)	1.77	Field of View (deg)	5.41
Width (m)	3.15	Night Sight	Kornet-T/1PN80 Thermal
Platform	BMP-3 hull with no turret	Acquisition Range (m)	4000
AUTOMOTIVE	SPECIFICATIONS	Field of View (deg)	7.8
Engine Type	500-hp Diesel	ATGM Guidance	Laser beam rider
Cruising Range (km)	600	ATGM Command Link	Laser beam guidance unit
Max On-Road (km/h)	70	ARMAMENT	SPECIFICATIONS
Max Off-Road (km/h)	45	Caliber(mm), Type, Name	ATGM, Various
Max Cross-Country (km/h)	35	Rate of Fire (prac, cyclic)	3,4
Max Swim (km/h)	10	Fire on Move	No
Fording Depth (m), note	Amphibious	Loader Type	Automated
PROTECTION	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Radio	R-173, R-173P	Missile Type, Name	ATGM, Kornet-LR/AT-14
Armor, Turret Front (mm):	INA	Max Range(m)	5500
Applique Armor (mm)	INA	Minimum Range (m)	100
Reactive Armor (mm):	INA	Penetration (mm), KE/CE	1200, CE
Mobility (mine clearing, self-entrenching)	Entrenching blade	Warhead Type	Shaped Charge (HEAT)
NBC Protection System	Collective	Missile Weight (kg)	27.0
Smoke Equipment	N/A	Missile Type, Name	ATGM, Kornet-LR HE
		Max Range(m)	5500
		Minimum Range (m)	100
		Penetration (mm), KE/CE	INA
		Warhead Type	High Explosive - Thermobaric
		Missile Weight (kg)	INA

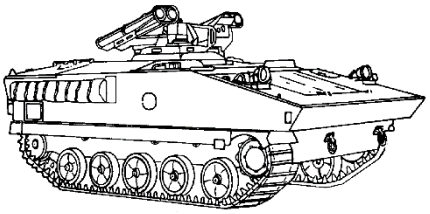
NOTES

KPB DISPLAYED A PROTOTYPE OVERHEAD WEAPONS MODULE TO MOUNT ON A VARIETY OF VEHICLES (DISPLAYED ON A HMMWV). IT HAS DUAL TWIN (4-TUBE) LAUNCHER, AND A CENTRAL MODULE WITH TV/FLIR SIGHTS AND MG.

ANOTHER ALTERNATIVE KORNET TURRET FOR ATGM LAUNCHER VEHICLES IS ATM: A MANNED TURRET WITH AN OVERHEAD WEAPON SYSTEM (OWS). ATM CAN MOUNT ON A VARIETY OF VEHICLES. (SEE PG. 6-68) KPB OFFERS THE KVARTET/9P163-2 OVERHEAD WEAPONS MODULE TO MOUNT ON A VARIETY OF VEHICLES (E.G., HMMWV AND VBL, SEE PG 6-31). IT HAS A DUAL TWIN (4-TUBE) LAUNCHER AND CENTRAL MODULE WITH TV/FLIR SIGHTS.

FRENCH ATGM LAUNCHER VEHICLE AMX-10 HOT





SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations		Caliber(mm), Type, Name	ATGM, Lancelot 3
Date, Country of Origin	INA, FRA	Rate of Fire (prac, cyclic)	3,4
Proliferation	At least 1 country	Fire on Move	No
Crew	4	Loader Type	Manual
Combat Weight (mt)	14.1	Elevation (deg min, max)	-12, +18
Length (m)	5.78	AMMUNITION	SPECIFICATIONS
Height (m)	2.57	Missile Type, Name	ATGM, HOT
Width (m)	2.78	Max Range(m)	4000
Platform	AMX-10P	Minimum Range (m)	80
AUTOMOTIVE	SPECIFICATIONS	Penetration (mm), KE/CE	800, CE
Engine Type	300-hp Diesel	Warhead Type	Shaped Charge (HEAT)
Cruising Range (km)	600	Missile Weight (kg)	32.0
Max On-Road (km/h)	65	Missile Type, Name	ATGM, HOT 2
Max Off-Road (km/h)	INA	Max Range(m)	4300
Max Cross-Country (km/h)	35	Minimum Range (m)	75
Max Swim (km/h)	7	Penetration (mm), KE/CE	1250, CE
Fording Depth (m), note	Amphibious	Warhead Type	Tandem shaped Charge (HEAT)
PROTECTION	SPECIFICATIONS	Missile Weight (kg)	32.0
Radio	VHF and intercom	Missile Type, Name	ATGM, HOT 3
Armor, Turret Front (mm):	12.7	Max Range(m)	4300
Applique Armor (mm)	INA	Minimum Range (m)	75
Reactive Armor (mm):	INA	Penetration (mm), KE/CE	1250, CE
Mobility (mine clearing, self-entrenching)	N/A	Warhead Type	Tandem shaped Charge (HEAT)
NBC Protection System	Collective	Missile Weight (kg)	32.0
Smoke Equipment	3 smoke grenade launchers		
FIRE CONTROL	SPECIFICATIONS		
FCS Name	INA		
Beacon or Tracker Type	INA		
Rangefinder	INA		
IR Searchlight	INA		
Day Sight	M509, 3x/12x		
Acquisition Range (m)	INA		
Field of View (deg)	INA		
Night Sight	Castor Thermal		
Acquisition Range (m)	INA		
Field of View (deg)	INA		
ATGM Guidance	SACLOS		

ATGM Command Link	Wire		

NOTES

THE AMX-10 HOT CONSTITUTES A HIGH-END APPLICATION ON THAT SPECTRUM, AND HAS NOT BEEN WIDELY PROLIFERATED. THE LANCELOT TURRET USED ON AMX-10 HOT CAN BE MOUNTED ON OTHER ARMORED FIGHTING VEHICLES.

THE HOT ANTITANK GUIDED MISSILE CAN BE LAUNCHED FROM A GROUND LAUNCHER. BUT THE CRUCIFORM-BASED SINGLE-TUBE GROUND LAUNCHER SYSTEM EXCEEDS THE WEIGHT LIMIT FOR THE PORTABLE CLASS OF ATGM LAUNCHERS. THUS IT WILL RARELY BE DISMOUNTED. HOWEVER, THE LAUNCHER CAN BE MOUNTED ON A VARIETY OF VEHICLES. MOST USE A SIMPLE PINTLE MOUNT. THE SINGLE-TUBE DISMOUNTABLE HOT FIRING STATION CAN BE FITTED ON LIGHT VEHICLES SUCH AS THE VBL. THUS THE OPFOR TIER 2 BATTALION ATGM LAUNCHER WAS PREVIOUSLY A HOT-3 PINTLE MOUNT VERSION ON THE VBL. IT HAS ALSO BEEN FITTED ON INFANTRY FIGHTING VEHICLES AND ATGM LAUNCHER VEHICLES, AND HELICOPTERS. ALTERNATE MOUNTS FOR THE LAUNCHER INCLUDE THE ATLAS/COMMANDO LIGHTWEIGHT LAUNCHER (140 KG) MOUNTED ON THE SPANISH SANTANA (4 X 4 LAND ROVER LIGHT TRUCK). THE TURRET CAN BE MOUNTED ON THE VBR CHASSIS, WHICH PERMITS EASIER CARRY OF THE LARGER HOT MISSILE THAN FOR ITS PREDECESSOR, THE VBL.

THE GERMAN JAGUAR 1 LAUNCHER VEHICLE IS AN UPGRADED VERSION OF THE RAKETENJAGDPANZER 2 VEHICLE WHICH LAUNCHED SS-11 ATGMS, THEN FITTED WITH A SINGLE-TUBE HOT LAUNCHER. THESE VEHICLES WERE ALL DERIVED FROM THE RELIABLE AND HIGHLY MOBILE LEOPARD 1 TANK CHASSIS.

THE FRENCH-PRODUCED VAB HOT USES A MEPHISTO RETRACTABLE TWIN-TUBE LAUNCHER, AND HAS AN ONBOARD LOAD OF 10 HOT ATGMS.

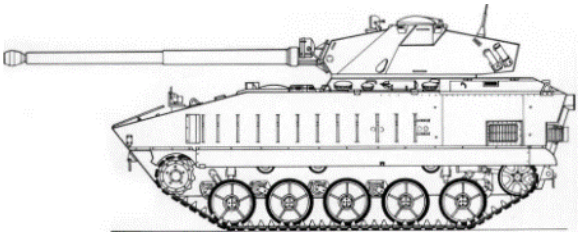
THE UTM800 TURRET HOLDS 4 X HOT MISSILES, WITH A STABILIZED SIGHT AND CASTOR THERMAL NIGHT SIGHT. THE TURRET IS USED IN TWO SYSTEMS. THE FRENCH VCR/TH EMPLOYS THE TURRET ON A PANHARD VCR/TT 6 X 6 APC CHASSIS. THE OTHER IS THE UTM TURRET ON A VAB APC CHASSIS.

AN UPDATED LAUNCHER FOR HOT-3 OFFERS A THERMAL MODULAR SYSTEM NIGHT SIGHT AND A DUAL BAND TRACKER. THE ATM LAUNCHER, SHOWN ON THE NEXT PAGE, CAN FIT A VARIETY OF VEHICLES AND LAUNCH HOT MISSILES OR MOUNT A COMBINATION OF MISSILES AND GUNS.

FRENCH SNPE EXPLOSIVE REACTIVE ARMOR CAN BE EMPLOYED ON AMX-10 TYPE VEHICLES, BUT THEY THEN LOSE THEIR SWIM CAPABILITY.

FRENCH FIRE SUPPORT VEHICLE AMX-10 PAC 90





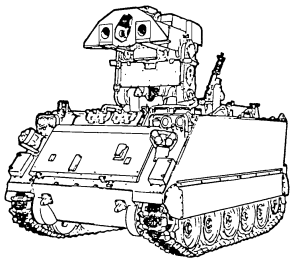
SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations	AMX-10PAC90 Marines	Caliber(mm), Type, Name	90, rifled gun, CN-90-F4 Super 90
Date, Country of Origin	1980, FRA	Rate of Fire (prac, cyclic)	
Proliferation	At least 3 countries	Fire on Move	No
Crew	3	Elevation (deg min, max)	-8, +15
Combat Weight (mt)	16.5	Caliber(mm), Type, Name	7.62, Coax MG, AAT 52
Length (m)	5.9	Rate of Fire (prac, cyclic)	700
Height (m)		Fire on Move	Yes
Width (m)	2.78	Caliber(mm), Type, Name	12.7, AA MG, M2HB
Ground Pressure (kg/cm^2)	0.60	Rate of Fire (prac, cyclic)	450, 550
Drive Formula		Fire on Move	Yes
AUTOMOTIVE	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Engine Type	300hp Diesel	Caliber(mm), Type, Name	90, APFSCS
Cruising Range (km)	600	Max Aimed Range (m)	2000
Max On-Road (km/h)	65	Max Eff Range, Day (m)	2000
Max Off-Road (km/h)		Max Eff Range, Night (m)	1650
Max Cross-Country (km/h)		Penetration (mm)	
Max Swim (km/h)	7	Combat Load (ready, stow)	20, 30
Fording Depth (m)	Amphibious	Caliber(mm), Type, Name	90, HEAT
PROTECTION	SPECIFICATIONS	Max Aimed Range (m)	2000
Radio		Max Eff Range, Day (m)	1100
Armor, Turret Front (mm):	12.7	Max Eff Range, Night (m)	1100
Applique Armor (mm)		Combat Load (ready, stow)	15
Reactive Armor (mm):		Caliber(mm), Type, Name	90, HE-ER
Mobility (mine clearing, self-entrenching)	No	Max Aimed Range (m)	3000
NBC Protection System	Collective	Max Eff Range, Day (m)	925
Smoke Equipment	4 smoke grenade launchers	Max Eff Range, Night (m)	925
FIRE CONTROL	SPECIFICATIONS	Combat Load (ready, stow)	15
FCS Name	Soptac	Caliber(mm), Type, Name	7.62
Main Gun Stabilization	No	Max Aimed Range (m)	1000
Rangefinder	Laser	Max Eff Range, Day (m)	800
Infrared Searchlight	Yes	Max Eff Range, Night (m)	800

Day Sight	Telescopic	Combat Load (ready, stow)	3200
Field of View (deg)		Caliber(mm), Type, Name	12.7, Sabot
Acquisition Range (m)	3000	Max Aimed Range (m)	2000
Night Sight	II night channel	Max Eff Range, Day (m)	2000
Field of View (deg)		Max Eff Range, Night (m)	1650
Acquisition Range (m)	1500	Combat Load (ready, stow)	500

NOTES
ORIGINAL SYSTEM LACKS 12.7MM AA MG. ORIGINAL FCS IS M563 TELESCOPIC SIGHT. FRENCH THOMPSON CANASTA FCS WITH LLLTV IS AVAILABLE.

US ATGM LAUNCHER VEHICLE M901





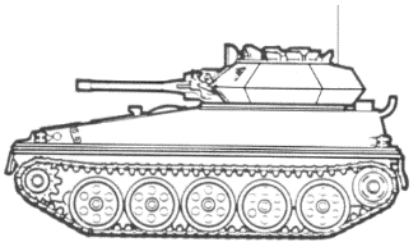
SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations	ITV, ITOW	Caliber(mm), Type, Name	ATGM, M27
Date, Country of Origin	1978, USA	Rate of Fire (prac, cyclic)	2
Proliferation	At least 8 countries	Fire on Move	No
Crew	4	Elevation (deg min, max)	-30, +34
Platform	M113A1	Loader Type	Manual
Combat Weight (mt)	11.79	Caliber(mm), Type, Name	7.62, Machinegun, INA
Length (m)	4.90	AMMUNITION	SPECIFICATIONS
Height (m)	2.91	Missile Type, Name	ATGM, TOW (BGM-71)
Width (m)	2.70	Max Range(m)	3750
AUTOMOTIVE	SPECIFICATIONS	Minimum Range (m)	65
Engine Type	212-hp DieseL	Penetration (mm KE)	600
Cruising Range (km)	483	Warhead Type	Shaped Charge (HEAT)
Max On-Road (km/h)	64	Missile Weight (kg)	25.5
Max Off-Road (km/h)	INA	Missile Type, Name	ATGM, ITOW (BGM-71C)
Max Cross-Country (km/h)	INA	Max Range(m)	3750
Max Swim (km/h)	5.8	Minimum Range (m)	65
Fording Depth (m), note	Amphibious	Penetration (mm KE)	800
PROTECTION	SPECIFICATIONS	Warhead Type	127-mm HEAT with a short
Radio	Various, including intercom	Missile Weight (kg)	25.7
Armor, Turret Front (mm):	INA	Missile Type, Name	ATGM, TOW2 (BGM-71D)
NBC Protection System	None	Max Range(m)	3750
Smoke Equipment	8 smoke grenade launchers	Minimum Range (m)	65
FIRE CONTROL	SPECIFICATIONS	Penetration (mm KE)	900
FCS Name	ATM	Warhead Type	152-mm HEAT bigger probe
Beacon or Tracker Type	Xenon (Infrared), thermal	Missile Weight (kg)	28.0
Rangefinder	INA	Missile Type, Name	ATGM, TOW 2A (BGM-71E)
Day Sight	Day sight/tracker, 13x	Max Range(m)	3750
Field of View (deg)	5.5	Minimum Range (m)	65
Acquisition Range (m)	INA	Penetration (mm KE)	900
Night Sight	AN/TAS-4 thermal sight	Warhead Type	Tandem Shaped Charge (Large HEAT, long probe)
Field of View (deg)	INA	Missile Weight (kg)	22.65
Acquisition Range (m)	INA	Missile Type, Name	ATGM, TOW 2B (BGM-71F)
ATGM Guidance	SACLOS	Max Range(m)	3750
ATGM Command Link	Wire	Minimum Range (m)	200
		Penetration (mm KE)	900

		Warhead Type	Dual explosive-formed penetrators (EFP),top-attack
		Missile Weight (kg)	22.60

NOTES
THE LOADER HAS SIDE AND OVERHEAD PROTECTION DURING LOADING, WHICH REQUIRES 40 SECONDS. THE IMPROVED TARGET ACQUISITION SYSTEM (ITAS) WAS DEVELOPED FOR TOW 2 AND LATER. IT INCLUDES A LASER RANGEFINDER, INCREASED ACQUISITION RANGE, IMPROVED NIGHT CAPABILITIES (SECOND-GENERATION THERMAL CHANNEL), AN AUTOMATIC BORE-SIGHT AND GREATER HIT PROBABILITY.

BRITISH COMBAT RECONNAISSANCE VEHICLE SCORPION





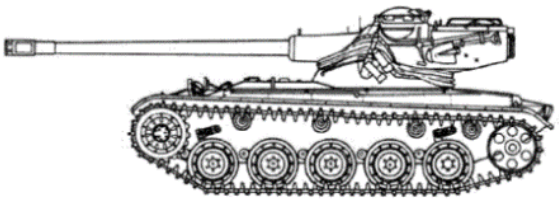
SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations	FV101	Caliber(mm), Type, Name	76, Rifled gun, L23A1
Date, Country of Origin	1972, GBR	Rate of Fire (prac, cyclic)	6
Proliferation	At least 18 countries	Fire on Move	No
Crew	3	Elevation (deg min, max)	-10, +35
Troop Capacity	0	Caliber(mm), Type, Name	7.62, COAX Machinegun, L8A1
Combat Weight (mt)	8.07	Rate of Fire (prac, cyclic)	250, 650
Length (m)	4.79	Fire on Move	Yes
Height (m)	2.10	AMMUNITION	SPECIFICATIONS
Width (m)	2.24	Caliber(mm), Type, Name	76, HESH, L29
Ground Pressure (kg/cm^2)	0.36	Max Aimed Range (m)	2,200
AUTOMOTIVE	SPECIFICATIONS	Max Eff Range, Day (m)	
Engine Type	190-hp Gasoline	Max Eff Range, Night (m)	
Cruising Range (km)	650	Penetration (mm KE)	
Max On-Road (km/h)	80	Combat Load (ready, stow)	
Max Cross-Country (km/h)	25	Caliber(mm), Type, Name	76, INDIR HE, L24A1/2
Max Swim (km/h)	6	Max Aimed Range (m)	
Fording Depth (m)	1.07, Amphibious	Max Eff Range, Day (m)	5000
PROTECTION	SPECIFICATIONS	Max Eff Range, Night (m)	
Radio	INA	Penetration (mm KE)	
Armor, Turret Front (mm):	20	Combat Load (ready, stow)	
NBC protection system	Yes	Caliber(mm), Type, Name	7.62
Smoke Equipment	4 smoke grenade launchers	Max Aimed Range (m)	1500
FIRE PROTECTION	SPECIFICATIONS	Max Eff Range, Day (m)	1000
FCS Name	INA	Max Eff Range, Night (m)	600
Main Gun Stabilization	No		
Rangefinder	Laser		
Infrared Searchlight	Yes		
Day Sight	Barr and Stroud Tank Laser Sight, 10x		
Acquisition Range (m)	2200		
Night Sight	GEC SS100, II, x5.8/1.6		
Acquisition Range (m)	INA		

NOTES
SCORPION 90: VARIANT WITH A 90-MM COCKERILL MK III GUN.

A NUMBER OF VEHICLES USE THE SAME ALVIS CHASSIS. THEY INCLUDE THE SCIMITAR ARMORED RECONNAISSANCE VEHICLE, STRIKER ARMORED ATGM LAUNCHER VEHICLE, SPARTAN ARMORED PERSONNEL CARRIER OR MILAN ATGM LAUNCHER, STORMER MODERNIZED APC, SAMARITAN ARMORED AMBULANCE, AND SABER MODERNIZED RECONNAISSANCE VEHICLE.
AS A REFLECTION OF THE VEHICLE'S SUITABILITY FOR A VARIETY OF ROLES, IN RECENT TIMES IT IS REFERRED TO AS AN ARMORED RECONNAISSANCE VEHICLE OR COMBAT VEHICLE RECONNAISSANCE (TRACKED)--CVR (T). A BRITISH UPGRADE PROGRAM INCLUDES A DIESEL ENGINE, THERMAL SIGHTS, AND SECURE COMMUNICATIONS. THE TANK LASER SIGHT AND AVIMO LV10 DAY/NIGHT LRF SIGHT CAN ACCEPT A THERMAL CHANNEL. THERMAL SIGHTS ARE AVAILABLE FOR USE ON THE TANK.

FRENCH LIGHT TANK AMX-13





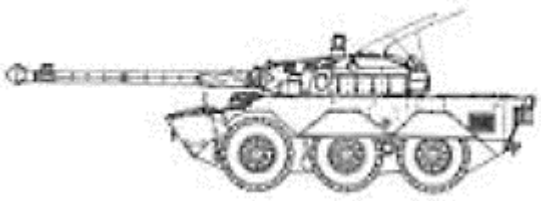
SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations	AMX-13/90	Caliber(mm), Type, Name	90, Rifled Gun, CN-90-F3
Date, Country of Origin	1966, FRA	Rate of Fire (prac, cyclic)	
Proliferation	At least 15 countries	Fire on Move	No
Crew	3	Elevation (deg min, max)	-5.5, +12.5
Combat Weight (mt)	15	Caliber(mm), Type, Name	7.62, Coax MG, AA52
Length (m)	4.88	Rate of Fire (prac, cyclic)	Number, Number
Height (m)	2.28	Fire on Move	Yes
Width (m)	2.51	AMMUNITION	SPECIFICATIONS
Ground Pressure (kg/cm²)	0.74	Caliber(mm), Type, Name	90, APFSDS, OFL 90 F1
Drive Formula	Tracked	Max Aimed Range (m)	2000
AUTOMOTIVE	SPECIFICATIONS	Max Eff Range, Day (m)	1600
Engine Type	250-hp Gasoline	Max Eff Range, Night (m)	1000
Cruising Range (km)	350	Penetration (mm)	120, K
Max On-Road (km/h)	60	Combat Load (ready, stow)	34
Max Off-Road (km/h)		Caliber(mm), Type, Name	90, HEAT,
Max Swim (km/h)		Max Aimed Range (m)	
Fording Depth (m), note	2.1, with snorkel	Max Eff Range, Day (m)	1000
PROTECTION	SPECIFICATIONS	Max Eff Range, Night (m)	1000
Radio	TR-VP118 and intercom	Penetration (mm)	160, C
Armor, Turret Front (mm):	25	Combat Load (ready, stow)	
Applique Armor (mm)	Number	Caliber(mm), Type, Name	90, HEAT, OCC 90-62
Reactive Armor (mm):	Number	Max Aimed Range (m)	1800
Mobility (mine clearing, self-entrenching)	Text	Max Eff Range, Day (m)	1000
NBC Protection System	Text	Max Eff Range, Night (m)	1000
Smoke Equipment	2 x 2 grenade launchers	Penetration (mm)	120, C
FIRE CONTROL	SPECIFICATIONS		
FCS Name			
Main Gun Stabilization			
Rangefinder			
Infrared Searchlight	Yes		
Day Sight	L862 7.5x and 8x		
Field of View (deg)	Number		
Acquisition Range (m)	Number		
Night Sight	OB-11-A 5x		

Field of View (deg)	Number		
Acquisition Range (m)	800		

NOTES
AMX-13 MODEL 51 – ORIGINAL TANK DESTROYER/RECON VEHICLE W/75MM GUN. UPGRADED DIESEL ENGINE AND A 7.62MM AA MG. 2 VERSIONS WERE FITTED WITH 2 X SS-11 OR 3XHOT ATGM LAUNCHERS
AMX-13/105 - VARIANT WITH A GIAT 105G1 105MM GUN
AMX-13 CD MODEL 55 - ARMORED VEHICLE RECOVERY VARIANT
AMX-13 DCA – AIR DEFENSE VARIANT WITH TWIN 30MM GUNS
AMX-13 WITH LAR – MULTIPLE ROCKET LAUNCHER SYSTEM
AMX 105 MK 61 – SELF PROPELLED HOWITZER VARIANT
AMX F3 – 155MM SELF-PROPELLED GUN
AMX-VCI – VARIANT USED AS AN APC

FRENCH ARMORED RECONNAISSANCE VEHICLE AMX-10RC



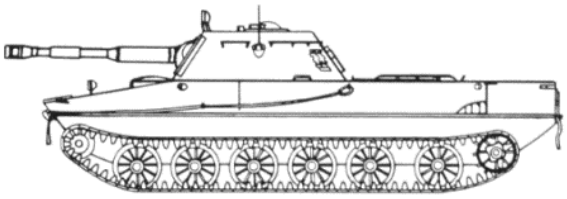


SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations		Caliber(mm), Type, Name	105, Rifled Gun, CN-105-F2
Date, Country of Origin	1979, FRA	Rate of Fire (prac, cyclic)	
Proliferation	At least 3 countries	Fire on Move	No
Crew	4	Elevation (deg min, max)	-8, +20
Combat Weight (mt)	15.8	Caliber(mm), Type, Name	7.62, COAX MG, Text
Length (m)	6.35	Rate of Fire (prac, cyclic)	
Height (m)	2.29	Fire on Move	Yes
Width (m)	2.95	AMMUNITION	SPECIFICATIONS
Ground Pressure (kg/cm^2)		Caliber(mm), Type, Name	105, APFSDS-T, Giat
Drive Formula	6 x 6 wheeled	Max Aimed Range (m)	2000
AUTOMOTIVE	SPECIFICATIONS	Max Eff Range, Day (m)	1500
Engine Type	260-hp Diesel	Max Eff Range, Night (m)	
Cruising Range (km)	1000	Penetration (mm)	
Max On-Road (km/h)	85	Combat Load (ready, stow)	10
Max Off-Road (km/h)		Caliber(mm), Type, Name	105, HEAT-T, French Giat
Max Cross-Country (km/h)		Max Aimed Range (m)	1130
Max Swim (km/h)	4.5	Max Eff Range, Day (m)	1250
Fording Depth (m), note		Max Eff Range, Night (m)	
PROTECTION	SPECIFICATIONS	Penetration (mm)	100, C
Radio		Combat Load (ready, stow)	9,
Armor, Turret Front (mm):		Caliber(mm), Type, Name	105, HE, OE 105 Mle F3
Applique Armor (mm)		Max Aimed Range (m)	2500
Reactive Armor (mm):		Max Eff Range, Day (m)	1000
Mobility (mine clearing, self-entrenching)		Max Eff Range, Night (m)	
NBC Protection System	Yes	Penetration (mm)	
Smoke Equipment	2 x 2 grenade launchers	Combat Load (ready, stow)	19
FIRE CONTROL	SPECIFICATIONS		
FCS Name	COTAC M401		
Main Gun Stabilization	No		
Rangefinder	Cilas APX M550 laser		
Infrared Searchlight	No		
Day Sight	APX M504-04 10x		
Night Sight	DIVT 13 LLLTV		

NOTES
DESERT STORM VERSION – VEHICLES HAVE APPLIQUE ARMOR, AN ATGM IRCM DECOY DEVICE, AND A DIVT 16 THERMAL SIGHT, RANGE 4000M
THE ALIS MODULAR THERMAL SIGHT CAN BE USED ON THE AMX-10RC. A 280-HP BAUDOUIN ENGINE REPLACED THE ORIGINAL ENGINE IN SOME UPGRADES. IN 1997 THE FRENCH ARMY DEMONSTRATED A VERSION OF THE LECLERC BATTLEFIELD MANAGEMENT SYSTEM ON THE AMX-10RC.

RUSSIAN AMPHIBIOUS TANK PT-76B





SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations		Caliber(mm), Type, Name	76, Rifled gun, D-56B
Date, Country of Origin	1952, RUS	Rate of Fire (prac, cyclic)	6, 8
Proliferation	At least 21 countries	Fire on Move	Yes
Crew	3	Elevation (deg min, max)	-4, + 30
Troop Capacity	0	Caliber(mm), Type, Name	7.62, Machinegun, PKT
Combat Weight (mt)	14.0	Rate of Fire (prac, cyclic)	250, 650
Length (m)	6.91	Fire on Move	Yes
Height (m)	2.26	AMMUNITION	SPECIFICATIONS
Width (m)	3.14	Caliber(mm), Type, Name	76, HVAP-T, BM-354P
Ground Pressure (kg/cm^2)	0.46	Max Aimed Range (m)	1,060
AUTOMOTIVE	SPECIFICATIONS	Max Eff Range, Day (m)	650
Engine Type	240-hp Diesel	Max Eff Range, Night (m)	600
Cruising Range (km)	260	Penetration (mm KE)	50
Max On-Road (km/h)	44	Combat Load (ready, stow)	
Max Cross-Country (km/h)	25	Caliber(mm), Type, Name	76, HEAT, BK-350M
Max Swim (km/h)	10	Max Aimed Range (m)	1000
Fording Depth (m)	Amphibious	Max Eff Range, Day (m)	650
PROTECTION	SPECIFICATIONS	Max Eff Range, Night (m)	600
Radio	R-123	Penetration (mm KE)	280
Armor, Turret Front (mm):	20	Combat Load (ready, stow)	
Smoke Equipment	VEESS	Caliber(mm), Type, Name	76, Frag-HE, OF-350
FIRE CONTROL	SPECIFICATIONS	Max Aimed Range (m)	4000
FCS Name	Text	Max Eff Range, Day (m)	
Main Gun Stabilization	Yes	Max Eff Range, Night (m)	600
Rangefinder		Penetration (mm KE)	
Infrared Searchlight	Yes	Caliber(mm), Type, Name	7.62
Day Sight	TShK-66	Max Aimed Range (m)	1500
Acquisition Range (m)	4000	Max Eff Range, Day (m)	1000
Night Sight	TVN-28 IR	Max Eff Range, Night (m)	600
Acquisition Range (m)	600		

NOTES

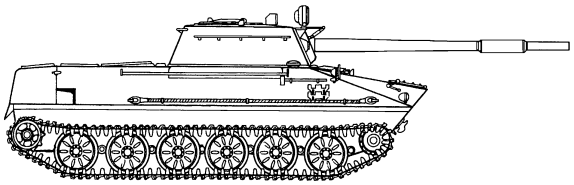
ORIGINAL PT-76 WAS PRODUCED IN LIMITED NUMBERS WITH A NON-STABILIZED MAIN GUN. SOME PT-76S ARE AUGMENTED WITH 12.7-MM AA MGS. API ROUND CAN DEFEAT ALL LAVS, AND MOST HACVS THE CHASSIS WAS DERIVED FROM THE BTR-50 APC CHASSIS. ISRAEL OFFERS AN UPGRADE PACKAGE WITH A 90-MM GUN, LRF FIRE CONTROL AND A 300-HP ENGINE.

M1985: NORTH KOREAN VARIANT LIGHT TANK.

POLISH PT-76: VARIANT WITH A COMMANDER'S HATCH AND 12.7-MM MG.TYPE 63: CHINESE VARIANT WITH A NEW TURRET, 85-MM GUN, AND 12.7-MM AA MG. PT-76E: RECENT UPGRADE PROGRAM FEATURES A STABILIZED VERSION OF THE 57-MM S-60 AUTOMATIC AA GUN (70 RDS/MIN), WITH COMPUTER FIRE CONTROL SYSTEM AND A THERMAL SIGHT. OTHER FEATURES ARE A MORE POWERFUL ENGINE AND IMPROVED TRACKS.

NORTH KOREAN LIGHT TANK M1985/PT-85





SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations		Caliber(mm), Type, Name	85, Rifled gun, Type 62/63
Date, Country of Origin	1985, PRK	Rate of Fire (prac, cyclic)	6, 8
Proliferation	At least 1 country	Fire on Move	Yes
Crew	3	Elevation (deg min, max)	-4, + 30
Combat Weight (mt)	19.0	Caliber(mm), Type, Name	12.7, HMG, Type 54/DShKM
Length (m)	7.0	Rate of Fire (prac, cyclic)	250, 650
Height (m)	2.6	Fire on Move	Yes
Width (m)	3.2	Caliber(mm), Type, Name	7.62, Machinegun, PKT
Ground Pressure (kg/cm^2)	INA	Rate of Fire (prac, cyclic)	250, 650
AUTOMOTIVE	SPECIFICATIONS	Fire on Move	Yes
Engine Type	320-hp Diesel	Caliber(mm), Type, Name	ATGM, 9P111
Cruising Range (km)	500	Rate of Fire (prac, cyclic)	2
Max On-Road (km/h)	60	AMMUNITION	SPECIFICATIONS
Max Off-Road (km/h)	INA	Caliber(mm), Type, Name	85, HVAP-T, BR-365PK
Max Cross-Country (km/h)	INA	Max Aimed Range (m)	1500
Max Swim (km/h)	10	Max Eff Range, Day (m)	1150
Fording Depth (m), note	Amphibious	Max Eff Range, Night (m)	800
PROTECTION	SPECIFICATIONS	Penetration (mm), KE/CE	130, KE
Radio	INA	Caliber(mm), Type, Name	85, APC-T, Type 367
Armor, Turret Front (mm):	30	Max Aimed Range (m)	1500
Applique Armor (mm)	N/A	Max Eff Range, Day (m)	1150
Reactive Armor (mm):	N/A	Max Eff Range, Night (m)	800
Mobility (mine clearing, self-entrenching)	N/A	Penetration (mm), KE/CE	120, CE
NBC Protection System	INA	Caliber(mm), Type, Name	85, HEAT-FS/BK-2M
Smoke Equipment	INA	Max Aimed Range (m)	1500
FIRE CONTROL	SPECIFICATIONS	Max Eff Range, Day (m)	1150
FCS Name	INA	Max Eff Range, Night (m)	800
Main Gun Stabilization	No	Penetration (mm), KE/CE	100, KE
Rangefinder	None	Missile Type, Name	ATGM, AT-3
Infrared Searchlight	Yes	Max Effective Range(m)	3000
Day Sight	INA	Penetration (mm), KE/CE	410, CE
Field of View (deg)	INA	Warhead Type	Tandem HEAT
Acquisition Range (m)	3000	Missile Type, Name	ATGM, Red Arrow-73A (CHN)
Night Sight	INA	Max Effective Range(m)	3000
Field of View (deg)	INA	Penetration (mm), KE/CE	580, CE
Acquisition Range (m)	800	Warhead Type	HEAT

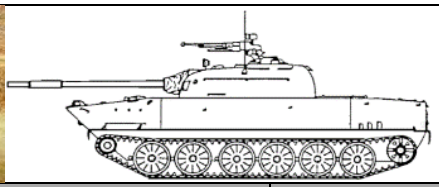
		Missile Type, Name	ATGM, Malyutka-2
		Max Effective Range(m)	3000
		Penetration (mm), KE/CE	INA
		Warhead Type	Frag-HE

NOTES

CHASSIS IS DERIVED FROM NORTH KOREAN STRETCHED VTT-323 APC CHASSIS. THE M1985 CHASSIS IS DERIVED FROM THE NORTH KOREAN VTT-323, AND IS SIMILAR TO THE RUSSIAN PT-76 AMPHIBIOUS TANK. THE TURRET ON THE M1985 IS AN INDIGENOUS DESIGN. MAIN GUN IS OF THE FAMILY WHICH INCLUDES CHINESE TYPE 62 AND 63 TANK GUNS, CHINESE TYPE 56/ FSU D-44 FIELD GUNS, AND THE T-34/85 TANK. THEREFORE, AMMUNITION OPTIONS INCLUDE THE VARIETY OF AMMUNITION AVAILABLE FOR THESE GUNS. THE AT-3 TYPE ATGM CAN BE UPGRADED BY AN OPERATOR WITH A NEW WARHEAD IN MINUTES. LOW-MID LEVEL MAINTENANCE CAN UPGRADE THE MISSILE MOTOR. THE HE-BLAST ATGM IS USED FOR KILLING PERSONNEL AND DESTROYING BUNKERS AND OTHER FORTIFICATIONS.

CHINESE AMPHIBIOUS LIGHT TANK TYPE 63A (MODERNIZED)





SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations	Type 99, Type ZTS 63A	Caliber(mm), Type, Name	105, Rifled gun, INA
Date, Country of Origin	1999, CHN	Rate of Fire (prac, cyclic)	8
Proliferation	At least 1 country	Fire on Move	Yes
Crew	3	Elevation (deg min, max)	-4, +22
Combat Weight (mt)	INA	Caliber(mm), Type, Name	12.7, Machine gun, W 85
Length (m)	8.15	Rate of Fire (prac, cyclic)	600, 100
Height (m)	INA	Caliber(mm), Type, Name	7.62, COAX MG, L8A1
Width (m)	3.20	Rate of Fire (prac, cyclic)	250, 650
Ground Pressure (kg/cm^2)	INA	Caliber(mm), Type, Name	105, ATGM, Arkan/AT-10B
AUTOMOTIVE	**SPECIFICATIONS**	**AMMUNITION**	**SPECIFICATIONS**
Engine Type	580-hp Diesel, or 1,000	Caliber(mm), Type, Name	105, APFSDS-T, Chinese
Cruising Range (km)	730	Max Aimed Range (m)	3000
Max On-Road (km/h)	64	Max Eff Range, Day (m)	3000
Max Off-Road (km/h)	28	Max Eff Range, Night (m)	3000
Max Cross-Country (km/h)	28	Penetration (mm KE)	460
Max Swim (km/h)	1.3	Caliber(mm), Type, Name	105, APFSDS, H6/62
Fording Depth (m), note	Amphibious	Max Aimed Range (m)	3000
PROTECTION	**SPECIFICATIONS**	Max Eff Range, Day (m)	3000
Radio	A-220A	Max Eff Range, Night (m)	3000
Armor, Turret Front (mm):	INA	Penetration (mm KE)	INA
Applique Armor (mm)	INA	Caliber(mm), Type, Name	105, HESH, L35 (UK)
Reactive Armor (mm):	INA	Max Aimed Range (m)	5000
Mobility	N/A	Max Eff Range, Day (m)	3000
NBC Protection System	Probable	Max Eff Range, Night (m)	3000
Smoke Equipment	8 x smoke grenade launcher	Penetration (mm KE)	INA
FIRE CONTROL	**SPECIFICATIONS**	Caliber(mm), Type, Name	105, HEAT, M456 (multi)
FCS Name	INA	Max Aimed Range (m)	3000
Main Gun Stabilization	Yes	Max Eff Range, Day (m)	3000
Rangefinder	Laser	Max Eff Range, Night (m)	3000
Infrared Searchlight	Yes	Penetration (mm KE)	432
Day Sight	INA	Caliber(mm), Type, Name	7.62-mm (7.62x 54R)
Field of View (deg)	INA	Max Aimed Range (m)	2000
Acquisition Range (m)	5500	Max Eff Range, Day (m)	1000
Night Sight	Thermal	Missile Type, Name	Arkan/AT-10B
Field of View (deg)	INA	Launch Method	Main-gun Tube
Acquisition Range (m)	5000	Max Effective Range(m)	5500
ATGM Guidance	SACLOS, Laser	Penetration (mm KE)	750
ATGM Command Link	Encoded IR laser	Warhead Type	Tandem shaped charge

NOTES (NONE)

CHINESE ATGM LAUNCHER VEHICLE TYPE 92B/RED ARROW-9

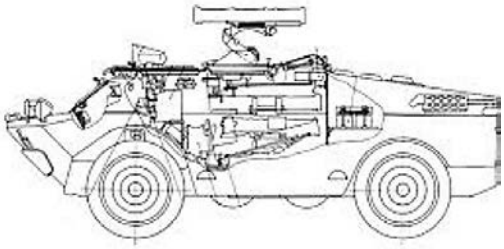


SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations	WXLZ602B for vehicle. AKA RA-9, Hong Jian-9, and HJ-9	Caliber(mm), Type, Name	ATGM, Red Arrow-9
Date, Country of Origin	1999, CHN	Rate of Fire (prac, cyclic)	3,4
Proliferation	1 country for vehicles and missile.	Fire on Move	No
Crew	3	Elevation (deg min, max)	-10, +10
Platform	WZ-550	Loader Type	Auto or Manual
Combat Weight (mt)	12.5	AMMUNITION	SPECIFICATIONS
Length (m)	6.63	Missile Type, Name	ATGM, Red Arrow-9
Height (m)	2.8	Max Range(m)	5,000
Width (m)	2.8	Minimum Range (m)	100
Ground Pressure (kg/cm^2)	INA	Penetration (mm KE)	1200
Drive Formula	4x4	Warhead Type	152-mm Tandem shaped Charge (HEAT)
AUTOMOTIVE	SPECIFICATIONS	Missile Weight (kg)	37
Engine Type	320-hp BF8L413F Diesel	VARIANTS	
Cruising Range (km)	800	THE SYSTEM IS ONLY VEHICLE-MOUNTED. FIRST FIELDED VEHICLE IS TYPE 92B. A RECENTLY SHOWN 4-TUBE LAUNCHER MOUNTS MISSILES IN AN ARMORED BOX. A SINGLE TUBE LAUNCHER WAS DEVELOPED FOR LIGHT VEHICLES. INITIAL VERSION IS ON THE NJ2046 4X4 LIGHT UTILITY VEHICLE. HIGH EXPLOSIVE THERMOBARIC. RED ARROW-9A: MMW-HOMING VERSION - IN DEVELOPMENT. RED ARROW-9B: SEMI-ACTIVE LASER HOMING- IN DEVELOPMENT.	
Max On-Road (km/h)	95		
Max Off-Road (km/h)	INA		
Max Cross-Country (km/h)	INA		
Max Swim (km/h)	8		
Fording Depth (m), note	Amphibious		
PROTECTION	SPECIFICATIONS		
Radio	INA		
Armor, Turret Front (mm):	INA		
NBC Protection System	None		
Smoke Equipment	INA		
FIRE CONTROL	SPECIFICATIONS		
FCS Name	ATM		
Beacon or Tracker Type	INA		
Rangefinder	Laser rangefinder 10,000m		
Day Sight	Low light level TV with auto-tracker, NFI		
Acquisition Range (m)	5000		
Night Sight	Thermal Image System, INA		
Acquisition Range (m)	4000		
ATGM Guidance	SACLOS		
ATGM Command Link	Laser beam rider guidance		

NOTES
THE MISSILE APPEARS TO HAVE BEEN DERIVED FROM THE U.S. TOW MISSILE, WITH UPGRADES IN RANGE, GUIDANCE, AND WARHEAD DESIGN.

RUSSIAN ATGM LAUNCHER VEHICLE 9P148



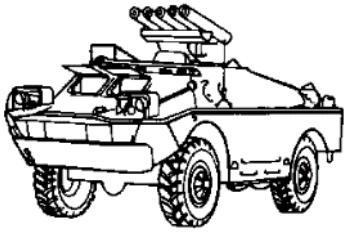


SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations	BRDM-2/AT-5	Caliber(mm), Type, Name	ATGM, 9P135M3
Date, Country of Origin	1977, PRK	Rate of Fire (prac, cyclic)	3,4
Proliferation	At least 6 countries	Fire on Move	No
Crew	2	AMMUNITION	SPECIFICATIONS
Combat Weight (mt)	7.0	Missile Type, Name	ATGM, AT-5/SPANDREL
Length (m)	5.73	Max Range(m)	4000
Height (m)	2.31	Minimum Range (m)	75
Width (m)	2.26	Penetration (mm), KE/CE	650, CE
Drive Formula	4x4	Warhead Type	Shaped Charge (HEAT)
AUTOMOTIVE	SPECIFICATIONS	Missile Weight (kg)	25.2
Engine Type	140-hp Gasoline	Missile Type, Name	ATGM, AT-5B
Cruising Range (km)	750	Max Range(m)	4000
Max On-Road (km/h)	100	Minimum Range (m)	75
Max Off-Road (km/h)	INA	Penetration (mm), KE/CE	925, CE
Max Cross-Country (km/h)	INA	Warhead Type	Tandem Shaped (HEAT)
Max Swim (km/h)	10	Missile Weight (kg)	26.5
Fording Depth (m), note	Amphibious	Missile Type, Name	ATGM, AT-4/SPIGOT
PROTECTION	SPECIFICATIONS	Max Range(m)	4000
Radio	R-123	Minimum Range (m)	75
Armor, Turret Front (mm):	30	Penetration (mm), KE/CE	480, CE
Applique Armor (mm)	N/A	Warhead Type	Shaped Charge (HEAT)
Reactive Armor (mm):	N/A	Missile Weight (kg)	13.0
Mobility (mine clearing, self-entrenching)	N/A /A	Missile Type, Name	ATGM, AT-4B
NBC Protection System	Collective	Max Range(m)	2500
Smoke Equipment	N/A	Minimum Range (m)	70
FIRE CONTROL	SPECIFICATIONS	Penetration (mm), KE/CE	550, CE
FCS Name	INA	Warhead Type	Shaped Charge (HEAT)
Beacon or Tracker Type	Incandescent, IR, 9S451M1	Missile Weight (kg)	13.4
Rangefinder	N/A	VARIANTS	
IR Searchlight	N/A	9P137: Original launcher vehicle with 5 AT-5 launch rails	
Day Sight	9Sh119M1		
Acquisition Range (m)	4500		
Night Sight	1PN65		
Acquisition Range (m)	2500		
ATGM Guidance	SACLOS		
ATGM Command Link	Wire		

NOTES
A VARIETY OF ATGM MIXES HAVE BEEN SEEN WITH 9P148, BETWEEN AT-4 AND AT-5-TYPE ATGMS. THE PRIMARY BENEFIT OF ADAPTABILITY IS INCREASED LAUNCHER LOAD AND ADAPTABILITY TO USER COUNTRIES' INVENTORIES OF ATGMS. MOST COMMON ATGM IS AT-5. AS AT-5B IS PRODUCED, IT IS LIKELY TO REPLACE AT-5 IN BETTER-BUDGETED COUNTRY INVENTORIES. RELOAD TIME FOR THE LAUNCHER IS 25 SECONDS. RUSSIAN FIRMS HAVE DEVELOPED COUNTERMEASURES, SUCH AS ENCODED-PULSE BEACONS FOR ATGMS AND COUNTER-DAZZLER ADJUSTMENTS TO THE 9S451M1 GUIDANCE BOX. FILTERS CAN BE MOUNTED IN FRONT OF RETICLES. THE 1PN66 THERMAL SIGHT IS AVAILABLE FOR THE ATGM LAUNCHER. ACQUISITION RANGE IS APPROXIMATELY 2,500 METERS. RUSSIAN KBP OFFERS A DROP-IN ONE-MAN TURRET, CALLED KLIVER, WITH A STABILIZED 2A72 30-MM GUN, A 4 KORNET ATGM LAUNCHER, THERMAL SIGHTS, AND IMPROVED FIRE CONTROL SYSTEM.

RUSSIAN/EUROPEAN ATGM LAUNCHER VEHICLE BRDM-2 HOT 3





SYSTEM	SPECIFICATIONS
Alternative Designations	ATM on BRDM-2
Date, Country of Origin	INA, RUS
Proliferation	More than 8 countries
Crew	3
Combat Weight (mt)	INA
Length (m)	5.78
Height (m)	2.57
Width (m)	2.78
Platform	BRDM-2
AUTOMOTIVE	**SPECIFICATIONS**
Engine Type	300-hp Diesel
Cruising Range (km)	600
Max On-Road (km/h)	65
Max Off-Road (km/h)	INA
Max Cross-Country (km/h)	35
Max Swim (km/h)	7
Fording Depth (m), note	Amphibious
PROTECTION	**SPECIFICATIONS**
Radio	VHF and intercom
Armor, Turret Front (mm):	12.7
Applique Armor (mm)	INA
Reactive Armor (mm):	INA
Mobility	N/A
NBC Protection System	Collective
Smoke Equipment	3 smoke grenade launchers
FIRE CONTROL	**SPECIFICATIONS**
FCS Name	ATM
Beacon or Tracker Type	Xenon
Rangefinder	Laser 15,000
Day Sight	TV, NFI
Acquisition Range (m)	4000
Night Sight	Thermal Image System, NFI
Acquisition Range (m)	4000
ATGM Guidance	SACLOS
ATGM Command Link	Wire

ARMAMENT	SPECIFICATIONS
Caliber(mm), Type, Name	ATGM, ATM
Rate of Fire (prac, cyclic)	3,4
Fire on Move	No
Loader Type	Manual
Elevation (deg min, max)	-12, +18
AMMUNITION	**SPECIFICATIONS**
Missile Type, Name	ATGM, HOT 3
Max Range(m)	4300
Minimum Range (m)	75
Penetration (mm), KE/CE	1250, CE
Warhead Type	Tandem shaped Charge (HEAT)
Missile Weight (kg)	32.0
Missile Type, Name	ATGM, HOT 2
Max Range(m)	4300
Minimum Range (m)	75
Penetration (mm), KE/CE	1250, CE
Warhead Type	Tandem shaped Charge (HEAT)
Missile Weight (kg)	32.0

VARIANTS

ATM variants include sensor only pods, and ATGMs on up to 4 weapon stations in mix with MG, 20/30-mm cannon, and Russian or Euospatiale ATGMs. Other ATM vehicle applications include BMP-3/ATM, Pandur/ATM (photo), HMMWV/ATM, Puma 4x4 ATM, Tactica/ATM, Fennek/ATM, and Wiesel/ATM HOT variants.

NOTES

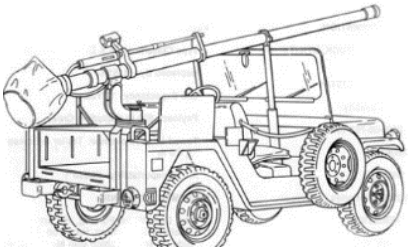
THE HOT ANTITANK GUIDED MISSILE IS PRODUCED BY A EUROPEAN CONSORTIUM, WHICH INCLUDES COMPANIES IN FRANCE AND GERMANY. THE CRUCIFORM-BASED SINGLE-TUBE GROUND LAUNCHER SYSTEM EXCEEDS THE WEIGHT LIMIT FOR THE PORTABLE CLASS OF ATGM LAUNCHERS. AN UPDATED LAUNCHER FOR HOT 3 OFFERS A THERMAL MODULAR SYSTEM NIGHT SIGHT AND A DUAL BAND TRACKER. THE HOT CAN BE LAUNCHED FROM A GROUND LAUNCHER, THE SAME LAUNCHER MOUNTED ON A VARIETY OF VEHICLES, FROM INFANTRY FIGHTING VEHICLES AND ATGM LAUNCHER VEHICLES, AND FROM HELICOPTERS.

THE VEHICLE REPRESENTS VAB HOT, PANDUR HOT, SANTANA/HOT AND OTHER WHEELED HOT VEHICLES. THE AMX-10 HOT CONSTITUTES A HIGH-END APPLICATION ON THAT SPECTRUM, AND HAS NOT BEEN WIDELY PROLIFERATED. ALTERNATE MOUNTS FOR THE LAUNCHER INCLUDE THE ATLAS/COMMANDO LIGHTWEIGHT LAUNCHER (140 KG) MOUNTED ON THE SPANISH SANTANA (4 X 4 LAND ROVER LIGHT TRUCK). THE LANCELOT TURRET USED ON AMX-10 HOT CAN BE MOUNTED ON OTHER ARMORED FIGHTING VEHICLES. THE FRENCH-PRODUCED VAB HOT USES A MEPHISTO RETRACTABLE TWIN-TUBE LAUNCHER, AND HAS AN ONBOARD LOAD OF 10 HOT ATGMS. THE UTM800 TURRET HOLDS FOUR HOT MISSILES, WITH A STABILIZED SIGHT AND CASTOR THERMAL NIGHT SIGHT. THE UTM800 IS USED ON TWO APPLICATIONS. THE FRENCH VCR/TH EMPLOYS THE TURRET ON A PANHARD VCR/TT 6 X 6 APC CHASSIS. THE OTHER IS THE UTM TURRET ON A VAB APC CHASSIS. THE TURRET CAN BE MOUNTED ON THE VBR CHASSIS, WHICH PERMITS EASIER CARRY OF THE LARGER HOT MISSILE THAN DOES ITS PREDECESSOR, THE VBL.

THE SINGLE-TUBE DISMOUNTABLE HOT FIRING STATION CAN BE MOUNTED ON LIGHT VEHICLES SUCH AS THE VBL.

UNITED STATES 106MM RECOILLESS RIFLE M40





SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
SYSTEM	SPECIFICATIONS	Caliber(mm)	105, Recoilless Rifle, M40
Alternative Designations	Battalion Antitank	Rate of Fire (prac, cyclic)	5,
Date, Country of Origin	1953, USA	Fire on Move	No
Proliferation	At least 50 countries	Elevation (deg min, max)	-17, +65
Crew	4	AMMUNITION	SPECIFICATIONS
Weight Firing (kg)	130	Caliber(mm), Type, Name	106, HEAT, M344A1
Length Firing (m)	3.4	Max Aimed Range (m)	2745
Height Firing (m)	1.3	Max Eff Range, Day (m)	1350
Rifling	Yes	Caliber(mm), Type, Name	106, HEAT-Tracer, 3A-HEAT-T
Feed	Manual	Max Eff Range, Day (m)	2000
Breech Mechanism Type	Interrupted thread	Penetration (mm)	700, C
Emplacement Time (min)	>5	Caliber(mm), Type, Name	106, HEP-T, M346A1
Fire from Inside Building	No	Max Aimed Range (m)	6,870
SIGHTS	SPECIFICATIONS	Caliber(mm), Type, Name	106, APERS-T, M581
Name	.50 spoting rifle	Max Eff Range, Day (m)	300
Type	Simrad LP101 laser day sight	Caliber(mm), Type, Name	106, HE, HEAP M-DN
Night Sights	NVL-11 Mk IV II with LRF	Max Eff Range, Day (m)	1500
		VARIANTS	
		M40A1: Initially fielded version of the rifle which was commonly exported, with the M-8C sporting rifle. M40A2: Upgrade with an M79 mount. M40A4: The latest fielded version, with the M27 tripod. Other countries have produced the rifle, under license, and mounted it on various chassis. Bofors Retrofit Program: Upgrade program, with the Simrad sights and the 3 A-HEAT-T round. The weapon can be ported, carried on a vehicle pintle mount then transferred to a ground semi-mobile tripod mount. M79 Mount: Tripod, ground or vehicle. M50 Ontos: Six-barrel mount on small tracked vehicle PAK-66: Austrian M40 on two wheeled carriage.	

NOTES
PRODUCER OF THE LAHAT GUN-LAUNCH ATGM OFFERS TO PRODUCE A VERSION FOR USE IN THE M40 LAUNCHER. THE TANDEM ATGM IS A VIABLE THREAT TO ALL MODERN ARMORED VEHICLES. USE REQUIRES A TRIPOD MOUNTED LASER GUIDANCE UNIT, AS USED WITH MT-12 AND 2A45M AT GUNS. THE RIFLE

PRODUCES A MASSIVE AMOUNT OF NOISE AND SMOKE WHICH REVEALS ITS LOCATION. THUS A FIRST ROUND HIT IS CRITICAL.

BRAZILIAN ARMORED RECONNAISSANCE VEHICLE EE-9 Cascavel





SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations	Cascavel IV	Caliber(mm), Type, Name	90mm, Cannon, Engesa EC 90
Date, Country of Origin	1977, Brazil	Rate of Fire (prac, cyclic)	INA, INA
Proliferation	18 countries	Fire on Move	INA
Crew	3	Elevation (deg min, max)	-8, + 15
Troop Capacity	0	Caliber(mm), Type, Name	7.62mm, MG, INA
Combat Weight (mt)	13.4	Rate of Fire (prac, cyclic)	INA, INA
Length (m)	5.19	Fire on Move	Yes
Height (m)	2.36	Elevation (deg min, max)	INA, INA
Width (m)	2.66	Caliber(mm), Type, Name	12.7mm, MG, M2
Ground Pressure (kg/cm²)	INA	Rate of Fire (prac, cyclic)	INA, INA
Drive Formula	6x6	Fire on Move	Yes
AUTOMOTIVE	SPECIFICATIONS	Elevation (deg min, max)	INA, INA
Engine Type	212-hp Diesel	AMMUNITION	SPECIFICATIONS
Cruising Range (km)	880	Caliber(mm), Type, Name	90mm, APFSDS-T, Engequimica
Max On-Road (km/h)	100	Max Aimed Range (m)	INA
Max Off-Road (km/h)	INA	Max Eff Range, Day (m)	2000
Max Cross-Country (km/h)	INA	Max Eff Range, Night (m)	1300
Max Swim (km/h)	N/A	Penetration (mm KE)	INA
Fording Depth (m), note	1.0, Unprepared	Caliber(mm), Type, Name	90mm, HE-T, Engequimica
PROTECTION	SPECIFICATIONS	Max Aimed Range (m)	INA
Radio	INA	Max Eff Range, Day (m)	2000
Armor, Turret Front (mm):	16	Max Eff Range, Night (m)	1300
Applique Armor (mm)	N/A	Penetration (mm KE)	INA
Reactive Armor (mm):	N/A	VARIANTS	
Mobility (mine clearing, self-entrenching)	N/A	CASCAVEL I: ORIGINAL VEHICLE HAD A US M36 37-MM GUN TURRET. CASCAVEL II: VARIANT WITH A FRENCH 90-MM GUN FROM AML-90. CASCAVEL III: USES THE 90-MMCOCKERILL GUN AND NEW TRANSMISSION. CASCAVEL IV: HAS A NEW ENGINE AND TRANSMISSION, IMPROVED DAY AND NIGHT OPTICS WITH LASER RANGEFINDER, AND .A 50 CAL ANTIAIRCRAFT MG. OTHER AMMUNITION TYPES: HEAT-T, HESH-T, SMOKE, CANISTER	
NBC Protection System	N/A		
Smoke Equipment	6 smoke grenade launchers		
FIRE CONTROL	SPECIFICATIONS		
FCS Name	INA		
Main Gun Stabilization	No		
Rangefinder	LV3 Laser		
Infrared Searchlight	No		
Day Sight	SS-123, 10x		
Field of View (deg)	INA		
Acquisition Range (m)	INA		

Night Sight	SS-122 II, 5.6x	MAXIMUM EFFECTIVE RANGES ARE (M): HEAT-T - 1,500, HESH-T - 800.
Field of View (deg)	INA	
Acquisition Range (m)	INA	

NOTES

RUSSIAN 73-MM RECOILLESS GUN SPG-9M



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designations	INA	Caliber(mm), Type, Name	73mm, Tandem HEAT Grenade, PG-9VNT
Date, Country of Origin	1970, Russia	Max Eff Range, Day (m)	1000
Proliferation	Widespread	Max Eff Range, Night (m)	1000
Crew	3	Penetration (mm)	550, C
Weight Firing (kg)	47.5	Penetration after ERA (mm)	400, C
Weight Travel (kg)	47.5	Penetration Concrete (m)	1
Weight Tripod (kg)	12	Penetration Brick (m)	1
Length Firing (m)	Number	Penetration Earth (m)	1.8
Length Travel (m)	2.11	Muzzle Velocity (m/s)	400
Height Firing (m)	Number	Length (mm)	INA
Height Travel (m)	0.80	Weight (Kg)	INA
Feed	Breech load	Caliber(mm), Type, Name	73mm, HEAT Gren, PG-9VS
Breech Mechanism Type	Interrupted Screw	Max Eff Range, Day (m)	1300
Emplacement Time (min)	1	Max Eff Range, Night (m)	1300
Fire from Inside Building	No	Penetration (mm)	400, C
SIGHTS	SPECIFICATIONS	Penetration post- ERA (mm)	400, C
Name	2Ts35	Penetration Concrete (m)	1
Type	FCS	Penetration Brick (m)	1.5
Sight Range Direct (m)	1000	Penetration Earth (m)	2
Sight Range Indirect (m)	4500	Muzzle Velocity (m/s)	435
Night Sights	2 gen II	Length (mm)	INA
		Weight (Kg)	4.4
		Caliber(mm), Type, Name	73mm, Frag HE Grenade, OG-9VM1
		Max Eff Range, Day (m)	4500
		Max Eff Range, Night (m)	1000
		Casualty Radius (sq.m)	500
		Muzzle Velocity (m/s)	INA
		Length (mm)	INA
		Weight (Kg)	5.3

NOTES
OTHER AMMUNITION

SPG-9M CAN FIRE OLDER AMMUNITION FOR THE SPG-9. A ROCKET ASSIST CAN EXTEND FRAG-HE RANGE TO 6,000 M, BUT WITH INCREASED ERROR.
VARIANTS
SPG-9: OLDER VERSION, WITH EARLIER PGO-9 DAY SIGHT, 1 GEN II NIGHT SIGHT, AND OLDER AMMUNITION. THE SPG-9 CAN FIRE THE NEWER AMMUNITION WITHOUT OTHER IMPROVEMENTS.
SPG-9D: AIRBORNE VERSION WITH DETACHABLE WHEELS
SPG-9M IS EASILY MOUNTED ON VEHICLES SUCH AS APCS OR TACTICAL UTILITY VEHICLES USING A PINTLE MOUNT, AS AN IMPROVISED SP AT GUN.

THE SPG-9/9M IS A RECOILLESS, SMOOTH-BORE, SINGLE-SHOT ANTITANK WEAPON THAT FIRES BOTH ANTI-ARMOR AND ANTIPERSONNEL AMMUNITION.
THE SPG-9M IS EQUIPPED WITH NIGHT SIGHTS. SEVERAL GENERATIONS OF NIGHT VISION EQUIPMENT (II AND IR) ARE AVAILABLE FOR THE SPG-9M AND THE OLDER SPG-9. THE GUN IS MAN-PORTABLE, BUT A TRUCK OR APC NORMALLY CARRIES IT. IT MUST BE DISMOUNTED AND PLACED ON ITS TRIPOD FOR FIRING. SEVERAL VARIANTS HAVE MOUNTED WHEELS

YUGOSLAV 82-MM RECOILLESS GUN M79



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designations	INA	Caliber(mm), Type, Name	82mm, HEAT, M79
Date, Country of Origin	1970, Yugoslavia	Max Eff Range, Day (m)	670
Proliferation	4 countries	Max Eff Range, Night (m)	670
Crew	4	Penetration (mm)	350, C
Weight Firing (kg)	30	Penetration after ERA (mm)	INA
Length Travel (m)	1.79	Penetration Concrete (m)	INA
Rifling	Yes	Penetration Brick (m)	INA
Feed	Breech load	Penetration Earth (m)	INA
Breech Mechanism Type	Horizontally Hinged	Muzzle Velocity (m/s)	322
Emplacement Time (min)	1	Length (mm)	INA
Fire from Inside Building	No	Weight (Kg)	4.87
SIGHTS	SPECIFICATIONS	Caliber(mm), Type, Name	82mm, HEAT, Type 65
Name	ON M72B	Max Eff Range, Day (m)	670
Type	Optical	Max Eff Range, Night (m)	670
Sight Range Direct (m)	1000	Penetration (mm)	380, C
Sight Range Indirect (m)	2700	Penetration after ERA (mm)	INA
Night Sights	2 gen II	Penetration Concrete (m)	INA
		Penetration Brick (m)	INA
		Penetration Earth (m)	INA
		Muzzle Velocity (m/s)	340
		Length (mm)	INA
		Weight (Kg)	INA
		Caliber(mm), Type, Name	82mm, Frag HE, M81
		Max Eff Range, Day (m)	1000
		Max Eff Range, Indirect (m)	2700
		Casualty Radius (sq.m)	INA
		Muzzle Velocity (m/s)	320
		Length (mm)	INA
		Weight (Kg)	INA

NOTES

OTHER AMMUNITION TYPES: O-881 HE, BK-881/BK-881M HEAT.

VARIANTS

B-10: RUSSIAN TOWED SYSTEM FROM WHICH THE M79 WAS DERIVED.

TYPE 65: CHINESE VARIANT WEIGHS 28.2 KG (WITH TRIPOD BUT WITHOUT WHEELS). THE GUN USES THE TYPE 69 COMBINATION SIGHT AND FIRES A MIX OF AMMUNITION INCLUDING THE TYPE 65 HEAT ROUND.

TYPE 65-1: CHINESE VARIANT WITH A TWO-PIECE GUN TUBE FOR LONG DISTANCE DISMOUNTED CARRY. ESTIMATED WEIGHT IS STILL 28.2 KG.
BST: CROATIAN VERSION OF M79 USES THE CN-5 OPTICAL DAYSIGHT.

THE M79 CAN BE OPERATED ON A PINTLE MOUNT.

RUSSIAN 82-MM RECOILLESS GUN B10

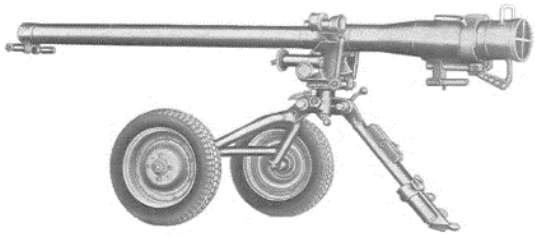


SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations	RG82	Caliber(mm)	82
Date, Country of Origin	1950, RUC	Rate of Fire (prac, cyclic)	7
Proliferation	At least 10 countries	Fire on Move	No
Crew	4	Elevation (deg min, max)	-20, +35
Weight Firing (kg)	85.3	Traverse (deg)	360
Weight Travel (kg)	85.3	AMMUNITION	SPECIFICATIONS
Weight Tripod (kg)	6.5	Caliber(mm), Type, Name	82, HEAT, BK881M
Length Firing (m)		Max Aimed Range (m)	1000
Length Travel (m)	1.85	Max Eff Range, Day (m)	400
Width Travel (m)		Max Eff Range, Night (m)	
Height firing (m)		Penetration (mm)	240,C
Height Travel (m)		Combat Load (ready, stow)	0, 12
Rifling	No	Caliber(mm) Type, Name	82, HEAT, Type 65
Feed	Breech Load	Max Aimed Range (m)	
Breech Mechanism Type	Horizontally hinged	Max Eff Range Day(m)	450
Emplacement Time (min)	0.5	Max Eff Range Night(m)	
Fire from Inside Building	No	Penetration (mm)	356, C
SIGHTS	SPECIFICATIONS	Combat Load (ready, stow)	0, 12
Name	PBO-2 combination	Caliber(mm) Type, Name	82, Frag-HE, O881A
Type	Optical, panoramic, iron	Max Aimed Range (m)	1000
Sight Range Direct (m)	1000	Max Eff Range Day(m)	4500
Sight Range Indirect (m)	4500	Max Eff Range Night(m)	
Night Sights	PN 5x80 (J) II	Penetration (mm)	
		Combat Load (ready, stow)	0, 24
		VARIANTS	
		Type 65: Chinese variant weighs only 28.2kg, includes combination sight and fires a mix of ammunition. Tyoe 65-1: Chinese variant with a two-piece gun tube for long distance dismounted carry. Type 78: Chinese upgrade with improved ammunition. Direct fire range for HEAT round is 500m, 445mm CE. M79: Yugoslavian lightweight variant.	

NOTES

THE B10 CAN BE MOUNTED ON A PINTLE, BUT IS NORMALLY TOWED ON A TWO-WHEELED CARRIAGE WITH AN UNDER SLUNG TRIPOD. THE GUN CAN BE FIRED WHILE ON TWO WHEELS OR ON THE TRIPOD.

FORMER YUGOSLAVIAN 82-MM RECOILLESS GUN M60



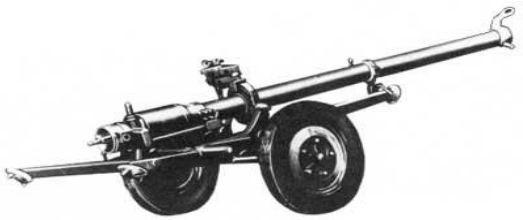
SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations	M60A	Caliber(mm)	82
Date, Country of Origin	1965, FYR	Rate of Fire (prac, cyclic)	4
Proliferation	At least 2 countries	Fire on Move	No
Crew	7	Elevation (deg min, max)	-20, +35
Weight Firing (kg)	122	Traverse (deg)	360
Weight Travel (kg)	122	AMMUNITION	SPECIFICATIONS
Length Travel (m)	2.4	Caliber(mm), Type, Name	82, HEAT, M60
Width Travel (m)	1	Max Aimed Range (m)	1500
Height Travel (m)	0.83	Max Eff Range, Day (m)	500
Rifling	Yes	Max Eff Range, Night (m)	
Feed	Breech Load	Penetration (mm)	200,C
Breech Mechanism Type	Vertically hinged w/ flanged rotate lock	Combat Load (ready, stow)	0, 36
Emplacement Time (min)	0.5	Caliber(mm) Type, Name	82, Rocket Assisted HEAT, M72
Fire from Inside Building	No	Max Aimed Range (m)	1500
SIGHTS	SPECIFICATIONS	Max Eff Range Day(m)	1000
Type	Optical telescopic	Max Eff Range Night(m)	
Sight Range Direct (m)	1500	Penetration (mm)	220, C
		Combat Load (ready, stow)	0, 36

NOTES

THE M60 IS MOUNTED ON A TWO-WHEELED CARRIAGE WITH A TRAILING LEG THAT IS USED AS A TRIPOD LEG FOR FIRING, AS WELL AS A TOW BAR. THE GUN CAN BE TOWED BEHIND A VARIETY OF VEHICLES AND THEN MOVED INTO POSITION BY HAND. GUN HEIGHT IS ADJUSTABLE BASED ON WHEEL AND LEG LOCK SETTINGS. THE M60 CAN ALSO BE MOUNTED ON A PINTLE, SUCH AS THE ANTITANK VERSION OF THE M60PB APC WHICH FEATURES TWO GUNS. BACK-BLAST SAFETY AREA IS 45M DEEP BY 25M WIDE.

RUSSIAN 107-MM RECOILLESS GUN B-11





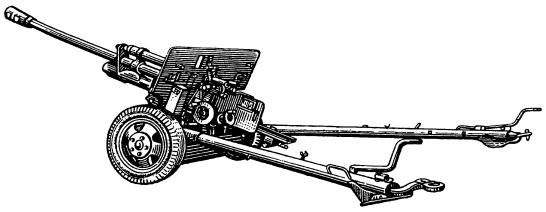
SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations	RG107	Caliber(mm)	107
Date, Country of Origin	1950, RUS	Rate of Fire (prac, cyclic)	
Proliferation	At least 5 countries	Fire on Move	No
Crew	5	Elevation (deg min, max)	-10, +45
Weight Firing (kg)	304.8	Traverse (deg)	360
Weight Travel (kg)	304.8	AMMUNITION	SPECIFICATIONS
Length Firing (m)	3.54	Caliber(mm), Type, Name	107, HEAT, BK-883
Length Travel (m)	3.56	Max Aimed Range (m)	1400
Width Travel (m)	1.45	Max Eff Range, Day (m)	450
Height firing (m)	1.19	Max Eff Range, Night (m)	
Height Travel (m)	0.9	Penetration (mm)	381,C
Rifling	No	Combat Load (ready, stow)	0, 10
Feed	Breech Load	Caliber(mm) Type, Name	107, Frag HE, BK-883
Breech Mechanism Type	Interrupted screw	Max Aimed Range (m)	1300
Emplacement Time (min)	1	Max Eff Range Day(m)	
Fire from Inside Building	No	Max Eff Range Night(m)	
SIGHTS	SPECIFICATIONS	Penetration (mm)	
Name	PBO-4 combination	Combat Load (ready, stow)	0, 20
Type	Optical, panoramic, iron		
Sight Range Direct (m)	1800		
Sight Range Indirect (m)	6650		
Night Sights	Available		
FIRE CONTROL	SPECIFICATIONS		
FCS Name	Text		
Rangefinder	9S53 laser guidance		
Infrared Searchlight			
Day Sight	OP4M-48A Direct Fire 5.5x		
Field of View (deg)	11		
Acquisition Range (m)	4000		
Night Sight	1PN79		
Field of View (deg)			
Acquisition Range (m)	3500		

NOTES

THE B11 IS TOWED ON A TWO-WHEELED CARRIAGE WITH AN UNDER-SLUNG TRIPOD. THE GUN CAN BE FIRED WHILE ON TWO WHEELS, BUT DUE TO THE EFFECT OF RECOIL ON ACCURACY IT IS USUALLY FIRED FROM THE TRIPOD. IT CAN BE EASILY REPOSITIONED BY HAND.

RUSSIAN 76-MM TOWED ANTITANK GUN ZIS-3



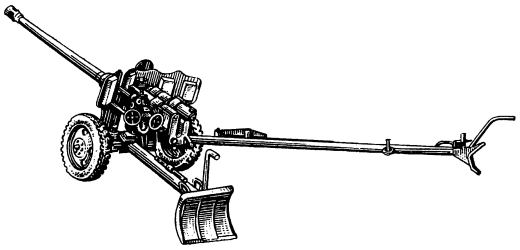


SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations	M1942	Caliber(mm)	76
Date, Country of Origin	1942, RUS	Rate of Fire (prac, cyclic)	0, 25
Proliferation	At least 14 countries	Fire on Move	No
Crew	7	Elevation (deg min, max)	-5, +37
Weight Firing (kg)	1112	Traverse (deg)	54
Weight Travel (kg)	2150	AMMUNITION	SPECIFICATIONS
Length Travel (m)	6.10	Caliber(mm), Type, Name	76, HVAP-T, BR-354P
Width Firing (m)	1.4	Max Aimed Range (m)	
Height Travel (m)	1.3	Max Eff Range, Day (m)	1000
Rifling	Yes	Penetration (mm)	58, K
Feed	Manual	Caliber(mm), Type, Name	76, APC, BR-350B
Breech Mechanism Type		Max Aimed Range (m)	
Emplacement Time (min)		Max Eff Range, Day (m)	1000
Fire from Inside Building		Penetration (mm)	61, K
SIGHTS	SPECIFICATIONS	Caliber(mm), Type, Name	76, HEAT, BK-354M
Name		Max Aimed Range (m)	1000
Type		Max Eff Range, Day (m)	500
Sight Range Direct (m)		Penetration (mm)	280, C
Sight Range Indirect (m)		Caliber(mm), Type, Name	76, Frag-HE, OF-350A
Night Sights		Max Aimed Range (m)	
FIRE CONTROL	SPECIFICATIONS	Max Eff Range, Day (m)	
FCS Name		Max Eff Range, Night (m)	
Infrared Searchlight		Penetration (mm KE)	
Day Sight		Caliber(mm), Type, Name	76, Frag-HE
Field of View (deg)		Max Aimed Range (m)	
Acquisition Range (m)		Max Effective Range(m)	
Night Sight		Max Range(m)	1500
Field of View (deg)			
Acquisition Range (m)			

NOTES

ALTHOUGH THE ZIS-3 IS CATEGORIZED AS AN ANTITANK GUN, SOME OPFOR FORCES WILL EMPLOY IT FOR GENERAL SUPPORT, ESPECIALLY AGAINST LIGHT TARGETS. TYPICAL COMBAT LOAD IS BASED ON THE PRIME MOVER, AND A WIDE VARIETY OF SYSTEMS CAN BE USED AS PRIME MOVERS.

RUSSIAN 85-MM TOWED GUN D-44



SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations	M1945	Caliber(mm)	85
Date, Country of Origin	1944, RUS	Rate of Fire (prac, cyclic)	8, 15
Proliferation	At least 16 counties	Fire on Move	No
Crew	8	Elevation (deg min, max)	-7, + 35
Weight Firing (kg)	1725	Traverse (deg)	54
Length Travel (m)	8.34	AMMUNITION	SPECIFICATIONS
Width Travel (m)	1.73	Caliber(mm), Type, Name	85, HVAP-T, BR365PK
Height Travel (m)	1.42	Max Aimed Range (m)	1500
Rifling	Yes or No	Max Eff Range, Day (m)	1150
Feed	Text	Penetration (mm)	180, K
Breech Mechanism Type	Text	Combat Load (ready, stow)	0, 140
Emplacement Time (min)	Number	Caliber(mm) Type, Name	85, HEAT-FS, BK-2M
Fire from Inside Building	Yes or No	Max Aimed Range (m)	1500
SIGHTS	SPECIFICATIONS	Max Eff Range Day(m)	1500
Name	OP-2-7	Penetration (mm)	300, C
Type	5.5 x magnification	Caliber(mm), Type, Name	85, AP HE,
Sight Range Direct (m)	1500	Max Aimed Range (m)	1500
		Max Eff Range, Day (m)	950
		Penetration (mm)	91, K
		Caliber(mm), Type, Name	85, Frag-HE, O365K
		Max Aimed Range (m)	1500
		Max Eff Range, Day (m)	1500
		VARIANTS	
		D-44-N with II night sight SD- SD-44 Airborne version auxiliary propulsion unit which permits self-propulsion for short distances at speeds of up to 25 km/h on the road, 5.5 km/h off road.	

NOTES

THE GUN IS VARIOUSLY REFERRED TO AS ARTILLERY, AS A FIELD GUN OR AS AN ANTITANK GUN. IT CAN BE USED FOR ALL ROLES OR SPECIFICALLY FOR ARTILLERY OR ANTITANK. TYPICAL COMBAT LOAD IS BASED ON THE PRIME MOVER, AND A WIDE VARIETY OF SYSTEMS CAN BE USED AS PRIME MOVERS.
SD-44 IS AN AIRBORNE VERSION WITH AUXILIARY PROPULSION UNIT WHICH PERMITS SELF PROPULSION FOR SHORT DISTANCES AT SPEEDS OF UP TO 25 KM/H ON THE ROAD.

RUSSIAN 100-MM TOWED ANTITANK GUN MT-12/MT-12R

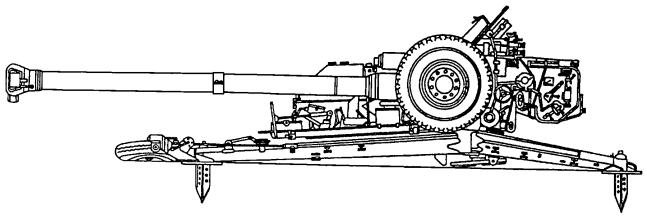


SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations	T-12A, 2A29/Rapira, MT12R	Caliber(mm)	100
Date, Country of Origin	1972, RUS	Rate of Fire (prac, cyclic)	6, 15
Proliferation	At least 12 counties	Fire on Move	No
Crew	6	Elevation (deg min, max)	-7, + 20
Weight Firing (kg)	3050	AMMUNITION	SPECIFICATIONS
Length Travel (m)	9.65	Caliber(mm), Type, Name	100, APFSDS-T, BM-412M
Width Travel (m)	2.3	Max Aimed Range (m)	3000
Height Travel (m)	1.6	Max Eff Range, Day (m)	2500
Rifling	No	Max Eff Range, Night (m)	2500
Breech Mechanism Type	Semi-automatic	Penetration (mm)	418, K
Emplacement Time (min)	2	Combat Load (ready, stow)	0, 8
Fire from Inside Building	Yes	Caliber(mm) Type, Name	100, APFSDS-T, M1000
SIGHTS	SPECIFICATIONS	Max Aimed Range (m)	3000
Name	OP4M-40U	Max Eff Range Day(m)	3000
Sight Range Direct (m)	3000	Max Eff Range Night(m)	3000
Sight Range Indirect (m)	3000	Caliber(mm), Type, Name	100, HEAT, BK-17
Night Sights	APN6-40 II	Max Aimed Range (m)	3000
FIRE CONTROL	SPECIFICATIONS	Max Eff Range, Day (m)	2500
FCS Name	Text	Max Eff Range, Night (m)	2500
Rangefinder	9S53 laser guidance	Penetration (mm)	380, C
Day Sight	OP40M-40U Direct Fire 5.5x	Combat Load (ready, stow)	0, 4
Field of View (deg)	11	Caliber(mm), Type, Name	100, Frag-HE, OF-15
Acquisition Range (m)	3000	Max Aimed Range (m)	3000
Night Sight	APN6-40 II	Max Eff Range, Day (m)	5500
Field of View (deg)	7	Max Eff Range, Night (m)	3000
Acquisition Range (m)	2000	Combat Load 9ready, stow)	0, 4
		Missile Type, Name	ATGM,AT-10 Kastet
		Max Eff Range(m)	5000
		Penetration (mm)	650, C
		Warhead Type	Shaped Charge HEAT
		Missile Type, Name	ATGM, AT-10B
		Max Eff Range (m)	5500
		Penetration (mm)	750, C
		Warhead Type	Tandem Shaped Charge

NOTES
VARIANTS T-12: ORIGINAL VERSION, MT-12 HAS CHANGES IN CARRIAGE AND OBTURATOR, WHICH DO NOT AFFECT PERFORMANCE. SD- MT-12R: RUSSIAN UPGRADE WITH RADAR-DIRECTED FCS, FOR USE AT NIGHT AND ADVERSE WEATHER. DSF TOPAZ: FORMER YUGOSLAV VARIANT OF T-12 WITH THE 2A19M GUN MOUNTED ON A D-30 CARRIAGE. TO LIMIT WEG SHEET TO 1 PAGE. USE CAPS FOR TITLES AND HEADINGS. BREVITY IS ENCOURAGED IN SYSTEM PARAMETERS AND NOTES. USE UPPERCASE FOR NOTES. THE SERB ISKRA AT FCS-1 COMPUTERIZED LASER RANGEFINDER FCS IS OFFERED FOR SALE. RANGE FOR FCS-1 IS 0-3000M. RUSSIAN 2ND GEN II SIGHTS ARE ALSO AVAILABLE. THE DAY SIGHT CAN BE USED AT NIGHT IF THE TARGET IS ILLUMINATED. THERMAL SIGHTS ARE ALSO AVAILABLE UP TO 3500M.

RUSSIAN 125-MM TOWED ANTITANK GUN 2A45M





SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations	SPRUT-B	Caliber(mm)	125
Date, Country of Origin	1980, RUS	Rate of Fire (prac, cyclic)	6, 8
Proliferation	At least 1 country	Fire on Move	No
Crew	7	Elevation (deg min, max)	-6, + 25
Weight Firing (kg)	6500	AMMUNITION	SPECIFICATIONS
Weight Travel (kg)	Number	Caliber(mm), Type, Name	125, APFSDS-T, BM-42M
Weight Tripod (kg)	Number	Max Aimed Range (m)	3000
Length Firing (m)	Number	Max Eff Range, Day (m)	3000
Length Travel (m)	7.12	Max Eff Range, Night (m)	3000
Width Travel (m)	2.3	Penetration (mm)	630, K
Height Travel (m)	2.09	Combat Load (ready, stow)	6, 22
Rifling	No	Caliber(mm) Type, Name	125, HEAT, BK27
Feed	Manual	Max Aimed Range (m)	4000
Breech Mechanism Type	Text	Max Eff Range Day(m)	4000
Emplacement Time (min)	2	Max Eff Range Night(m)	3000
SIGHTS	SPECIFICATIONS	Penetration (mm)	800, C
Name	PG-1M & 2Ts33	Caliber(mm), Type, Name	125, HEAT-MP, BK29M
Type	Iron	Max Aimed Range (m)	4000
Sight Range Direct (m)	2000	Max Eff Range, Day (m)	4000
Sight Range Indirect (m)		Max Eff Range, Night (m)	300
FIRE CONTROL	SPECIFICATIONS	Penetration (mm)	750, C
FCS Name	Text	Combat Load (ready, stow)	0, 4
Rangefinder	9S53 laser guidance	Caliber(mm), Type, Name	125, Frag-HE-T, OF-26
Infrared Searchlight		Max Aimed Range (m)	5000
Day Sight	OP4M-48A Direct Fire 5.5x	Max Eff Range, Day (m)	5000
Field of View (deg)	11	Max Eff Range, Night (m)	3500
Acquisition Range (m)	4000	Combat Load 9ready, stow)	0, 20
Night Sight	1PN53-1	Missile Type, Name	ATGM,AT-11B Invar
Field of View (deg)		Max Eff Range(m)	5000
Acquisition Range (m)	3500	Penetration (mm)	900, C
		Warhead Type	Tandem Shaped Charge

NOTES

OTHER AMMUNITION TYPES ARE GIAT 125G1, BM42, BM32 APFSDS-T. THE RUSSIANS MAY HAVE A BM42M WITH A DU PENETRATOR. THE DAY SIGHT CAN BE USED AT NIGHT IF THE TARGET IS ILLUMINATED. THE SOKOL-

1 GUIDED ANTITANK ROUND USES SEMI-ACIVE LASER-HOMING FOR A 5-KM EFFECTIVE RANGE. A LASER TARGET DESIGNATOR CAN BE POSITIONED NEXT OT THE GUN. THE DIRECT-FIRE ROUND CAN BE USED WITHOUT AN LTD UNDER SOME CIRCUMSTANCES. THE ROUND IS LESS EXPENSIVE THAN ATGMS AND OFFERS A FAST RESPONSE (1-5 SEC) TO DEFEAT TARGET VEHICLES BEFORE THEY CAN EMPLOY THEIR WEAPONS. WITH A HEAT WARHEAD AND 700MM PENETRATION, LETHALITY IS SUFFICIENT FOR A MOBILITY OR FIREPOWER KILL AGAINST TANKS AND A CATASTROPHIC KILL AGAINST OTHER TARGETS.

RUSSIAN 105-MM ANTITANK GRENADE LAUNCHER RPG-29





SYSTEM	SPECIFICATIONS
Alternative Designations:	See Variants
A980s, RUS	A980s, RUS
Proliferation:	At least 5 countries
Crew	2
Caliber (mm)	105, tube
Weight w/o sight (kg)	11.5 (launch tube, sight, and canister); 20 on the tripod
Length (transport) (mm)	1000 w/o rear section/canister
Length Firing (mm)	1850, with grenade canister attached
Life of Tube/barrel	300
Rate of Fire (rd/min)	4-6 est
Emplace/displace time (min)	<0.25

SIGHTS	SPECIFICATIONS
Name	Simrad IS2000 or similar EO sight for RPG-29 Mounted
Type	LRF-based FCS with ballistic computer
Magnification	1x/3.5x
Location	Left side
Sighting Range (m)	800
Name	KN250F or similar sight for RPG-29 Mounted
Type	3 gen II clip-on sight designed to work with day sight
Magnification	1x
Location	Left side
Sight Range (m)	600-800 for vehicle targets; 300+ man
Other sights	A variety can be used. 1st was the heavy 2Ts35 (3kg).

AMMUNITION	SPECIFICATIONS
Name	PG-29V (in canister/launch tube extension)
Caliber(mm), Type, Name	105, warhead
Effective Range (m)	800
Penetration CE, Armor(mm)	750+ ERA, 950+ conv
Penetration CE, Other(mm)	1,500+concrete and brick, 2.000 brick, 3,000 earth
Complete Round Wt (kg)	6.7
Muzzle Velocity (m/s)	280

VARIANTS

RPG-29 Mounted: Mounted crew-served launcher variant, designed to replace SPG-9. It can fit on a vehicle with a pintle mount, or be dismounted to a tripod ground mount. The RPG-29 Mounted has a fire control system with an optical sight, laser rangefinder and ballistic data computer for increased range and precision. This increases the effective range of the mounted system to 800 m against a stationary target with a hit probability of 80%. The system can fire at all targets to maximum range (even moving, with reduced Ph). For Tier 1 and Tier 2 COE OPFOR, RPG-29 Mounted is the crew weapon in Weapons Squads and other supporting tactical units.

The shoulder launch version has an optical sight similar to RPG-7V. The RPG-29 could become a standard squad ATGL for maneuver squads; but weight and large size are problems. The launcher, even stripped down for shoulder launch, is almost 2 m long and considered to be fairly burdensome and ungainly for use with infantry attempting to move in close quarters or dense cover, and set up quickly to fire.

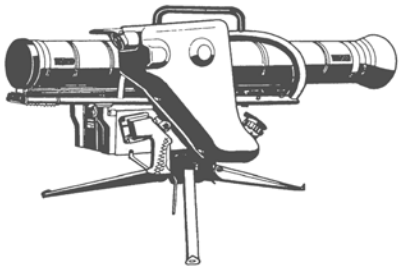
RPG-32/Hashim: Russian Bazalt and Jordanian KADDB squad launcher (see RPG-29, pg 2-37). They jointly developed a lighter 105 mm shoulder launcher, for infantry squad use. Loaded, it weighs 7 kg, with a length of 1.2 m. It can also launch a variety of smaller 72.5 mm grenades. There is also a vehicle remote weapons station with 7.62-

		mm MG, Hashim launcher, and thermal sight. An upgrade is due in 2010, to add "precision" for increased range and 80% P-hit

NOTES
TRPG-29 MOUNTED, LIKE ITS PREDECESSOR, SPG-9, SERVES AS ALL-PURPOSE SMALL UNIT ARTILLERY - TO DELIVER SUPPORTING FIRES AGAISNT THE AMUT OF TARGETS (INCLUDING VEHICLES, PERSONNEL, BUILDINGS, AND ANY OTHER DIRECT-FIRE TARGETS WITHIN RANGE - INCLUDING HELICOPTERS).

EUROPEAN ATGM LAUNCHER MILAN/MILAN 3/MILAN ADT





SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations	Missile d/Infantrie Leger Antichar	Name	MILAN 2/MILAN 3
Date, Country of Origin	1985 MILAN 2/1996 MILAN 3 EUR	Launch method	Disposable launch canister
Proliferation	At least 43 countries MILAN/MILAN 2/MILAN 3	Elevation (deg min, max)	INA
Crew	2, 3 with ammo bearer	Rate of launch (min)	2-3
Weight, excl. missile (kg)	16.5	Reaction time (sec)	INA
Length Firing (m)	1.2 (missile canister)	Emplacement time (min)	INA
Height Firing (m)	0.6	Displacement time (min)	INA
Width Firing (m)	0.42	Ready/Stowed Missiles	1/1
Primary mount	Ground tripod	AMMUNITION	SPECIFICATIONS
Alternate Mounts	IFV, ATGM Launcher Vehicle, jeep, helicopter	Name	MILAN
FIRE CONTROL	SPECIFICATIONS	Max Range (m)	2000
FCS Name		Max Range(m)	25
Guidance	SACLOS	Armor Penetration (mm CE)	600 (RHA)
Command Link	Wire	Warhead Type	Shape Charge (HEAT)
Beacon Type	Pyrotechnic flare, MILAN 2/xenonbulb, MILAN 3	Missile Diameter (mm)	
Tracker Type	IR, 2.2 µm/ 0.9 µm MILAN 3	Missile Weight (kg)	
Susceptible to countermeasures: Smoke, counter-fire, moving		Probability of hit (%)	>90
Counter-countermeasures: Encoded tracker, counters EOIRCM		Time of flight to Max (sec)	12.5
Rangefinder	INA	Average Velocity (m/s)	160
Sights w/ magnification		Name	MILAN 2
Gunner, Day	INA, 7x	Max Range (m)	2000
Field of View (deg)	4.3	Max Range(m)	25
Acquisition Range (m)	INA	Armor Penetration (mm CE)	800 (RHA)
Night Sight	MIRA Thermal sight available	Warhead Type	Tandem Shaped Charge
Field of View (deg)	3 x 6	Missile Weight (kg)	6.7
Acquisition Range (m)	4000 detect/2000 recognize	Probability of hit (%)	>90

		Time of flight to Max range (sec)	12.5
		Average Velocity (m/s)	160
		Name	MILAN 3
		Max Range (m)	1920
		Max Range(m)	20
		Armor Penetration (mm CE)	880 (RHA)
		Warhead Type	Tandem Shaped Charge with precursor charge
		Missile Weight (kg)	7.1
		Probability of hit (%)	>90
		Time of flight to Max range (sec)	12.5

NOTES

ALTHOUGH THE LAUNCHER IS PORTABLE AND HAS BEEN LAELED MAN-PORTABLE, IT IS TOO HEAVY FOR ONE-MAN CARRY WITH MISSILE. A KIT IS AVAILABLE FOR RETROFIT TO EARLIER MILAN LAUNCHERS, TO PERMIT FIRING THE MILAN 3 ATGM USING EOIRCM (JAMMER COUNTERMEASURE).

FRENCH MAN-PORTABLE ATGM LAUNCHER ERYX



SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations	Anti-Char Courtee Portee (ACCP)	Launcher	Eryx
Date, Country of Origin	1991, FRA	Launch Method	Disposable launch canister
Proliferation	At least 8 countries	Rate of Launch (missiles/min)	1 est
Crew	1-3 depending on required load or vehicle available	Fire on Move	Yes or No
Primary mount	Ground mount on tripod or shoulder launch	Elevation (deg)	INA, tripod; unlimited on shoulder launch
Alternate mounts	Shoulder-launch: standing, kneeling, or prone	Reaction Time (sec)	20-30 (inc emplace time)
Weight Excl. Missile (kg)	3 with II night sight	Emplacement time (min)	See reaction time
Weight Tripod (kg)	4 7.4 with tripod and Mirabel sight	Displacement time (min)	<0.03
Length Firing (m)	0.905	Ready/Stowed Missiles	1/0
Height Firing (m)	INA	AMMUNITION	SPECIFICATIONS
Width Firing (m)	INA tripod, 0.16 on shoulder	Missile Type, Name	Antitank Guided Missile, Eryx
SIGHTS	SPECIFICATIONS	Alternative Designations	ACCP
Name	Gunner	Max Range(m)	600
Type	Day, INA 3x	Minimum Range (m)	50
Field of view (deg)	3.4	Probability of Hit (%)	90
Acquisition range (m)	INA	Penetration (mm)	900
Night Sights	French Mirabel thermal sight	Warhead Type	Tandem Shaped Charge (HEAT) CE
Field of view (deg)	INA	Missile Diameter (mm)	136
Acquisition range (m)	1000	Missile Weight (kg)	11 (in tube)
FIRE CONTROL	SPECIFICATIONS	Average Velocity (m/s)	162
FCS Name	INA		
Guidance	SACLOS		
Command Link	Wire		
Beacon Type	Infrared laser diode		
Tracker Type	Charge couple device (CCD)		
Susceptible to countermeasures	EO Jammers, smoke, counter-fire		
Counter-countermeasures	Flight time less than 4 seconds		

NOTES
THE DISPOSABLE CANISTER/LAUNCH TUBE IS ATTACHED TO THE REUSABLE FIRING POST (WHICH INCLUDES SIGHT SYSTEMS). ERYX EMPLOYS A RECOIL REDUCTIONS SYSTEM WITH REDUCED BACK-BLAST, WHICH PERMITS LAUNCH FROM INSIDE OF BUILDINGS. A REST SUCH AS A LEDGE OR SANDBAG IS REQUIRED FOR LAUNCHES BEYOND 350 METERS. SIGNATURE REDUCTION INCLUDES NOISE AND SMOKE REDUCTION. THE ORIGINAL SOPELEM OB50 II NIGHT SIGHT HAD A RANGE OF 600 M.

RUSSIAN ATGM LAUNCHER AT-3/MALYUTKA-2



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designations	Malyutka for missile and complex	Missile Type, Name	AT-3/3a/3b SAGGER
Date, Country of Origin	1963, Russia	Max Aimed Range (m)	3000
Proliferation	at least 45 countries	Max Effective Range(m)	3000
Crew	3	Max Range(m)	3000
Weight Travel (kg)	30.5	Minimum Range (m)	500
Height Firing (m)	1.02	Penetration (mm)	400, C
Emplacement Time (min)	1.7	Warhead Type	Shaped Charge (HEAT)
Fire from Inside Building	No	Missile Weight (kg)	10.9
FIRE CONTROL	SPECIFICATIONS	Average Velocity (m/s)	115
FCS Name	9S415/M/M1	Missile Type, Name	AT-3c SAGGER
Rangefinder	LRF	Max Aimed Range (m)	3000
Infrared Searchlight	No	Max Effective Range(m)	3000
Day Sight	9Sh16, 8x	Max Range(m)	3000
Field of View (deg)	22.5	Minimum Range (m)	500
Acquisition Range (m)	4000	Penetration (mm)	520, C
Night Sight	Iskra TS-M Thermal	Warhead Type	Shaped Charge (HEAT)
Field of View (deg)	INA	Missile Weight (kg)	11.4
Acquisition Range (m)	3000	Average Velocity (m/s)	115
		Missile Type, Name	Malyutka-2/AT-3e
		Max Aimed Range (m)	3000
		Max Effective Range(m)	3000
		Max Range(m)	3000
		Minimum Range (m)	500
		Penetration (mm)	800, C
		Warhead Type	Shaped Charge (HEAT)
		Missile Weight (kg)	12.5
		Average Velocity (m/s)	130

NOTES

COPIES INCLUDE NORTH KOREAN SUSONG-PO, TAIWANESE KUN WU, AND CHINESE RED ARROW-73/HJ-73. HJ-73B CHINESE UPGRADE WITH INDIGENOUS SACLOS GUIDANCE AND 500 MM PENETRATION.

I-RAAD: IRANIAN UPGRADE SACLOS-GUIDED WITH TANDEM WARHEAD.

MALYUTKA-2/-2M: UPGRADE MISSILES OFTEN LINKED TO OTHER UPGRADES.

9M14P1B1: SLOVENIAN MISSILE UPGRADE (NEW MOTOR AND PROPELLANT, LOWER SMOKE SIGNATURE, NOSE PROBE, AND 580 MM PENETRATION).

POLK: SLOVENIAN PORTABLE ANTI-ARMOR LAUNCHING SET INCLUDES NEW LAUNCHER, GUIDANCE PANEL WITH BINOCULAR SIGHT, AND 3 ATGMS.

MALYUTKA 2000: SWISS/BULGARIAN MISSILE DEFEATS 850 MM+ERA.
MALYUTKA M2T: ROMANIAN MISSILE WITH MILAN 2T WARHEAD. SIMILAR TO MILAN 3, IT DEFEATS IS 850 MM +ERA, TO 3,000M.

AT-3 IS CLASSED BY WEIGHT AS PORTABLE (21+ KG WITH CREW CARRY), RATHER THAN MAN-PORTABLE (<21 KG). HOWEVER, WITH A 3-MAN CREW AND SEPARATED COMPONENTS, IT CAN BE CARRIED LIKE A MAN-PORTABLE SYSTEM. THE LAUNCHER IS ALSO A MISSILE CARRY CASE, WITH MISSILE BODY AND WARHEAD SEPARATED. THEY SNAP TOGETHER IN SECONDS. MISSILE UPGRADE TIME TO MALYUTKA 2 IS A FEW MINUTES. THE GUIDANCE PANEL CAN BE LOCATED UP TO 15 METERS FROM THE LAUNCHER, AND CAN CONTROL UP TO FOUR LAUNCHERS. IF TARGET IS <1,000 METERS FROM LAUNCHER, THE OPERATOR CAN JOYSTICK THE MISSILE TO TARGET WITHOUT USING OPTICS. BECAUSE THE MODULE IS SMALL AND CAN BE SHIFTED, ELEVATION AND FIELD OF VIEW ARE OPERATIONALLY UNLIMITED. IMPROVED VERSIONS CAN BE USED ON OLDER LAUNCHERS, BUT IN THE MCLOS MODE. ANY AT-3 CAN USE THE MALYUTKA-2M MISSILE OR BE UPGRADED TO IT WITH REPLACEMENT OF WARHEAD AND OR REPLACEMENT OF SPECIFIC WARHEAD AND MOTOR COMPONENTS.

RUSSIAN ATGM LAUNCHER 9P135 FOR AT-4/4B/5/5B



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designations	9P135M/Fagot/Fagot-M	Missile Type, Name	Konkurs M/AT5B SPANDREL-B
Date, Country of Origin	1973, Russia	Max Aimed Range (m)	4000
Proliferation	at least 25 countries	Max Effective Range(m)	4000
Crew	3	Max Range(m)	4000
Weight Travel (kg)	22.5	Minimum Range (m)	75
Length Firing (m)	1.3	Penetration (mm)	925, C
Emplacement Time (min)	INA	Warhead Type	Shaped Charge (HEAT)
Fire from Inside Building	No	Time of Flight to max (sec)	19
FIRE CONTROL	SPECIFICATIONS	Average Velocity (m/s)	208
FCS Name	9S451M1	Missile Type, Name	Konkurs/AT5 SPANDREL –A
Guidance	SACLOS	Max Aimed Range (m)	4000
Command Link	Wire	Max Effective Range(m)	4000
Day Sight	9Sh119M1, 4x	Max Range(m)	4000
Field of View (deg)	4.5	Minimum Range (m)	75
Acquisition Range (m)	4000	Penetration (mm)	650, C
Night Sight	1PN86/Mulat thermal	Warhead Type	Shaped Charge (HEAT)
Field of View (deg)	INA	Time of Flight to max (sec)	20
Acquisition Range (m)	3600	Average Velocity (m/s)	200
		Missile Type, Name	AT4B/SPIGOT-B
		Max Aimed Range (m)	2500
		Max Effective Range(m)	2500
		Max Range(m)	2500
		Minimum Range (m)	70
		Penetration (mm)	480, C
		Warhead Type	Shaped Charge (HEAT)
		Time of flight to max (sec)	14
		VARIANTS	
		P135M3: KONKURS-M COMPLEX. LAUNCHER WITH 1PN65 THERMAL SIGHT AND AT-5B/KONKURS-M MISSILES. NIGHT RANGE IS 2,500M. TOSAN-1: IRANIAN VARIANT OF AT-5.	

NOTES

BECAUSE OF ITS WEIGHT, THE RUSSIANS CATEGORIZE THE AT-4/4B SYSTEM AS PORTABLE (21+ KG WITH CREW CARRY), RATHER THAN MAN-PORTABLE. FOR DISMOUNTED CARRY LOAD IS DIVIDED AMONG THREE PACKS. DUE TO THE GREATER WEIGHT, AT-5/-5B FITS INTO THE "HEAVY" CLASS (40+ KG), AND SHOULD ONLY

BE CARRIED SHORT DISTANCES FROM VEHICLES (<500 METERS). TPVP/1PN65 THERMAL SIGHT IS AVAILABLE, WITH THE RANGE APPROXIMATELY 2,500 METERS (SEE VARIANTS, ABOVE). WEIGHT IS 13 KG. SLOVENIAN TS-F SIGHT HAS A 3,600-METER DETECTION RANGE.

RUSSIAN ATGM LAUNCHER AT-7/AT-13





SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designations	9P151 Firing Post	Missile Type, Name	ATGM, AT-7/Saxhorn
Date, Country of Origin	1978, RUS	Alternative Designation	Metis
Proliferation	At least 5 countries	Max Range(m)	1000
Crew	2	Minimum Range (m)	40
Primary Mount	Ground mount on tripod	Armor Penetrate (mm CE)	460
Weight Overall (kg)	10.2	Warhead Type	Shaped Charge (HEAT)
Length Firing (m)	0.78 with AT-7/Metis 0.98 with AT-13/Metis-M	Missile Weight (kg)	6.3 (in tube)
Height Firing (m)	0.72 with AT-7/Metis	Probability of Hit (%)	90
Width in Overall Firing Position (m)	INA	Time of Flight to Max Range (sec)	6.2
FIRE CONTROL	**SPECIFICATIONS**	Average Velocity (m/s)	180
FCS Name	9S816 Guidance system	Missile Type, Name	ATGM, AT-13
Guidance	SACLOS	Alternative Designation	Metis-M
Command Link	Wire	Max Range(m)	1500
Beacon Type	INA	Minimum Range (m)	80
Tracker Type	IR	Penetration (mm CE)	1000/900 behind ERA
Counter-Countermeasures	AT-13 defeats EO jammers	Warhead Type	Tandem Shaped Charge (HEAT)
Rangefinder	Available	Missile Weight (kg)	13.8 (in tube)
Day Sight	INA	Probability of Hit (%)	90
Field of View (deg)	INA	Time of Flight to Max Range (sec)	8
Acquisition Range (m)	INA	Average Velocity (m/s)	287
Field of View (deg)	4.6	Other Missiles	Metis-MHE thermobaric
ARMAMENT	**SPECIFICATIONS**	**VARIANTS**	
Name	9P151 Firing Post	Metis-MI: New Russian variant of AT-13,weighing 1 kg less, with 2000 m range Metis-M/AT-13: System with 9P151firing post adapted for and including the Metis-M missile, IOC 1992. The Mulat-115 thermal sight is likely to be used with the missile. This represents the Tier 3 OPFOR dismount ATGM system. The missile can be used on the AT-7 launcher, but cannot then defeat EO jammers.	
Launch Method	Disposable launch canister		
Elevation (deg min, max)	-5, +10		
Rate of Launch (missiles/min)	3-5 depending on range		
Emplacement Time (min)	0.20		
Displacement Time (min)	0.33		
Ready/Stowed Missiles	4/0 (1 on launcher)		

NOTES

THE RUSSIANS USED TO CHARACTERIZE THE AT-7 COMPLEX AS A MAN-PORTABLE (<21 KG), PERMITTING LONG-DISTANCE CARRY BY DISMOUNTED INFANTRY. HOWEVER, THE AT-13 MISSILE COMPLEX SLIGHTLY EXCEEDS 20 KG. WITH A 2-MAN CREW, IT IS CLOSE ENOUGH TO FIT INTO THE CATEGORY.
GUIDANCE ELEVATION HAS A 15 DEGREE SPAN. BECAUSE THE MODULE IS SMALL AND CAN BE QUICKLY CORRECTED BY SHIFTING, ELEVATION AND FIELD OF VIEW ARE OPERATIONALLY UNLIMITED, AND PERMIT USE AGAINST HOVERING OR STATIONARY HELICOPTERS.

RUSSIAN ATGM LAUNCHER KORNET-E AND KVARTET





SYSTEM	SPECIFICATIONS
Alternative Designations	AT-14, Kornet-LR/MR
Date, Country of Origin	1997, Russia
Proliferation	at least 3 countries
Crew	3
Weight Travel (kg)	30
Length Firing (m)	1.21
Emplacement Time (min)	1.0
Fire from Inside Building	No
FIRE CONTROL	**SPECIFICATIONS**
FCS Name	INA
Guidance	Laser Beam Rider
Command Link	N/A
Day Sight	1P45-1
Field of View (deg)	INA
Acquisition Range (m)	5000
Night Sight	1PN79/Metis-3 thermal
Field of View (deg)	INA
Acquisition Range (m)	5500
AMMUNITION	**SPECIFICATIONS**
Missile Type, Name	Kornet-LR
Max Aimed Range (m)	5000
Max Effective Range(m)	5000
Max Range(m)	5000
Minimum Range (m)	100
Penetration (mm)	1100, C
Warhead Type	Tandem Shaped Charge (HEAT)
Time of Flight to max (sec)	22
Average Velocity (m/s)	255

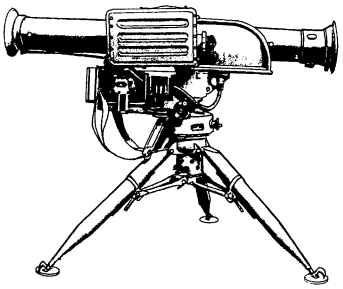
VARIANTS

KORNET-E: EXPORT VERSION OF THE KORNET SYSTEM INCLUDES A LIGHT-WEIGHT LAUNCHER TRIPOD, THERMAL NIGHT SIGHT, AND KORNET-LR MISSILE.
A VERSION IS OFFERED FOR HOT CLIMATES.
9P163-1: PORTABLE LAUNCHER WITH KORNET -LR MISSILE. KBP SUGGESTS MOUNTING THE LAUNCHER ON TUVS AND OTHER VEHICLES. A REMOTE-OPERATED VERSION IS AVAILABLE.
KORNET-MR: MISSILE FOR A MAN-PORTABLE VERSION OF THE LAUNCHER. RANGE IS KM, WITH PENETRATION 1,000 MM. IT IS UNKNOWN IF THE MISSILE IS CURRENTLY FIELDED. SEE NOTES, BELOW.
KORNET-LR SELF-PROPELLED/9P162: ATGM LAUNCHER VEHICLE SYSTEM ON BMP-3 CHASSIS WITH TWIN LAUNCHERS (SEE PG 6-64).
KLIVER: IFV/FSV TURRET UPGRADE WITH KORNET (PG 3-47).
BMP-2M BEREZHOK: IFV UPGRADE WITH KORNET (PG 3-33).
KPB OFFERS THE KVARTET/9P163-2 OVERHEAD WEAPON STATION FOR MOUNT ON LIGHT VEHICLES (E.G., HMMWVS CURRENTLY IN UAE) AND VBL (AKA: VBL KVARTET, TIER 1 REPRESENTATIVE ATGM LAUNCHER VEHICLE). IT HAS A DUAL TWIN (4-TUBE) LAUNCHER AND CENTRAL MODULE WITH TV/FLIR SIGHTS.
OTHER MISSILES: KORNET-LR HE (THERMOBARIC, 9M133F) KORNET-MR TANDEM HEAT AND HE (THERMOBARIC) KORNET-EM: NEW ATGM LAUNCHER VEHICLE IS BASED ON A RUSSIAN TIGR ARMORED 4X4 TACTICAL UTILITY VEHICLE. TWO 4-MISSILE MODULES JACK THRU THE ROOF. AN IR AUTO-TRACKER GIVES SIMULTANEOUS DUAL-LAUNCH LBR ACLOS GUIDANCE. THE NIGHT SIGHT IS 3RD GEN THERMAL, FOR A RANGE OF 5+ KM. KORNET-EM (KORNET-D) MISSILES RANGE 8 KM FOR HEAT, 10 FOR THERMOBARIC-HE. THE TANDEM HEAT DEFEATS 1,300 MM OF ARMOR. THE HE OFFERS A PROXIMITY FUZE FOR MULTI-ROLE USE (E.G., AGAINST HELICOPTERS).

NOTES
BY WEIGHT, KORNET-MR CAN BE BROKEN DOWN INTO A PORTABLE (30-50) 2-MAN SYSTEM, OR A MAN-PORTABLE SYSTEM WITH FEWER ACCESSORIES. KORNET-LR IS ONLY PORTABLE (SHORT-DISTANCE CARRY – SEE AT-3). MR AND LR KORNET MISSILES ARE INTERCHANGEABLE ON LAUNCHERS.

CHINESE ATGM LAUNCHER RED ARROW-8





SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations	Hongjian-8, RA-8, HJ-8	Caliber(mm)	
Date, Country of Origin	1986, CHI	Rate of Fire (prac, cyclic)	2, 3
Proliferation	At least 4 countries	Fire on Move	
Crew	4	Elevation (deg min, max)	-7, + 12
Weight Firing (kg)		Traverse (deg)	
Weight Travel (kg)	63	AMMUNITION	SPECIFICATIONS
Weight Tripod (kg)		Missile Type, Name	ATGM, Red Arrow-8A
Length Firing (m)	1.57	Max Range(m)	3000
Length Travel (m)		Minimum Range (m)	100
Height Firing (m)		Penetration (mm)	800, C
Height Travel (m)		Warhead Type	Shaped Charge HEAT
Rifling		Missile Diameter (mm)	Number
Feed	Disposable Launch Canister	Missile Weight (kg)	22.5
Breech Mechanism Type		Total Weight (kg)	25.5
Emplacement Time (min)		Average Velocity (m/s)	220
Fire from Inside Building		Missile Type, Name	ATGM, Red Arrow-8E
SIGHTS	SPECIFICATIONS	Max Range(m)	4000
Name	Text	Minimum Range (m)	100
Type	Text	Penetration (mm)	900, C
Sight Range Direct (m)	Number	Warhead Type	Tandem Shaped Charge HEAT
Sight Range Indirect (m)	Number	Missile Diameter (mm)	
Night Sights	Text	Missile Weight (kg)	22.5
FIRE CONTROL	SPECIFICATIONS	Total Weight (kg)	24.5
FCS Name	Text	Average Velocity (m/s)	210
Main Gun Stabilization	Yes or No	Missile Type, Name	ATGM, Red Arrow-8F
Rangefinder	Text	Max Range(m)	4000
Infrared Searchlight	Yes or No	Minimum Range (m)	100
Day Sight	12x Magnification	Penetration (mm)	1100, C
Field of View (deg)		Warhead Type	Tandem Shaped Charge HEAT
Acquisition Range (m)		Missile Diameter (mm)	
Night Sight	PTI-32	Missile Weight (kg)	
Field of View (deg)	Number	Total Weight (kg)	25
Acquisition Range (m)	2000	Average Velocity (m/s)	220

NOTES
THE ORIGINAL LAUNCHER IS TOO HEAVY TO BE CONSIDERED PORTABLE.

VARIANTS: RED ARROW 8L IS A COMPACT LIGHTWEIGHT (22.5 KG) LAUNCHER FOR MAN-PORTABLE USE. TRACKER SYSTEM USES AN ENCODED BEACON TO DEFEAT IR JAMMING. A PTI-32 THERMAL NIGHT SIGHT CAN BE USED. VEHICLE SINGLE TUBE LAUNCHERS ARE ON JEEPS, A MINIBUS, AND ON CHINESE APCS SUCH AS WZ-551 / TYPE 90. A 4-TUBE LAUNCHER TURRET IS USED ON MANY ATGM LAUNCHER VEHICLES, INCLUDING YW531, WZ-551, TYPE 89/ YW 534. HELICOPTER MOUNTS ARE WZ-9 AND Z-9G GUNSHIPS AND THE FRENCH ANTELOPE.
BAKTAR SHIKAN: PAKISTANI VARIANT, AKA GREEN ARROW. MISSILE DATA IS SIMILAR TO RED ARROW-8A. ONE VEHICLE MOUNT IS ON A LAND ROVER.
THERE MAY BE 8B AND 8C VERSIONS OF THE ATGM; HOWEVER, THE ABOVE ARE MORE LIKELY FOR ENCOUNTER. THE RED ARROW-8F HAS AN HE-THERMOBARIC WARHEAD OPTION. IT IS A MULTI-PURPOSE WARHEAD FOR BUNKERS, LAVS, DISMOUNTS ETC.

BRITISH ANTI-AIRCRAFT/ANTI-ARMOR (HIGH VELOCITY) MISSILE SYSTEM STARSTREAK



SYSTEM	SPECIFICATIONS	FIRE CONTROL	SPECIFICATIONS
Alternative Designations		Sights w/ Magnification	
Date, Country of Origin	1997	Day Sight	Avimo stabilized optical sight with lead bias system
Proliferation	2–6 countries	Field of view (deg)	INA
Crew	2 with a loader (1 possible)	Acquisition range (m)	7000+
Target	FW, heli, ground vehicles	Night Sight	Thales clip-on thermal sight
ARMAMENT	SPECIFICATIONS	Acquisition Range (km)	4-5 est
Name	Aiming unit	Other Acquisition Aides:	
System Dimensions	See Missile	ADAD: British passive thermal IR scanners on remote tripod or vehicle mount with 240 degree FOV automatic cueing Missile team employs an azimuth plotting board (e.g. Russian 1L15-1) for direction of approach on aerial targets.	
System weight (kg)	24.3 with missile	VARIANTS	
Reaction time (sec)	<6	The most common launcher used is–SL. Starburst: Javelin SAM launcher adapted for Starstreak LBR guidance- in production Lightweight Multiple Launcher (LML): Pedestal launcher for three missiles (above). The launcher can also mount on a light vehicle, e.g., TUV. A demonstrator is LML on a Panhard tactical truck. Starstreak II: Improved launcher uses Starstreak or Starstreak II missile. It has an auto-tracker for hands-free guidance. It was fielded in 2010. Starstreak Lightweight Vehicle (LWV): Land Rover truck converted into an SP SAM system with a 6-canister launcher, ADAD auto-tracker, and TV/ thermal FCS. This launcher can be mounted on other vehicles. Armored Starstreak or (SP HVM): Vehicle is a Stormer tracked APC chassis, with an 8-missile launcher. The passive IR fire control system uses ADAD, an auto-tracker and thermal sight. The launcher can be mounted on other vehicles. Seastreak: Single-stage missile naval variant in a 12-missile launcher, with mm-wave radar FCS. Optional Use: As a low-cost air defense/anti-armor (multi-role) system, Starstreak can be employed against ground	
Time between launches (sec)	<30		
Reload time (sec)	<25 est		
Fire on the move	Yes, in short halt		
AMMUNITION	SPECIFICATIONS		
Name	Starstreak		
Range (m)	300-7000 max (guided)		
Altitude (m)	0-5000		
Dimensions (mm)	1400 length 127 diameter		
Weight (kg)	14.0		
Max missile speed (m/s)	1364, mach 4		
Flight time to max range (sec)	5-7		
Guidance	Laser beam rider SACLOS		
Warhead type	Three 25-mm darts-tungsten KE tip and case & HE fill		
Penetrations (mm KE):	120		
Fuze type	Contact with time delay		
Probability of Hit (ph%)	60 FW, >95 heli (each dart 67% for heli)		
Self-destruct (sec)	Yes, INA		

Other Missiles	
Starstreak II: Improved missile has 8-km range and better precision. Fielded 2010 Lightweight Multi-Role Missile/LMM: A multi-role missile options with a single 3-kg tandem (HEAT/HE) warhead and proximity fuze. At 13 kg, the lower-cost missile flies 8-km at 1.5 Mach. It was due in 2013 and was successfully launched by a Camcopter S-100 UCAV variant. Other projected upgrades are semi-active laser-homing and/or dual-mode (LBR/SAL-H).	targets, such as light armored vehicles, and snipers in bunkers or buildings. The missile and its darts, with a unique combination of penetrator and following Frag-HE, have been successfully tested against vehicle targets. With a missile cost of 1/2 to 1/3 of competing MANPADS, the system could be used as a fire support asset to complement ATGM launchers and vehicle weapons. Thor: British Multi-Mission Air Defense System is a RWS, with 4 missile launchers, TV, FLIR, and an auto-tracker. Weighing .5 mt, it mounts on trucks, vans, TUVs, APCs, etc., with a remote operator. Designed for Starstreak, launchers, it can also mount other MANPADS, and ATGMs, such as Ingwe, TOW, HELLFIRE, Mokopa, Spike, etc.

NOTES

GROUND-BASED AD SYSTEM OPTIMIZED FOR USE AGAINST ARMORED HELICOPTERS AND LOW FLYING FIXED-WING AIRCRAFT. MISSILE EMPLYS SMOKELESS PROPELLANT FOR MINIMAL DIGNATURE. FLIGHT TIME (5-8 SEC) AND LBR GUIDANCE MAKE IT ESSENTIALLY IMMUNE TO COUNTERMEASURES. BECAUSE OF THE HIGH VELOCITY, THE SYSTEM EXCEEDS THE HIT PROBABILITY OF COMETING SYSTEMS AGAISNT HIGH-SPEED AITCRAFT ON RECEDING FLIGHT PATHS.

THE STARTSTREAK'S LOWER COST AND CAPABILITIES AS A MULIT-ROLE MISSILE SYSTEM OFFERS VARIED USES. TWO CONSIDERATIONS ARE THE SEMI-AUTOMOATIC COMMAND LINE-OF-SIGHT (SACLOS) GUIDANCE AND CONTACT FUZES WHICH MAKE IT LESS EFFECTIVE AGAISNT AGILE FIXED-WING AIRCRAFT FROM SOME ASPECTS. THUS A MORE PRACTICAL COURSE WOLD BE TO REPLACE 33-50% OF THE MANPADS. WITH THE LOWER COST OF STARSTREAK AND ITS MULTI-OLE CAPABILITY, IT COULD REPLACE A PORTION OF THE EXPENSIVE SINGLE-ROLE MANPADS WITH STARSTREAKS, FOR INSTANCE, AN 18-MANPADS BATTERY COULD BE REDUCED 35%.

ISRAELI/EUROPEAN BLOS ATGM LAUNCHER SPIKE



SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations	Gill	Launch method	Disposable launch canister
Date, Country of Origin	1997-98, Israel/Europe	Rate of launch (min)	2-3
Proliferation	At least 15	Reaction time (sec)	2
Crew	3 w/ 4 ATGMs	Emplacement and Displacement Time (min)	0.5
Weight Overall (kg)	13	Reload Time (min)	0.25
Primary Mount	Tripod, sitting, crouching	Ready/Stowed Missiles	2 / 4
Alternate Mounts	IFV, APC, jeep, helicopter	AMMUNITION	SPECIFICATIONS
Length Firing (m)	1.2 with missile canister	Missile Name	Spike-MR
FIRE CONTROL	SPECIFICATIONS	Max Range(m)	2500
FCS Name	INA	Minimum Range (m)	200
Guidance	IIR-homing Seeker (-MR), CCD/IIR fiber-optic	Penetration (mm CE)	800
Rangefinder	Not included but available	Warhead Type	Tandem Chape Charge (HEAT)
Launcher:	Day, on Command Launch Unit (CCU)	Missile Weight (kg)	13; fills Spike-MR and -LR
Field of View (deg)	5 IIR, 10 CCD	Probability of Hit (%)	95
Acquisition Range (m)	2500 CCD/IIR, Spike-MR, -LR 4000 CCD/IIR FOG for -LR	Missile Name	Spike-LR (or Spike, NT-S)
Night Sight	Thermal sight, 3.5x and 10x (removable for easier carry)	Max Range(m)	4000
Field of View (deg)	Wide and narrow	Minimum Range (m)	200
Acquisition Range (m)	3000	Penetration (mm CE)	800 top-attack
		Warhead Type	Tandem Shape Charge (HEAT)
		Missile Weight (kg)	13; will fit on all launchers
		Probability of Hit (%)	95
		Missile Name	Spike-ER
		Max Range(m)	8000
		Minimum Range (m)	200
		Penetration (mm CE)	1000+top-attack
		Warhead Type	Tandem Shape Charge (HEAT)
		Missile Weight (kg)	32
		Probability of Hit (%)	95

NOTES

FITS THE CATEGORY BEYOND-LINE-OF-SIGHT (BLOS), BECAUSE IT CAN LAUNCH FROM COVER AND HIT TARGETS BEHIND COVER. MISSILE HAS A DIVE OR TOP-ATTACK MANEUVER FOR HIGH ARMOR PENETRATION. LOFTED FLIGHT PATH PERMITS USE AGAINST HELICOPTERS.

THE WEIGHT (26 KG) FITS CATEGORIZATION PORTABLE, AND IS QUITE MAN-PORTABLE WITH A 2-3 MAN TEAM.

VARIANTS:
GILL SF: LIGHTWEIGHT GILL MISSILE/CANISTER FOR SPECIAL FORCES.
SPIKE 2.5: VARIANT WHICH WILL BE PRODUCED BY EUROSPIKE CONSORTIUM, WITH 2.5 KM MAX RANGE FOR BOTH MODES AND HIGH CM RESISTANCE. THIS VERSION HAS A EUROPEAN MADE MISSILE LAUNCHER AND FCS, AND HAS BEEN ACCEPTED FOR FIELDING IN A EUROPEAN COUNTRY.

RCWS-30: REMOTE CONTROLLED WEAPON STATION WITH A 30-MM GUN,
MG AND TWIN SPIKE LAUNCHER. IT IS USED ON THE CZECH PANDUR IIS.
MANGOSTA: HELICOPTER SPIKE MISSILE LAUNCHER WITH TOPAZ EO SENSOR TURRET, CURRENTLY MARKETED FOR SALES IN LATIN AMERICA.
MANTIS: SPIKE-LR 6-MISSILE LAUNCHER CURRENTLY MOUNTED ON A MARVIN ATV, WITH THERMAL SIGHT, GPS NAV AND LRF.

SPIKE ER/SPIKE-EXTENDED RANGE/DANDY: INITIALLY FOR HELICOPTERS (4-MISSILE LAUNCHER), IT CAN BE USED ON OTHER LAUNCHERS. A SINGLE-TUBE LAUNCHER CAN BE MOUNTED ON LIGHT VEHICLES. THE LIGHT COMBAT VEHICLE (LCV) REMOTE LAUNCHER HOLDS 2 MISSILES. THE MISSILE CAN LAUNCH IN FOG MODE AND SWITCH TO IIR-HOMING FOR PRECISE IMPACT.

COUNTERMEASURES:
-IIR SEEKER PENETRATES MOST SMOKES.
-FOG ALLOWS VARIED CONTROLLED FLIGHT PATH.
-IIR AND CCD CAN BE FUZED IN DUAL MODE TO COUNTER VARIOUS CMS.
-SPIKE-MR CAN LAUNCH FROM ENCLOSED AREA AND BUILDINGS
-LR FOG CAN LAUNCH FROM COVER, OVER-FLY DEFILADE/OBSCURATION

BLANK SOUTH AFRICAN NLOS ATGM LAUNCHER SYSTEM MOKOPA





SYSTEM	SPECIFICATIONS
Alternative Designations	ZT-6, Black Mamba
Date, Country of Origin	1990, ZAF
Proliferation	At least 3 countries.
Crew	3
Platform	Ratel IFV
Combat Weight (mt)	18.5
Length (m)	7.21
Height (m)	2.92
Width (m)	2.52
Ground Pressure (kg/cm^2)	INA
Drive Formula	6x6
AUTOMOTIVE	**SPECIFICATIONS**
Engine Type	282-hp Diesel
Cruising Range (km)	1000
Max On-Road (km/h)	105
Max Off-Road (km/h)	30
Max Cross-Country (km/h)	30
Max Swim (km/h)	4
Fording Depth (m), note	1.2
PROTECTION	**SPECIFICATIONS**
Armor, Turret Front (mm):	20
NBC Protection System	None
Smoke Equipment	4 smoke grenade launchers
FIRE CONTROL	**SPECIFICATIONS**
FCS Name	INA
Beacon or Tracker Type	None needed w/seeker
Rangefinder	Laser
Day Sight	TV guidance
Acquisition Range (m)	10000
Night Sight	Thermal night sight
Acquisition Range (m)	5000
ATGM Guidance	SACLOS
ATGM Command Link	Semi-active laser homing (SAL), digital autopilot

ARMAMENT	SPECIFICATIONS
Caliber(mm), Type, Name	ATGM, Mokopa
Rate of Fire (prac, cyclic)	1, 2
Fire on Move	No
AMMUNITION	**SPECIFICATIONS**
Missile Type, Name	ATGM, Mokopa
Max Range(m)	10,000
Minimum Range (m)	500
Penetration (mm KE)	1400
Warhead Type	Tandem Shaped (HEAT)
Missile Weight (kg)	52

VARIANTS

Swift/ZT-5 and Ingwe/ZT-35 ATGM launcher vehicles launch indigenous ATGMs with similar guidance.
Ratel Mk1, 2, and 3 variants include fire support vehicle with 90-mm gun, 81-mm mortar carrier, command vehicle, IFV with 60-mm mortar, armored maintenance vehicle, logistics vehicle.
Mokopa is a variant of the US Hellfire/Hellfire II developed initially for helicopter launch from Rooivalk. The system can also launch British Brimstone ATGMs. An upgraded Mi-24/35 HIND package includes Mokopa.
Mokopa LUV (Light Utility Vehicle) turret system: A remote weapon station to fit on vehicle flat beds, with 4 Mokopa launchers.
Thor: The light turret (pg 6-23) can launch a SAL missile, e.g.,
Hellfire or the Mokopa variant, and use a remote laser designator from a UAV, helicopter, vehicle or dismount to guide it to target

NOTES

THE SYSTEM REPRESENTS NIMROD, SHIN-JUMAT, HERMES, AND OTHER NLOS ATGM LAUNCHER SYSTEMS. DEVELOPERS NOTED THAT MOKOPA WILL FIT VARIOUS MODULAR LAUNCH APPLICATIONS, AND CAN BE

MOUNTED ON A GROUND LAUNCHER (TRUCK, LAV OR TACTICAL UTILITY VEHICLE CHASSIS), AND ON NAVAL VESSELS. SINCE CURRENT SOUTH AFRICAN SWIFT (ZT-3) AND INGWE (ZT-35) ATGM LAUNCHER VEHICLES ARE BASED ON THE ROBUST RATEL IFV CHASSIS, WE SELECTED THAT CHASSIS AS A CANDIDATE FOR THE MOKOPA SYSTEM.

Dec
2016

Worldwide Equipment Guide

Chapter 6: Artillery



TRADOC G-2 ACE–Threats Integration
Ft. Leavenworth, KS

Distribution Statement: Approved for public release; distribution is unlimited.

CHAPTER 6: ARTILLERY

This chapter provides the basic characteristics of selected artillery weapon systems, artillery reconnaissance, and artillery command and control (C2) systems in use or readily available to the OPFOR. Therefore, systems discussed in this chapter are those likely to be encountered by U.S. forces in varying levels of conflict. The selection of artillery systems is not intended to be all-inclusive, rather a representative sampling of weapons and equipment supporting various military capabilities.

This update is divided into the following categories—artillery command and reconnaissance, multiple-rocket launchers, mortars and hybrid systems, towed cannon, self-propelled cannon, and artillery ammunition.

Other Weapons. Theater missiles, naval weapons, aircraft, unmanned combat aerial vehicles (UCAVs), and antitank/anti-armor guided missiles (ATGMs) are not artillery. But they can be used for strike support in coordination with an Integrated Fires Command.

Questions and comments on data listed in this chapter should be addressed to:

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Artillery Command and Reconnaissance Systems

OPFOR artillery command and reconnaissance systems include artillery command and reconnaissance vehicles (ACRVs), battlefield surveillance and countermortar/counterbattery radars, sound-ranging sets, rangefinders, and topographic survey equipment. The ACRVs serve as command observation posts (COPs) and fire direction centers (FDCs). There are either tracked or wheeled versions, so that ACRVs are compatible in mobility with the unit's artillery systems. Typical equipment in an ACRV includes—

- Day/night observation and rangefinding equipment.
- Topographic survey equipment.
- Artillery fire direction computation equipment (automated and/or manual).
- Communications equipment.

RUSSIAN ARTILLERY COMMAND VEHICLE 1V152



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations		PROTECTION:	
Date of Introduction:	2000	Armor, Turret Front (mm)	Defeat 12.7-mm rounds
Proliferation:	At least 2 countries	Armor, Turret Top (mm)	INA
DESCRIPTION:		Armor, Hull (mm)	INA
Crew	5 (2 + 3)	NBC Protection System	Yes
Platform (Chassis)	BTR-80K1SH1	Smoke Equipment	No
Engine Type	260 hp Water-cooled, V-8 diesel		
Chassis Length Overall (m)	7.65	SENSORS/COMPONENTS	
Height Overall (m)	2.60	Fire Control (Automated)	Baget-41
Width (m)	2.90	Fire Direction (Manual)	PUO-7
Combat Weight (mt)	12.0	Number of Workstations	2
		Number of Remote Workstations	1
Max On Road (km/h)	85	Land Navigation	Yes
Max Off-Road (km/h)	40	Laser Rangefinder	Yes
Cross Country (km/h)	INA		
Max Swim (km/h)	10.0		
Fording Depths (m)	Amphibious	VARIANTS	
		None	INA
Radio	VHF 20 km		
	HF 40km		
	HF Antenna Mast 350km		

NOTES

THE KAPUSTNIK-B SYSTEM OR 1V126 COMPLEX IS CAPABLE OF THE COMMAND AND CONTROL OF A ROCKET FIRING BATTALION CONSISTING OF 3 BATTERIES. THE 1V152 SERVES AS THE BATTERY AND BATTALION COMMANDER VEHICLES IN THE 1V126 COMMAND VEHICLE SET. TYPICALLY, FOUR COMMAND VEHICLES COMPRISE THE 1V126 COMPLEX. THERE IS ONE VEHICLE FOR EACH BATTERY COMMANDER AND ONE VEHICLE FOR THE BATTALION COMMANDER.

RUSSIAN ARTILLERY FIRE DIRECTION CENTER VEHICLE 1V153



1V153 (on left)

SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations		PROTECTION:	
Date of Introduction:	2000	Armor, Turret Front (mm)	N/A
Proliferation:	At least 2 countries	Armor, Turret Top (mm)	N/A
DESCRIPTION:		Armor, Hull (mm)	N/A
Crew	5 (2 + 3)	NBC Protection System	No
Platform (Chassis)	Ural 4320 6x6	Smoke Equipment	No
Engine Type	260 hp Water-cooled, V-8 diesel		
Chassis Length Overall (m)	7.40	SENSORS/COMPONENTS	
Height Overall (m)	3.50	Fire Control (Automated)	Baget-41
Width (m)	2.50	Fire Direction (Manual)	PUO-7
Combat Weight (mt)	13.4	Number of Workstations	2
		Number of Remote Workstations	1
Max On Road (km/h)	85	Land Navigation	Yes
Max Off-Road (km/h)	40	Laser Rangefinder	No
Cross Country (km/h)	INA		
Max Swim (km/h)	N/A		
Fording Depths (m)	1.5		
Radio	VHF 20 km		
	HF 40km		
	HF Antenna Mast 350km		

NOTES

THE 1V153 SERVES AS THE BATTALION AND BATTERY FIRE DIRECTION CENTER (FDC) VEHICLE FOR THE 1V126 KAPUSTNIK-B ARTILLERY FIRE CONTROL COMPLEX. NORMALLY, THE BATTALION CHIEF OF STAFF OR BATTERY EXECUTIVE OFFICER, ASSISTED BY FIRE DIRECTION AND COMMUNICATION PERSONNEL MANS THE VEHICLE. IT HAS NEITHER BATTLEFIELD OBSERVATION OPTICS NOR A NAVIGATION SYSTEM. TYPICALLY, FOUR FDC VEHICLES COMPRISE THE 1V126 COMPLEX. THERE IS ONE VEHICLE FOR EACH BATTERY EXECUTIVE OFFICER AND ONE VEHICLE FOR THE BATTALION CHIEF OF STAFF.

RUSSIAN ARTILLERY COMMAND VEHICLE MP-32M1

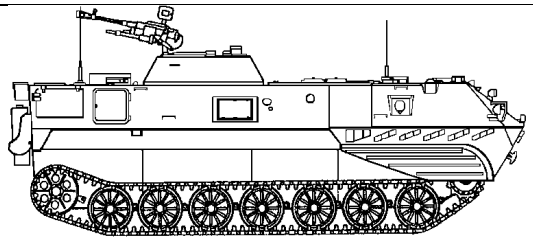


SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations	Slepok-M	Cruising Range (km)	625
Date of Introduction:			
Proliferation:	At least 1 country	Radio	VHF In motion 40 km
DESCRIPTION:			VHF Stationary 60km
Crew	6		HF Antenna Mast 350km
Platform (Chassis)	KamAZ-43101 6x6		
Engine Type	KamAZ-740, 220 hp, diesel	SENSORS/COMPONENTS:	
Chassis Length Overall (m)	7.12	Fire Control (Automated)	Baget Series
Height Overall (m)	3.20	Number of Workstations	5
Width (m)	2.50	Data transmissions/reception channels	8
Combat Weight (mt)	15.0	Data Transmission Rate, kbit/s	Up to 32
Max On Road (km/h)	85	Radio Channels	6
Max Off-Road (km/h)	INA	Land Navigation	Yes
Cross Country (km/h)	INA	Location Accuracy (m)	20
Max Swim (km/h)	N/A		
Fording Depths (m)	1.5	Emplacement Time (min)	5
Ground Clearance (mm)	365	Displacement Time (Min)	5
Grade (%)	70		

NOTES

THE MP-32M1 IS A COMMAND AND CONTROL VEHICLE (PART OF THE 9S729 COMMAND VEHICLE SET) THAT IS USED WITH THE 9A52-2 SMERCH OR THE TOCHKA-U TACTICAL MISSILE SYSTEM. THE VEHICLES ARE CAPABLE OF BEING USED AT BRIGADE, BATTALION, AND BATTERY LEVEL. THE NUMBER OF VEHICLES DEPENDS ON THE ORGANIZATIONAL STRUCTURE OF THE RESPECTIVE UNIT. THE K-4 COMMAND SHELTER RECEIVES POWER FROM TWO ON-BOARD GENERATORS RATED AT 8KW EACH. IT IS POSSIBLE TO PROGRAM THE ON-BOARD COMPUTERS TO CONDUCT A VARIETY OF FUNCTIONS THAT FACILITATES VARIATIONS FOR THE COMMANDERS AND EXECUTIVE OFFICERS VEHICLES. THE VEHICLE ALSO HAS A LIFE SUPPORT CAPABILITY OF NUCLEAR, BIOLOGICAL, AND CHEMICAL PROTECTION, A FILTERING-VENTILATING UNIT, AIR CONDITIONER, AND HEATER.

RUSSIAN ARTILLERY COMMAND/RECONNAISSANCE VEHICLE 1V13



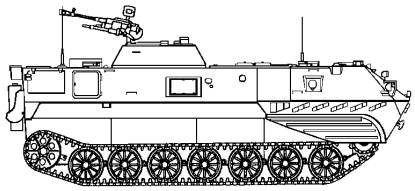
SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations	M1974-1	Armor, Turret Top (mm)	INA
Date of Introduction:	1974	Armor, Hull (mm)	15
Proliferation:	At least 1 country	NBC Protection System	Yes
Crew	6	Smoke Equipment	No
Platform (Chassis)	MT-LBu		
Engine Type	YaMZ-238, 240hp Diesel	ARMAMENT	
Chassis Length Overall (m)	7.26	Caliber, Type, Name	12.7-mm HMG DShK
Height Overall (m)	2.72	Mount Type	Pintle
Width (m)	2.85	Direct Fire Range (m)	1,500
Combat Weight (mt)	15.7	Max Effective Range (m)	1,500 (day/night)
		Fire on the Move	Yes
Max On Road (km/h)	60	Rate of Fire (rpm)	80-100
Max Off-Road (km/h)	26		
Cross Country (km/h)	INA	VARIANTS	
Max Swim (km/h)	4.5	1V13M	INA
Fording Depths (m)	Amphibious		
		SENSORS/COMPONENTS	
Radio	R-123M (3 ea)	Fire Direction (Automated)	APK automated firing data reciever
		Fire Direction (Manual)	PUO-7
PROTECTION:		Navigation	1T121-M Navigation System
Armor, Turret Front (mm)	20	Other Equipment	DSP-30 Rangefinder, K-1 collimator, roof mounted periscopic aiming circle, VOP-7 vision blocks and driver periscopes.

NOTES

THE SET PROVIDES THE COMMAND AND CONTROL VEHICLES FOR SP CANNON BATTALIONS. THE EIGHT-VEHICLE SET CONSISTS OF THREE 1V13 BATTERY SENIOR OFFICER'S VEHICLES, THREE 1V14 BATTERY COMMANDER'S VEHICLES, ONE 1V15 BATTALION COMMANDER'S VEHICLE, AND ONE 1V16 BATTALION FDC/CHIEF OF STAFF'S VEHICLE. THE 1V12M *FALTSET* ACRV SET IS A MODERNIZED VERSION OF THE SYSTEM. THE INSTALLATION OF AN UPGRADED ELECTRONICS PACKAGE IN THE VEHICLES NECESSITATED THE REQUIREMENT FOR AN EXTERNAL-MOUNTED POWER GENERATOR. IN ADDITION TO FREEING A SMALL AMOUNT OF SPACE INSIDE THE VEHICLE, THE EXTERNAL MOUNTING REDUCES THE INTERNAL NOISE LEVEL.

THE ACRV 1V13 IS THE BATTERY FDC OF THE 1V12 ACRV COMPLEX. THE BATTERY SENIOR OFFICER, ASSISTED BY FIRE DIRECTION AND COMMUNICATIONS PERSONNEL MANS THE VEHICLE. IT HAS DIRECT RADIO COMMUNICATIONS WITH THE BATTERY COP, THE BATTALION COP, AND THE BATTALION FDC. THE VEHICLE IS EQUIPPED WITH A LAND NAVIGATION SYSTEM AND HAS A ROOF MOUNTED PERISCOPIC AIMING CIRCLE. THE ROOF MOUNTED PERISCOPIC AIMING CIRCLE ALLOWS THE BATTERY SENIOR OFFICER THE ABILITY TO LAY THE HOWITZERS FOR DIRECTION FROM WITHIN HIS VEHICLE. THERE IS NO BATTLEFIELD OBSERVATION EQUIPMENT PRESENT ON THE 1V13.

RUSSIAN ARTILLERY COMMAND/RECONNAISSANCE VEHICLE 1V14

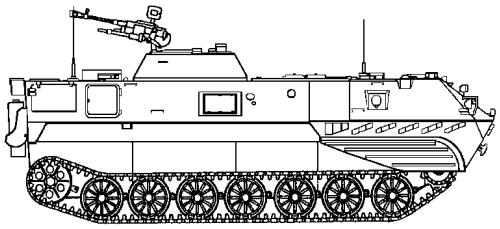


SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations	M1974-2A	Armor, Turret Top (mm)	INA
Date of Introduction:	1974	Armor, Hull (mm)	15
Proliferation:	At least 1 country	NBC Protection System	Yes
DESCRIPTION:		Smoke Equipment	No
Crew	6		
Platform (Chassis)	MT-LBu	ARMAMENT	SPECIFICATIONS
Engine Type	YaMZ-238, 240hp Diesel	Caliber, Type, Name	7.62-mm machinegun, PKT
Chassis Length Overall (m)	7.26	Mount Type	Pintle
Height Overall (m)	2.72	Direct Fire Range (m)	1,500
Width (m)	2.85	Max Effective Range (m)	1,000 (day/night)
Combat Weight (mt)	15.7	Fire on the Move	Yes
Max On Road (km/h)	60	Rate of Fire (rpm)	650 (cyclic), 2-10 round bursts
Max Off-Road (km/h)	26	SENSORS/COMPONENTS	
Cross Country (km/h)	INA	Fire Direction (Automated)	1V520
Max Swim (km/h)	4.5	Fire Direction (Manual)	PUO-7
Fording Depths (m)	Amphibious	Navigation	1T121-M Navigation System
Radio	R-123M (3 ea), R-107M (1 ea)	Other Equipment	1D15 laser rangefinder, DSP-30 Rangefinder, 1PN44 day/night sight, PAB-2AM aiming circle, DS-1 stereoscopic rangefinder, VOP-7 vision blocks and driver periscopes.

NOTES

THE ACRV 1V14 IS THE BATTERY COMMANDER'S VEHICLE OF THE 1V12 ACRV COMPLEX. THE ACRV IS EQUIPPED WITH THE 1T121 LAND NAVIGATION SYSTEM, A 1D15 LASER RANGEFINDER, AND THE 1PN44 DAY/NIGHT SIGHT MOUNTED IN A BASKET TURRET. THE OBSERVER USES AN ANALOG COORDINATE CONVERTER TO TRANSLATE THE POLAR LOCATION DATA WHEN DETERMINING RECTANGULAR TARGET COORDINATES. THE 1V14 HAS AN INTERNAL POWER GENERATOR. THE 1V520 FIRE DIRECTION COMPUTER MAY BE TRANSPORTED INTERNALLY AND DISMOUNTED AT A COMMAND OBSERVATION POST. THE ARTILLERY COMMANDER, ASSISTED BY TARGET ACQUISITION, FIRE DIRECTION AND COMMUNICATIONS PERSONNEL MANS THE VEHICLE. THE ARTILLERY COMMANDER DECIDES HOW TO ATTACK TARGETS OF OPPORTUNITY AND TARGETS RELAYED TO HIM BY THE SUPPORTED MANEUVER UNIT

RUSSIAN ARTILLERY COMMAND/RECONNAISSANCE VEHICLE 1V15

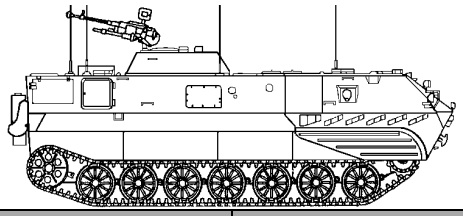


SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations	M1974-2B	Armor, Turret Top (mm)	INA
Date of Introduction:	1974	Armor, Hull (mm)	15
Proliferation:	At least 1 country	NBC Protection System	Yes
DESCRIPTION:		Smoke Equipment	No
Crew	7		
Platform (Chassis)	MT-LBu	ARMAMENT	SPECIFICATIONS
Engine Type	YaMZ-238, 240hp Diesel	Caliber, Type, Name	7.62-mm machinegun, PKT
Chassis Length Overall (m)	7.26	Mount Type	Pintle
Height Overall (m)	2.72	Direct Fire Range (m)	1,500
Width (m)	2.85	Max Effective Range (m)	1,000 (day/night)
Combat Weight (mt)	15.7	Fire on the Move	Yes
Max On Road (km/h)	60	Rate of Fire (rpm)	650 (cyclic), 2-10 round bursts
Max Off-Road (km/h)	26		
Cross Country (km/h)	INA	VARIANTS	
Max Swim (km/h)	4.5	1V15M	INA
Fording Depths (m)	Amphibious		
		SENSORS/COMPONENTS	
Radio	R-123M (2 ea), R-107M (1 ea), R-111 (1 ea), R-130M (1 ea)	Fire Direction (Automated)	1V520
		Fire Direction (Manual)	PUO-7
PROTECTION:	SPECIFICATIONS	Navigation	1T121-M Navigation System
Armor, Turret Front (mm)	20	Other Equipment	1D15 laser rangefinder, DSP-30 Rangefinder, 1PN44 day/night sight, PAB-2AM aiming circle, DS-1 stereoscopic rangefinder, VOP-7 vision blocks and driver periscopes.

NOTES

THE ACRV 1V15 IS THE BATTALION COMMANDER'S VEHICLE OF THE 1V12 ACRV COMPLEX. THE 1V15 CAN BE DISTINGUISHED FROM THE 1V14 BY THE EXTERNAL ANTENNA BRACKET ON THE REAR OF THE VEHICLE. THE ACRV IS EQUIPPED WITH THE 1T121 LAND NAVIGATION SYSTEM, A 1D15 LASER RANGEFINDER, AND THE 1PN44 DAY/NIGHT SIGHT MOUNTED IN A BASKET TURRET. THE OBSERVER USES AN ANALOG COORDINATE CONVERTER TO TRANSLATE THE POLAR LOCATION DATA WHEN DETERMINING RECTANGULAR TARGET COORDINATES. THE 1V14 HAS AN INTERNAL POWER GENERATOR. THE 1V520 FIRE DIRECTION COMPUTER MAY BE TRANSPORTED INTERNALLY AND DISMOUNTED AT A COMMAND OBSERVATION POST. THE ARTILLERY COMMANDER, ASSISTED BY TARGET ACQUISITION, FIRE DIRECTION AND COMMUNICATIONS PERSONNEL MANS THE VEHICLE. THE ARTILLERY COMMANDER DECIDES HOW TO ATTACK TARGETS OF OPPORTUNITY AND TARGETS RELAYED TO HIM BY THE SUPPORTED MANEUVER UNIT.

RUSSIAN ARTILLERY COMMAND/RECONNAISSANCE VEHICLE 1V16



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations	M1974-3	Armor, Turret Top (mm)	INA
Date of Introduction:	1974	Armor, Hull (mm)	15
Proliferation:	At least 1 country	NBC Protection System	Yes
DESCRIPTION:		Smoke Equipment	No
Crew	7		
Platform (Chassis)	MT-LBu	ARMAMENT	SPECIFICATIONS
Engine Type	YaMZ-238, 240hp Diesel	Caliber, Type, Name	12.7-mm HMG DShK
Chassis Length Overall (m)	7.26	Mount Type	Pintle
Height Overall (m)	2.72	Direct Fire Range (m)	1,500
Width (m)	2.85	Max Effective Range (m)	1,500 (day/night)
Combat Weight (mt)	15.7	Fire on the Move	Yes
Max On Road (km/h)	60	Rate of Fire (rpm)	80-100
Max Off-Road (km/h)	26		
Cross Country (km/h)	INA		
Max Swim (km/h)	4.5		
Fording Depths (m)	Amphibious		
		SENSORS/COMPONENTS	SPECIFICATIONS
Radio	R-123M (2 ea), R-111M (1 ea)	Fire Direction (Automated)	9V59
	R-130M (1 ea, R-326 receiver (1 ea)	Fire Direction (Manual)	PUO-7
PROTECTION:	SPECIFICATIONS		
Armor, Turret Front (mm)	20		

NOTES

THE 1V16 IS THE SIMPLEST OF THE VEHICLES IN THE 1V12 ACRV COMPLEX AND SERVES AS THE BATTALION FDC/CHIEF OF STAFF'S VEHICLE. NORMALLY, THE BATTALION CHIEF OF STAFF, ASSISTED BY FIRE DIRECTION AND COMMUNICATION PERSONNEL MANS THE VEHICLE. IT HAS NEITHER BATTLEFIELD OBSERVATION OPTICS NOR A NAVIGATION SYSTEM. HOWEVER, THE VEHICLE IS EQUIPPED WITH THE STANDARD VOP-7 VISION BLOCKS AND DRIVER'S PERISCOPES. IT IS EQUIPPED WITH EXTRA RADIOS AND HAS AN EXTENDABLE ANTENNA MAST MOUNTED ON THE VEHICLE REAR. THE 9V59 FIRE-DIRECTION COMPUTER IS MOUNTED IN THE VEHICLE.

THE 9V59 FIRE-CONTROL COMPUTER COMES IN SEVERAL DIFFERENT MODELS BELIEVED TO BE DESIGNATED AS 9V59-1, -2, AND –3. FOR EXAMPLE, THE 9V59-2 IS ASSOCIATED WITH 152-MM ARTILLERY UNITS. THE 9V59 FIRE-CONTROL COMPUTER IS PROBABLY A 4-BIT COMPUTER AND, ALTHOUGH QUITE RUGGED, IS ASSESSED TO HAVE A LOW MEAN TIME BETWEEN FAILURES BECAUSE OF A LARGE NUMBER OF DISCRETE COMPONENTS. THE 1V510 IS ASSESSED TO BE A REPLACEMENT FOR THE 9V59 FIRE-CONTROL COMPUTER. THE 1V510 IS CAPABLE OF PERFORMING SURVEY CALCULATIONS AND TECHNICAL FIRING DATA. THE SYSTEM IS ASSESSED TO BE 33% FASTER THAN THE 9V59.

RUSSIAN ARTILLERY COMMAND AND RECONNAISSANCE VEHICLE 1V18/1V19



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations:	M1979-2A (1V17), M1979-2B (1V18)		1V19: R-123M (2 each), R-107M (1 each), R-111 (1 each), R-130M (1 each)
Date of Introduction:	1979		
Proliferation:	At least 1 country	PROTECTION	SPECIFICATIONS
DESCRIPTION:		Armor, Turret Front (mm)	INA
Crew	6	Armor, Turret Top (mm)	INA
Platform (Chassis)	BTR-60PB	Armor, Hull (mm)	INA
Engine Type	2 GAZ-49B 90hp (180 hp total) in line water-cooled gasoline	NBC Protection System	Yes
Chassis Length Overall (m)	7.22	Smoke Equipment	No
Height Overall (m)	2.06		
Width (m)	2.85	ARMAMENT	None
Combat Weight (mt)	2.82		
Cruising Range (km)	500	SENSORS/COMPONENTS	SPECIFICATIONS
Max On Road (km/h)	80	Navigation	1T21-M Navigation System
Max Off-Road (km/h)	60	Fire Direction (Automated)	1V520
Cross Country (km/h)	INA	Fire Direction (Manual)	PUO-7
Max Swim (km/h)	10	Other Equipment	1D15 laser rangefinder, 1PN44 day/night sight, PAB-2AM aiming circle, DS-1 steroscopic rangefinder
Fording Depths (m)	Amphibious		
Radio	1V18: R-123M (3 each), R-107M (1 each)		

NOTES

IN 1979, THE SOVIET UNION INTRODUCED A SIMILAR WHEELED ACRV SET FOR MULTIPLE ROCKET LAUNCHER AND TOWED CANNON UNITS. THE EIGHT-VEHICLE SET CONSISTS OF THREE 1V110 BATTERY SENIOR OFFICER'S VEHICLES, THREE 1V18 BATTERY COMMANDER'S VEHICLES, ONE 1V19 BATTALION COMMANDER'S VEHICLE, AND ONE 1V111 BATTALION CHIEF OF STAFF'S VEHICLE. EARLY VERSIONS OF THE 1V17 ACRV SET INCLUDED A 1V111 EQUIPPED WITH A MODIFIED ZIL-130-MOUNTED 9S77M INSTEAD OF THE ZIL-131. THERE HAVE BEEN NO UPGRADES TO THE 1V17 LIKE THAT OF THE 1V12 TO 1V12M.

THE ACRV 1V18 AND 1V19 ARE THE BATTERY AND BATTALION COMMANDER'S VEHICLES OF THE 1V17 ACRV COMPLEX. BOTH VEHICLES ARE EQUIPPED WITH THE 1T121 LAND NAVIGATION SYSTEM, A 1D15 LASER RANGEFINDER, AND THE 1PN44 DAY/NIGHT SIGHT. THE OBSERVER USES AN ANALOG COORDINATE CONVERTER TO TRANSLATE THE POLAR LOCATION DATA WHEN DETERMINING RECTANGULAR TARGET COORDINATES. THE 1V520 FIRE DIRECTION COMPUTER MAY BE TRANSPORTED INTERNALLY AND DISMOUNTED AT A COMMAND OBSERVATION POST.

RUSSIAN ARTILLERY COMMAND/RECONNAISSANCE VEHICLE 1V110



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations:	M1979-1	Radio	R-123M (3 each)
Date of Introduction:	1979		
Proliferation:	At least 1 country	SENSORS/COMPONENTS	SPECIFICATIONS
DESCRIPTION:		Navigation	See NOTES
Crew	5	Fire Direction (Automated)	1V520
Platform (Chassis)	GAZ-66B, 4x4 wheeled, Box Body Van	Fire Direction (Manual)	PUO-7
Engine Type	ZMZ-66, 115 hp V-8 water-cooled gasoline	Other Equipment	DSP-30 laser rangefinder, K-1 collimator
Chassis Length Overall (m)	5.66		
Height Overall (m)	2.44		
Width (m)	2.34		
Combat Weight (mt)	3.60		
Cruising Range (km)	875		
Max On Road (km/h)	87		
Max Off-Road (km/h)	35		
Cross Country (km/h)	INA		
Max Swim (km/h)	N/A		
Fording Depths (m)	.80		

NOTES

IN 1979, THE SOVIET UNION INTRODUCED A SIMILAR WHEELED ACRV SET FOR MULTIPLE ROCKET LAUNCHER AND TOWED CANNON UNITS. THE EIGHT-VEHICLE SET CONSISTS OF THREE 1V110 BATTERY SENIOR OFFICER'S VEHICLES, THREE 1V18 BATTERY COMMANDER'S VEHICLES, ONE 1V19 BATTALION COMMANDER'S VEHICLE, AND ONE 1V111 BATTALION CHIEF OF STAFF'S VEHICLE. EARLY VERSIONS OF THE 1V17 ACRV SET INCLUDED A 1V111 EQUIPPED WITH A MODIFIED ZIL-130-MOUNTED 9S77M INSTEAD OF THE ZIL-131. THERE HAVE BEEN NO UPGRADES TO THE 1V17 LIKE THAT OF THE 1V12 TO 1V12M.

THE ACRV 1V110 BATTERY FDC SERVES THE SAME FUNCTION AS THE ACRV 1V13 (1V12 ACRV COMPLEX) AND IS SIMILARLY EQUIPPED. HOWEVER, THE LAND NAVIGATION SYSTEM IS A DIFFERENT MODEL.

RUSSIAN ARTILLERY COMMAND/RECONNAISSANCE VEHICLE 1V111



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations:	M1979-3	Radio	R-111M (1 each), R-123M (2 each), R-130M (1 each), and R-326 receiver (1 each)
Date of Introduction:	1979		
Proliferation:	At least 1 country	SENSORS/COMPONENTS	SPECIFICATIONS
DESCRIPTION:		Navigation	INA
Crew	5	Fire Direction (Automated)	9V59 fire control computer
Platform (Chassis)	ZIL 131, 6x6wheeled, Box Body Van		
Engine Type	ZIL 131 61, 150 hp V-8, water-cooled, gasoline		
Chassis Length Overall (m)	6.90		
Height Overall (m)	2.48		
Width (m)	2.50		
Combat Weight (mt)	6.7		
Cruising Range (km)	850		
Max On Road (km/h)	80		
Max Off-Road (km/h)	35		
Cross Country (km/h)	INA		
Max Swim (km/h)	N/A		
Fording Depths (m)	1.4		

NOTES

IN 1979, THE SOVIET UNION INTRODUCED A SIMILAR WHEELED ACRV SET FOR MULTIPLE ROCKET LAUNCHER AND TOWED CANNON UNITS. THE EIGHT-VEHICLE SET CONSISTS OF THREE 1V110 BATTERY SENIOR OFFICER'S VEHICLES, THREE 1V18 BATTERY COMMANDER'S VEHICLES, ONE 1V19 BATTALION COMMANDER'S VEHICLE, AND ONE 1V111 BATTALION CHIEF OF STAFF'S VEHICLE. EARLY VERSIONS OF THE 1V17 ACRV SET INCLUDED A 1V111 EQUIPPED WITH A MODIFIED ZIL-130-MOUNTED 9S77M INSTEAD OF THE ZIL-131. THERE HAVE BEEN NO UPGRADES TO THE 1V17 LIKE THAT OF THE 1V12 TO 1V12M.

THE ACRV 1V111 BATTALION FDC/CHIEF OF STAFF'S VEHICLE SERVES THE SAME FUNCTON AS THE ACRV 1V16 (1V12 ACRV COMPLEX) AND HOUSES THE FIRE-DIRECTION COMPUTER. LIKE THE 1V16, IT IS THE SIMPLEST OF THE VEHICLES IN THE 1V17 ACRV COMPLEX AND LACKS A LAND NAVIGATION SYSTEM.

RUSSIAN ARTILLERY COMMAND AND RECONNAISSANCE VEHICLE 1V119



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations:	1V119 Spektr	Fording Depths (m)	Amphibious
Date of Introduction:	1981		
Proliferation:	At least 1 country	Radio	R-123M (3 each), R-107M (1 each)
DESCRIPTION:			
Crew	6	SENSORS/COMPONENTS	SPECIFICATIONS
Platform (Chassis)	BMD-1	Navigation	1T121-M Navigation System
Engine Type	Type 5D20, 240 hp V-6, liquid cooled diesel	Fire Direction (Automated)	1V520
Chassis Length Overall (m)	5.88	Fire Direction (Manual)	PUO-7
Height Overall (m)	1.97	Other Equipment	1D15 laser rangefinder, DSP-30 rangefinder, 1PN44 day/night sight, PAB-2AM aiming circle, DS-1 steroscopic rangefinder, VOP-7 vision blocks and driver's periscopes
Width (m)	2.63		
Combat Weight (mt)	6.70		
Cruising Range (km)	500		
Max On Road (km/h)	61		
Max Off-Road (km/h)	35		
Cross Country (km/h)	INA		
Max Swim (km/h)	10		

NOTES

THE ACRV 1V119 IS ASSOCIATED WITH THE DEPLOYMENT OF THE 2S9 NONA-S 120-MM COMBINATION GUN AND CAN BE PARACHUTE LANDED WITH AIRBORNE TROOPS. THE 1V119'S SENSOR AND FIRE DIRECTION PACKAGE IS SIMILAR TO THE ACRV 1V14. THE 1V118 REOSTAT IS CLASSIFIED AS A COMMAND AND RECONNAISSANCE VEHICLE AND IS NOT ASSOCIATED WITH AN ACRV COMPLEX.

RUSSIAN ARTILLERY COMMAND AND RECONNAISSANCE VEHICLE
PRP-3



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations	PRP-3 aka: Val, MRP	ARMAMENT	
Date of Introduction:	1975	Caliber, Type, Name	7.62-mm machinegun PKT
Proliferation:	At least 1 country	Mount Type	Coaxial
		Direct Fire Range (m)	1,300
Crew	5, 2x dismounted scouts	Max Effective Range (m)	
Platform (Chassis)	BMP-1	Day:	Day: 1,000 / 400-500 on the move
Engine Type	293-hp Diesel	Night:	Night: 800
Chassis Length Overall (m)	6.73	Fire on the Move	Yes
Height Overall (m)	2.14	Rate of Fire (rpm)	80-100
Width (m)	2.94	SENSORS/COMPONENTS	SPECIFICATIONS
Combat Weight (mt)	13.20	Navigation:	1G25 gyrocompass and 1G13 gyro course indicator
Cruising Range (km)	600	Fire Direction:	None
Max On Road (km/h)	60	Right Side Sensors:	Day sight, 1PN61 passive IR night sight (with a laser illuminator, and 1D11 laser rangefinder
Max Off-Road (km/h)	35	Left Side Sensors:	None
Cross Country (km/h)	INA	Other Sensors:	There are two periscopes for commander and operator.
Max Swim (km/h)	7	Radar:	1RL133-1 PSNR-5K/TALL MIKE Radar
Fording Depths (m)	Amphibious	Operating Band:	I
Radio	R-123M onPRP-3.	Detection Range (vehicle):	10, 15 larger vehicles
PROTECTION	SPECIFICATIONS	Detection Range (personnel) km:	3.0
Armor, Turret Front (mm)		Other Comments:	A 1D13 LRF is provided for dismounts.
Armor, Turret Top (mm)	23	VARIANTS	The PRP-4 variants still use a BMP-1 chassis, but lack the rocket launchers
Armor, Hull (mm)	19		
NBC Protection System	Yes		
Smoke Equipment	VEESS		

NOTES

A BRM-3K HAS THE SAME SENSORS AS THE PRP-4M, AND HAS BEEN UPGRADED SIMILARLY. IT CAN BE USED IN ITS PLACE BUT COSTS MORE. THE LATEST AVAILABLE RADAR FOR REPLACING PSNR-5K OR PSNR-5M IS KREDO-1E. THE KREDO-1E COHERENT DOPPLER RADAR OFFERS A MAST-MOUNTED DROP-IN REPLACEMENT FOR THE PSNR-5/KREDO-M1 RADARS, WITH RANGE TO 40 KM. PROCESSING, DISPLAY, AND TRANSMISSION EQUIPMENT CHANGES REQUIRED SIMILAR TO THOSE ON THE KREDO-M1 UPGRADE.

RUSSIAN ARTILLERY COMMAND AND RECONNAISSANCE VEHICLE
PRP-4M



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations	PRP-4/Nard	Mount Type	Coaxial
Date of Introduction:	Mid 1980's	Direct Fire Range (m)	1,300
Proliferation:	At least 1 country	Max Effective Range (m)	
Crew	5, including two scouts for dismounted operations	Day:	Day: 1,000 / 400-500 on the move
Platform (Chassis)	BMP-1	Night:	Night: 800
Engine Type	293-hp Diesel	Fire on the Move	Yes
Chassis Length Overall (m)	6.73	Rate of Fire (rpm)	80-100
Height Overall (m)	2.14	Mount Type	Coaxial
Width (m)	2.94	SENSORS/COMPONENTS	SPECIFICATIONS
Combat Weight (mt)	13.20	Navigation:	1G25 gyrocompass and 1G13 gyro course indicator
Cruising Range (km)	600	Fire Direction:	1V520 Ballistic Computer
Max On Road (km/h)	60	Radio:	R-173
Max Off-Road (km/h)	35	Right Side Sensors:	LLLTV sight, 1PN61 and 1D11M-1 LRF. Range (km): 10 for TV and LRF, 3 1PN61
Cross Country (km/h)	INA	Left Side Sensors:	1PN59 Thermal sight and 1D14. Range (km): 3
Max Swim (km/h)	7	Radar:	1RL133-1 PSNR-5K/TALL MIKE
Fording Depths (m)	Amphibious	Operating Band:	I
Radio	R-123M onPRP-3.	Detection Range (vehicle):	10, 15 larger vehicles
PROTECTION:		Detection Range (pers) km:	3.0
Armor, Turret Front (mm)		Other Comments:	A 1D13 LRF for dismounts.
Armor, Turret Top (mm)	23		
Armor, Hull (mm)	19	VARIANTS	
NBC Protection System	NBC filtration and overpressure system	PRP-4M/Deytery Sensors/ Components (1988):	Radar is PSNR-5M; and the LRF is now 1D14.
Smoke Equipment	VEESS	Radar	PSNR-5M, Kredo-M1 (opt)
ARMAMENT	SPECIFICATIONS	Radio	R-163-50
Caliber, Type, Name	7.62-mm machinegun PKT		

NOTES

THE PRP-4 VARIANTS STILL USE A BMP-1 CHASSIS, BUT LACK THE ROCKET LAUNCHERS AS SEEN ON THE PRP3. THEY DIFFER IN THEIR UPGRADED SENSORS AND COMPONENTS.

THE LATEST AVAILABLE RADAR FOR REPLACING PSNR-5K OR PSNR-5M IS KREDO-1E. THE KREDO-1E COHERENT DOPPLER RADAR OFFERS A MAST-MOUNTED DROP-IN REPLACEMENT FOR THE PSNR-5/KREDO-M1 RADARS, WITH RANGE TO 40 KM. PROCESSING, DISPLAY, AND TRANSMISSION EQUIPMENT CHANGES REQUIRED SIMILAR TO THOSE ON THE KREDO-M1 UPGRADE.

RUSSIAN BATTLEFIELD SURVEILLANCE RADAR SNAR 10



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations	BIG FRED, 1RL232, 1RL232-1	ARMAMENT	15
Date of Introduction:	1975	Caliber, Type, Name:	7.62-mm machinegun PKT
Proliferation:	At least 12 countries	Mount Type:	Coaxial
DESCRIPTION:		Direct Fire Range (m):	1,300
Crew	5	Max Effective Range (m):	
Platform (Chassis)	MT-LBu	Day:	1,000 / 400-500 on the move
Engine Type	YaMZ-238, 240 hp diesel	Night:	800
Chassis Length Overall (m)	7.62	Fire on Move	Yes
Height Overall (m)	2.72 (est)	Rate of Fire (rpm):	600 cyclic in 2-10 round bursts
Width (m)	2.85 (est)	SENSORS/COMPONENTS	SPECIFICATIONS
Combat Weight (mt)	12.60	Performance Capability	
Max On Road (km/h)	60	Antenna Type:	Parabolic
Max Off-Road (km/h)	26	Operating Band:	K (34.55 to 35.25 GHz)
Cross Country (km/h)	INA	Vehicles:	16
Max Swim (km/h)	4.5	Ships:	30
Fording Depths (m)	Amphibious	Shell Impact:	10
Radio	R-123M (2 each)	Detection Against Moving Targets, With MTI (km):	10
PROTECTION:	SPECIFICATIONS	Emplacement Time	5 minutes
Armor, Turret Front (mm)	20	Displacement Time	5 minutes
Armor, Turret Top (mm)	INA		
Armor, Hull (mm)	15		
NBC Protection System	Yes		
Smoke Equipment	No		

NOTES

THE PRIMARY MISSION OF THE BIG FRED RADAR IS TO DETECT AND TRACK BOTH MOVING GROUND AND WATER SURFACE TARGETS. ADDITIONALLY, THE RADAR CAN BE USED TO PROVIDE FRIENDLY FIRE CORRECTION DATA TO ARTILLERY UNITS. THE SNAR 10 IS NOT CAPABLE OF AMPHIBIOUS OPERATIONS (UNLIKE OTHER MEMBERS OF THE MT-LBU FAMILY) DUE TO THE HEAVY TURRET. THE VEHICLES ARE ALSO EQUIPPED WITH A NBC FILTRATION AND OVERPRESSURE SYSTEM. THE SNAR-10M IS AN UPDATED VEHICLE THAT REPLACES THE BIG FRED RADAR WITH A KREDO-1E RADAR, FOR A GROUND VEHICLE DETECTION RANGE OF 40 KM. IT ALSO HAS DIGITAL DISPLAY AND COMMUNICATIONS.

RUSSIAN ARTILLERY LOCATING RADAR ARK-1M RYS



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations	None	Armor, Hull (mm)	15
Date of Introduction:	1986	NBC Protection System	Yes
Proliferation:	At least 1 country	Smoke Equipment	No
DESCRIPTION:			
Crew	4	RADAR	SPECIFICATIONS
Platform (Chassis)	MT-LBu	Antenna Type	Paraboloid Deflector
Engine Type	YaMZ-238, 240hp Diesel	Polarization	INA
Chassis Length Overall (m)	7.62		
Height Overall (m)	2.72	RECEIVER:	
Width (m)	2.85	Noise Figure (dB)	8.0
Combat Weight (mt)	15.7		
		PERFORMANCE (km)	
Max On Road (km/h)	60	Detection Range (Mortar)	13
Max Off-Road (km/h)	26	Detection Range (Artillery)	8
Cross Country (km/h)	INA	Detection Range (Rocket)	25
Max Swim (km/h)	4.5	Detection Range (Missile)	30.0
Fording Depths (m)	Amphibious	Max Number of Targets (tracks/min)	3
		Emplacement Time	5 minutes
Radio	R-123M	Displacement Time	5 minutes
PROTECTION:			
Armor, Turret Front (mm)	20		
Armor, Turret Top (mm)	INA		

NOTES

THE ARK-1M POWER SUPPLY IS LOCATED ON THE REAR OF THE VEHICLE.

CHINESE ARTILLERY LOCATING RADAR SLC-2



Chinese SLC-2 Artillery Locating Radar with antenna erected

SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations	None	Scan Method	Electronic
Date of Introduction:		Scan Type	Sector (azimuth)
Proliferation:	At least 3 countries	Scan Width -Hostile Fire (deg)	90
Crew	4	Scan Width -Friendly Fire (deg)	22.56
Platform (Chassis)	Dong Feng EQ2102 3.5 ton 6x6	TRANSMITTER:	
Engine Type	Cummings 6BT5.9 Diesel	Transmitter Type	INA
Chassis Length Overall (m)	7.49	Peak Power (kw)	45
Height Overall (m)	2.74	Frequency Band	S-band (2-4Ghz)
Width (m)	2.47	Modulation Type	Pulsed
Combat Weight (mt)	10.4		
		RECEIVER:	
Max On Road (km/h)	90	Noise Figure (dB)	3.5
Max Off-Road (km/h)	INA	Single Pulse Processing	Coherent
Cross Country (km/h)	INA	Multiple Pulse Processing	Doppler Filters
Fording Depths (m)	1.0	PERFORMANCE (km)	SPECIFICATIONS
		Detection Range (Mortar)	10.0
Radio	INA	Detection Range (Artillery)	35.0
		Detection Range (Rocket)	50.0
RADAR:		Detection Range (Missile)	50.0
Antenna Type	Active Phased Array	Emplacement Time	10 minutes (est)
Polarization	Vertical	Displacement Time	10 minutes (est)

NOTES

THE SYSTEM IS SIMILAR TO THE U.S. AN/TPQ-37 IN BOTH APPEARANCE AND PERFORMANCE (AS CLAIMED BY THE MANUFACTURER). THE SYSTEM CAN BE USED TO TRACK FRIENDLY ARTILLERY FIRE. THE SYSTEM CALCULATES THE IMPACT ERROR OF FRIENDLY ARTILLERY ROUNDS AND PROVIDES AUTOMATIC CORRECTION PARAMETERS FOR INCREASED ACCURACY. THE RADAR SYSTEM IS EMPLOYED AS A TWO-VEHICLE SET. VARIOUS OPEN-SOURCE MATERIAL INDICATES THE DONG FENG EQ2102 3.5 TON 6X6 TRUCK IS ASSOCIATED WITH THE SLC-2 RADAR SET. ONE VEHICLE (2 PERSONNEL) CARRIES THE RADAR WHILE THE OTHER VEHICLE (2 PERSONNEL) CARRIES THE COMMAND CABIN AND THE SYSTEM POWER SUPPLY. THE COMMAND CABIN CONTAINS THE OPERATION AND CONTROL PANEL, DATA PROCESSING EQUIPMENT, COMPUTER MONITORS/DISPLAYS, ETC.

CHINESE ARTILLERY LOCATING RADAR BL 904



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations	Type 704 and Type 704M	Scan Method	Electronic
Date of Introduction:	1991	Scan Type	Sector (azimuth)
Proliferation:	At least 2 countries	Scan Width (deg)	Narrow 30; Wide 90
DESCRIPTION:			
Crew	4	TRANSMITTER:	
Platform (Chassis)	Dong Feng EQ2102 3.5 ton 6x6	Transmitter Type	Traveling Wave Tube
Engine Type	Cummings 6BT5.9 Diesel	RF Minimum (GHz)	8.0
Chassis Length Overall (m)	6.84 (est)	RF Maximum (GHz)	12.0
Height Overall (m)	INA	Mode	All
Width (m)	2.40 (est)		
Combat Weight (mt)	11.5	RECEIVER:	
		Noise Figure (dB)	8.0
Max On Road (km/h)	85	Single Pulse Processing	Coherent
Max Off-Road (km/h)	INA	Multiple Pulse Processing	Doppler Filters
Cross Country (km/h)	INA		
Max Swim (km/h)	N/A	PERFORMANCE (km)	
Fording Depths (m)	0.9	Detection Range (Mortar)	12.0 (82-mm, wide scan)
		Detection Range (Artillery)	16.0 (122-mm, wide scan)
Radio	INA	Detection Range (Artillery)	20.0 (155-mm, wide scan)
		Detection Range (Rocket)	30.0 (273-mm, narrow scan)
RADAR:		Max Targets (tracks/min)	8
Antenna Type	Active Phased Array	Emplacement Time	10 minutes (est)
Antenna Gain (dBi)	43.3	Displacement Time	10 minutes (est)

NOTES

THE SYSTEM WAS INITIALLY NAMED THE TYPE 704. LATER AN IMPROVED-PERFORMANCE VERSION WAS CALLED THE TYPE 704M. THE SYSTEM IS SIMILAR TO THE U.S. AN/TPQ-36 IN BOTH APPEARANCE AND PERFORMANCE (AS CLAIMED BY THE MANUFACTURER). THE SYSTEM CALCULATES THE IMPACT ERROR OF FRIENDLY ARTILLERY ROUNDS AND PROVIDES AUTOMATIC CORRECTION PARAMETERS FOR INCREASED ACCURACY. THE RADAR SYSTEM IS EMPLOYED AS A TWO-VEHICLE SET. ONE VEHICLE CARRIES THE RADAR WHILE THE OTHER VEHICLE CARRIES THE COMMAND CABIN AND THE SYSTEM POWER SUPPLY. THE COMMAND CABIN CONTAINS THE OPERATION AND CONTROL PANEL, DATA PROCESSING EQUIPMENT, COMPUTER MONITORS/DISPLAYS, ETC.

EUROART ARTILLERY LOCATING RADAR COBRA



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations	None	Scan Method	Electronic
Date of Introduction:	2003	Scan Type	Sector (azimuth)
Proliferation:	At least 4 countries	Scan Width -Hostile Fire (deg)	90
DESCRIPTION:		Scan Width -Friendly Fire (deg)	INA
Crew	3 (1 driver/2 radar operators)	TRANSMITTER:	
Platform (Chassis)	Renault TRM 10000, 6x6	Transmitter Type	Solid State Amplifier
Engine Type	Berliet MIDS 06.20.45, Diesel	Peak Power (kw)	INA
Chassis Length Overall (m)	9.27	Frequency Band	C-band (3.9 – 6.2 Ghz)
Height Overall (m)	INA	Modulation Type	Pulsed
Width (m)	2.48	RECEIVER:	
Combat Weight (mt)	10	Noise Figure (dB)	INA
		Single Pulse Processing	Coherent
Max On Road (km/h)	90	Multiple Pulse Processing	Doppler Filters
Max Off-Road (km/h)	INA	PERFORMANCE (km)	SPECIFICATIONS
Cross Country (km/h)	INA	Detection Range (Mortar)	INA
Max Swim (km/h)	N/A	Detection Range (Artillery)	INA
Fording Depths (m)	1.0	Detection Range (Rocket)	> 40.0
Radio	INA	Max tracks/min	40 < 2 minutes
RADAR:		Emplacement Time	10 minutes
Antenna Type	Phased Array	Displacement Time	3.0 minutes/1.0 (hasty)
Polarization	Vertical		

NOTES

THE COUNTER-BATTERY RADAR OR COBRA IS A RADAR SYSTEM DEVELOPED BY THE EUROART CONSORTIUM CONSISTING OF THE UNITED KINGDOM, FRANCE, AND GERMANY. EACH COUNTRY MOUNTS THE SYSTEM CONSISTING OF THE RADAR AND SHELTER ON VARIOUS TRUCKS. THE COMMUNICATIONS SUITE IS ALSO SPECIFIED BY THE CUSTOMER. FOR EXAMPLE, FRANCE USES THE ATLAS FIRE DIRECTION COMMAND AND CONTROL SYSTEM AND THE RENAULT TRM 10000 6X6 TRUCK. THE ELECTRONICALLY-STEERED ARRAY ANTENNA RADAR INCORPORATES THE 2720 SOLID-STATE GALLIM ARSENIDE TRANSMIT-RECEIVE MODULE. THUS, THE INCLUSION OF THIS MODULE IS AN EXAMPLE OF WHY SOME ARTILLERY LOCATING RADARS EXPERTS CONSIDER COBRA AS ONE OF THE WORLD'S MOST ADVANCED TECHNOLOGY ALRS OF THE 21ST CENTURY. COBRA DOES NOT REQUIRE THE USE OF LEVELING OR STABILIZATION JACKS DURING EMPLACEMENT. THE MANUFACTURER CLAIMS THE RADAR'S ABILITY TO ACQUIRE MORE THAN 240 WEAPONS OR 40 SITES IN LESS THAN TWO MINUTES. THE CREW SIZE MAY RANGE FROM 2-3 DEPENDING ON THE TYPE OF VEHICLE USED FOR TRANSPORT OF THE RADAR.

NORWEGIAN ARTILLERY LOCATING RADAR ARTHUR



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations	None	Scan Method	Electronic
Date of Introduction:	2000	Scan Type	Lobing
Proliferation:	At least 6 countries	Scan Width -Hostile Fire (deg)	90
Crew	2	Scan Width -Friendly Fire (deg)	INA
Platform (Chassis)	Unimog U2150L, 5 ton 4x4	TRANSMITTER:	
Engine Type	Mercedes Benz OM366LA, Diesel	Transmitter Type	Traveling Way Tube (TWT)
Chassis Length Overall (m)	6.70	Peak Power (kw)	20
Height Overall (m)	INA	Frequency Band	C-band (5.4– 5.9 Ghz)
Width (m)	2.46	Modulation Type	Pulsed
Combat Weight (mt)	12.5	RECEIVER:	
Max On Road (km/h)	85	Noise Figure (dB)	3.0
Max Off-Road (km/h)	INA	Single Pulse Processing	Coherent
Cross Country (km/h)	INA	Multiple Pulse Processing	Doppler Filters
Max Swim (km/h)	N/A	PERFORMANCE (km)	SPECIFICATIONS
Fording Depths (m)	1.30	Detection Range (Mortar)	55
		Detection Range (Artillery)	31
Radio	INA	Detection Range (Rocket)	60
RADAR:		Max Number of Targets (tracks/min)	100
Antenna Type	Phased Array	Emplacement Time	5 minutes
Polarization	Horizontal	Displacement Time	3 minutes

NOTES

THE ARTILLERY HUNTING RADAR (ARTHUR) IS AN ARTILLERY LOCATING RADAR SYSTEM DEVELOPED BY NORWAY. ARTHUR CAN BE DEPLOYED AS A SELF-SUSTAINED CONTAINER ON VARIOUS VEHICLES. FOR EXAMPLE, THE NORWEGIAN AND SWEDISH ALR ARE MOUNTED ON THE HAGGLUNDS BV 208 ALL-TERRAIN CARRIER. THE DANISH ARTUR IS MOUNTED ON A MERCEDES-BENZ UNIMOG 4X4 TRUCK. THE DATA LISTED ABOVE IS BASED ON THE MERCEDES BENZ U2150 4X4 CHASSIS. AN ENHANCED VARIANT, ARTHUR MOD B, IS THE BASIS FOR THE UNITED KINGDOM ARMY'S MAMBA (MOBILE ARTILLERY MONITORING BATTLEFIELD) RADAR. THE CREW SIZE MAY RANGE FROM 2-3 DEPENDING ON THE TYPE OF VEHICLE USED FOR TRANSPORT OF THE RADAR. THE ARTHUR MOD C INCORPORATES A LARGER ANTENNA THAT INCREASES THE DETECTION RANGE OF PROJECTILES AND ROCKETS WITH A CIRCULAR ERROR OF PROBABILITY (CEP) OF 0.2% OF RANGE FOR GUNS AND ROCKETS AND 0.1% FOR MORTARS

RUSSIAN ARTILLERY LOCATING RADAR 1L219M ZOOPARK



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations	Zoopark-1	Scan Method	Electronic
Date of Introduction:	1L219, 1997/1L219M, 2004	Scan Type	Sector
Proliferation:	At least 1 country	Scan Width -Hostile Fire (deg)	90
DESCRIPTION:			
Crew	3 (1 driver/2 radar operators)	TRANSMITTER:	
Platform (Chassis)	MT-LBu	Transmitter Type	INA
Engine Type	YaMZ 238, 240 hp Diesel	Peak Power (kw)	INA
Chassis Length Overall (m)	7.62	Frequency Band	6.0 – 8.0 (Ghz)
Height Overall (m)	INA	Modulation Type	All
Width (m)	2.85		
Combat Weight (mt)	10	RECEIVER:	
		Noise Figure (dB)	5.0
Max On Road (km/h)	60	Single Pulse Processing	INA
Max Off-Road (km/h)	26	Multiple Pulse Processing	INA
Cross Country (km/h)	INA		
Max Swim (km/h)	4.5	PERFORMANCE (km)	SPECIFICATIONS
Fording Depths (m)	Amphibious	Detection Range (Mortar)	20.0
		Detection Range (Artillery)	15.0
Radio	R-123M	Detection Range (Rocket)	30.0
		Detection Range (Missile)	40.0
RADAR:		Max Number of Targets (tracks/min)	12
Antenna Type	Active Phased Array	Emplacement Time	5 minutes
Antenna Gain (dBi)	40.0	Displacement Time	5 minutes

NOTES

THE ZOOPARK-1 AUTOMATED MULTIFUNCTIONAL RECONNAISSANCE AND CONTROL COMPLEX CONSISTS OF THE 1L259 RADAR MOUNTED ON A MT-LBU CHASSIS, 1IZ0 MAINTENANCE VAN ON A URAL-43203 TRUCK, AND THE TRAILER-MOUNTED ED30-T230P-1RPM POWER STATION. THE MT-LBU ENGINE-DRIVEN GENERATOR ALLOWS FOR AUTONOMOUS OPERATION. THE ED30-T230P-1RPM POWER STATION PROVIDES POWER DURING VEHICLE AND RADAR MAINTENANCE. THE SYSTEM IS CAPABLE OF TRANSMITTING INFORMATION OF A DETECTED ENEMY FIRING UNIT POSITION TO AN ARTILLERY UNIT WITHIN 20 SECONDS OF DETECTION.

THE ZOOPARK-1 IS CAPABLE OF TRACKING FRIENDLY ARTILLERY FIRE. THE SYSTEM CALCULATES THE IMPACT ERROR OF FRIENDLY ARTILLERY ROUNDS AND PROVIDES AUTOMATIC CORRECTION PARAMETERS FOR INCREASED ACCURACY. ADDITIONALLY, THE SYSTEM IS ALSO CAPABLE OF CONTROLLING (SIMULTANEOUSLY)

SEVERAL REMOTE PILOTED VEHICLES (RPVS) USING AN AUTOMATIC SCREEN INDICATION WITH A TOPOGRAPHIC MAPPING OF CALCULATED AND REAL RPV FLIGHT ROUTES. THE RADAR IS CAPABLE OF CONDUCTING AIR TRAFFIC CONTROL AROUND AN AIRFIELD OR OPERATING AREA. THE RADAR TRACKS AND ESTABLISHES THE CURRENT POSITION OF AIRCRAFT IN THE OPERATING AREA OF RESPONSIBILITY AND PROVIDES REAL-TIME DATA TRANSMISSION OF DATA RECEIVED TO THE AIR CONTROL CENTER.

THE ANTENNA BEAM IS ELECTRONICALLY PHASE-STEERED IN AZIMUTH AND ELEVATION. THE REFLECT-ARRAY IS COMPOSED OF 3328 PHASE SHIFTERS, SPACE-FED BY A MONO-PULSE HORN LOCATED ON THE FRONT SIDE OF THE ARRAY AND ELECTRONICS ENCLOSURE. AFTER COMING INTO POSITION, AND AFTER THE ARRAY IS RAISED FROM THE TRAVEL POSITION, IT IS ROTATED SO THAT ITS BORE SIGHT IS CENTERED IN THE ASSIGNED COVERAGE SECTOR. THE SEARCH SCAN ELEVATION ANGLE IS PROBABLY FIXED, NOMINALLY AT A LOW ANGLE IN THE RANGE OF 30 TO 50 MILS. THE SEARCH MODE WILL BE INTERRUPTED BY VERIFICATION AND TRACK MODE SCANS DURING PERIODS WHEN TARGETS ARE DETECTED. VERIFICATION IS MOST LIKELY A NON-SCANNING MODE, WITH THE BEAM POINTED AT THE SAME ELEVATION ANGLE AS THE SEARCH SCAN. ALSO, VERIFICATION MAY BE REPEATED FOR SOME TARGETS. DURING THE TRACK MODE, THE RADAR TRACKS THE TARGET BY SCANNING IN BOTH AZIMUTH AND ELEVATION.

UKRAINIAN ARTILLERY LOCATING RADAR 1L220-U

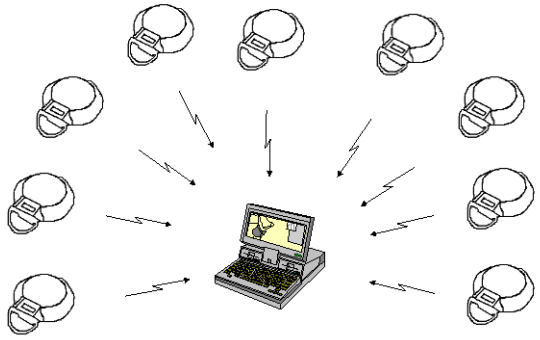


SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations	Zoopark 2	Mode	Search
Date of Introduction:	1999	Scan Method	Electronic
Proliferation:	At least 1 country	Scan Type	Monopulse
DESCRIPTION:		Scan Width (deg)	2.3 (Single beam position is assumed)
Crew	INA		
Platform (Chassis)	GM-5951 ATV	Mode	Verification
Engine Type	INA	Scan Method	Electronic
Chassis Length Overall (m)	9.42	Scan Type	Sector
Height Overall (m)	3.35	Scan Width (deg)	60
Width (m)	3.25		
Combat Weight (mt)	39.6	TRANSMITTER:	
		Transmitter Type	Traveling Way Tube (TWT)
Max On Road (km/h)	60	Peak Power (kw)	40
Max Off-Road (km/h)	INA	Frequency Band	3.0– 4.0 Ghz
Cross Country (km/h)	INA	Modulation Type	Pulsed
Max Swim (km/h)	N/A		
Fording Depths (m)	INA	RECEIVER:	
		Noise Figure (dB)	5.0
Radio	INA	Single Pulse Processing	Coherent
		Multiple Pulse Processing	MTI and Doppler Filters
RADAR:			
Antenna Type	Phased Array	PERFORMANCE (km)	
Polarization	Vertical	Detection Range (Mortar)	30
Mode	Track	Detection Range (Artillery)	20
Scan Method	Electronic	Detection Range (Rocket)	50
Scan Type	Monopulse	Detection Range (Tactical Missile)	80
Scan Width (deg)	6 (10% of the full azimuth sector is assumed for a crossing trajectory)	Emplacement Time	5 minutes
		Displacement Time	5 minutes

NOTES

A UKRAINIAN EXPORT COMPANY REPORTED THE UKRAINIAN ARMY WOULD BEGIN RECEIVING THE ZOOPARK 2 IN 1999. THE ALR HAS THE CAPABILITY OF DETECTING MORTARS, CANNON ARTILLERY, ROCKET, AND TACTICAL MISSILE BATTERIES. IT CAN ESTIMATE THE IMPACT POINTS OF HOSTILE FIRES AS WELL AS REGISTER FRIENDLY ARTILLERY. THE ALR HAS AN INTERNAL NAVIGATION AND ORIENTATION SYSTEM TO ENABLE AUTONOMOUS OPERATIONS AND IS EQUIPPED WITH A COMMUNICATIONS SUITE FOR COMMAND AND CONTROL.

SWEDISH SOUND RANGING SYSTEM SORAS 6



Swedish Sound Ranging System SORAS 6 Configuration

SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations	None	Height (mm)	52
Date of Introduction:	INA	Weight (kg)	2.8
Proliferation:	At least 1 country	Sound Frequency (hz)	2 - 150
DESCRIPTION:		Mic Cable Length (km)	1 - 8
Crew	2	Meteorological Unit:	
Platform (Chassis)	Unimog U1350L 4x4	Mast Height (m)	15
Engine Type	OM-352 6 cylinder diesel	Mast weight (kg)	40
Chassis Length Overall (m)	5.5		
Height Overall (m)	2.5	PERFORMANCE (km)	
Width (m)	2.3	Detection Range:	
Combat Weight (mt)	7.5	Minimum	INA
Max On Road (km/h)	80	Maximum	30
Max Off-Road (km/h)	INA	Precision:	
Cross Country (km/h)	INA	Under 10 km	0.5 % of the measured distance
Max Swim (km/h)	N/A	Under 30 km	2% of the measured distance
Fording Depths (m)	1.20	Max Number of Targets	200
Radio	INA	Response Time	2 to 45 seconds
MICROPHONES:		Emplacement Time	Varies
Number	9	Displacement Time	Varies
Circumference (mm)	255		

NOTES

SOUND RANGING SYSTEM (SORAS) 6 IS A FULLY AUTOMATED, EMP-PROTECTED, COMPLETELY PASSIVE SOUND RANGING SYSTEM CAPABLE OF ACCURATELY LOCATING ENEMY GUN POSITIONS. THE SYSTEM IS NOT SUSCEPTIBLE TO JAMMING. THE SYSTEM IS COMPRISED OF A COMPUTER TERMINAL, NINE MICROPHONES, AND A METEOROLOGICAL UNIT. EACH MICROPHONE IS SURVEYED INTO POSITION, AND ACOUSTICALLY DESIGNATES AN AZIMUTH TO EACH FIRER. THE COMPUTER TERMINAL THEN CALCULATES INTERSECTION POINTS WITH THE AZIMUTHS, FOR TARGET LOCATIONS. THE SYSTEM OPERATES IN TEMPERATURES RANGING FROM -40° TO +55° C. NORMALLY, IT TAKES BETWEEN 2 AND 45 SECONDS FOR THE COMPUTER TERMINAL TO CALCULATE TARGET COORDINATES. BUT, THE TARGET COORDINATE CALCULATION TIME DEPENDS ON THE NUMBER OF SOUND SOURCES WITHIN THE SAME INTERVAL OF TIME. NINE MICROPHONES ARE DEPLOYED IN AN AREA 8 KM WIDE AND 1-2 KM DEEP. THE MICROPHONE POSITIONS ARE DETERMINED BY CONVENTIONAL SURVEYING METHODS OR BY SPECIAL EQUIPMENT. AN ALARM ON THE CALCULATOR IS AUTOMATICALLY TRIGGERED IF CONTACT IS BROKEN WITH ANY OF THE MICROPHONES. THE METEOROLOGICAL UNIT PROVIDES AIR TEMPERATURE, WIND SPEED, AND WIND DIRECTION. TWO PEOPLE CAN CONNECT THE METEOROLOGICAL UNIT AND RAISE THE MAST IN 15 TO 20 MINUTES.

THE SYSTEM POSSESS THE ABILITY TO DETECT FIRING SYSTEMS BY ITSELF AND/OR ACT AS A PASSIVE CUEING SYSTEM WHEN USED IN CONJUNCTION WITH AN ARTILLERY LOCATION RADAR. THERE ARE NO ASSOCIATED VEHICLES FOR THE SORAS 6. HOWEVER, THE MERCEDES BENZ UNIMOG U1350L TRUCK (DESCRIBED WITHIN THE TABLE) PROVIDES A REPRESENTATIVE WORLDWIDE TRANSPORTATION CAPABILITY FOR THE SYSTEM.

Artillery Weapons: Rocket Launchers

Compared to cannon, rocket launchers (RLs) are relatively uncomplicated, easy to operate and maintain, and are highly mobile. Single-tube RLs vary from 107 mm (Type 85) to 544 mm (Luna-M/FROG-7). Single-tube RLs of 122-mm or less are man-portable for use by dismounted troops.

The majority of RLs are multiple rocket launchers (MRLs). The OPFOR categorizes MRLs as medium-caliber (100 – 220 mm), and large-caliber (220 mm and larger). The OPFOR uses MRLs to deliver heavy fire on important targets at decisive moments in a battle. They offer an economical means to deliver massive, destructive fires on an area-type target in a very short period of time. The principal disadvantage of some MRLs is that excessive dispersion does not permit direct, close support to maneuver elements. For sudden massive strikes, MRLs may execute salvo fire from the launchers. These flexible assets may fire as battery and battalion groups or as platoons or autonomous weapons. MRLs can provide the initial area coverage fires, while cannons and mortars either maintain fire at a steady volume or attack high-value point targets. MRLs are also excellent weapons for counter-battery fire, especially when the enemy uses large-area dispersion for survivability.

The MRL is an excellent area coverage weapon, and its rapid ripple fire is an excellent delivery system for high-explosive (HE), volumetric explosive (VEX), and smoke projectiles; chemical agents; and submunitions. The OPFOR often dedicates some MRLs with scatterable mines to lay on-demand mine fields. Improved munitions, e.g., guided projectiles enable MRLs to fire multiple salvos strikes from autonomous platoons or launchers, with lethal results against point targets or small target nodes.

CHINESE 107-MM MULTIPLE ROCKET LAUNCHER TYPE 63



Type 63 launcher



Type 81Chinese SP MRL



Improvised launcher

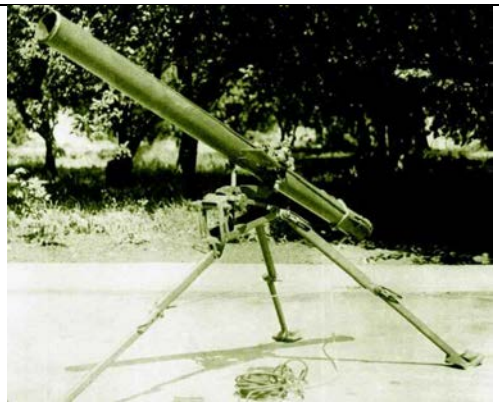
SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations:	Also called BM-1, Haseb (IR)	107-mm Frag-HE, Type 63 spin-stabilized rocket	
Date of Introduction:	IOC 1963	Indirect Fire Maximum Range (m):	8,000
Proliferation:	At least 20. Iran, Turkey, and North Korea also produce	Warhead Weight (kg):	18.8
Description:		Rocket Length (m):	0.84
Crew:	5 (incl ammunition bearers)	Maximum Velocity (m/s):	372
Combat Weight (kg):	602 loaded; 376 unloaded	Fuze Type: PD	PD
Length (m):	2.9	Effects:	1,600 steel balls
Width (m):	1.65		
Height (m):	0.91	107-mm, Controlled Frag-HE, Type 63 II SS rocket	
Emplacement and Displacement Times (min):	0.5	Maximum Range (m):	8,500
		Warhead Weight (kg):	18.84
ARMAMENT	SPECIFICATIONS	Effects:	Lethal radius 18.5 m with 1,214 fragments
Caliber, Type, Name:	107-mm, Towed, Type 63	107-mm HE Incendiary, White Phosphorus, Type 63 SS rocket	
Number of Tubes:	12	Maximum Range (m):	8,500
Launch Rate:	12 rockets in 7-8 sec	Warhead Weight (kg):	18.74
Loader Type:	Manual		
Reload Time:	3 min	107-mm Type 81 DP, DPICM rocket (Chinese)	
Traverse (°):	32 without moving carriage, 360 for single salvo	Maximum Range (m):	8,000
Left and Right:	16	Warhead Weight (kg):	8.4
Elevation (°) (-/+):	+3/+57°	Effects:	Submunitions with HE effects and 80-mm penetration
FIRE CONTROL		Other Ammunition Types:	
Indirect Fire:	Optical Sight, MS-2 or similar	Jammer round:	Duration 15 min, range 7,800 m
		TRB-107 Turkish rocket :	11+ km Steel balls proximity
		Type 63 III SS:	10 km Frag-HE electronic

NOTES

THE MRL HAS BEEN MOUNTED ON A VARIETY OF VEHICLES. THE TYPE 81 MOUNTS THE LAUNCHER ON A SHORT BED. NORTH KOREA HAS SEVERAL VERSIONS WITH ONE, TWO, OR THREE LAUNCHERS MOUNTED AT THE REAR OF VTT TRACKED APC CHASSIS. IRAN MOUNTS THE LAUNCHER ON A 4X4 TACTICAL UTILITY VEHICLE.

A VARIETY OF VARIANTS HAVE BEEN PRODUCED BY VARIOUS COUNTRIES. THE ROCKETS HAVE BEEN USED AS IMPROVISED WEAPONS, INCLUDING PROPELLANT MOTORS ATTACHED TO LARGER MUNITIONS, TO FORM IMPROVISED ROCKET ASSISTED MUNITIONS (IRAMS), AKA: “FLYING IEDS”. LOCAL VERSIONS OF LAUNCHERS AND ROCKET MODELS DIFFER. PACK VERSION FOR AIRBORNE TROOPS (281KG) CAN BE DISMANTLED FOR MANPACK LOADS.

RUSSIAN 122-MM 1- ROUND ROCKET LAUNCHER 9P132



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations:	DKZ-66, BM-21P, Grad-1P, 9K510	FIRE CONTROL	
Date of Introduction:	Mid to late 1960s	Indirect Fire:	PG-1M Panoramic Telescope (PANTEL)
Proliferation:	At least 5 countries	Collimator	K-1
Crew:	4-5 (includes ammunition bearers)	Caliber, Type, Name:	
Combat Weight (kg):	101 loaded; 55 unloaded	122-mm Frag-HE, 9M22M	
Chassis Length Overall (m):	2.5	Indirect Fire Range (m):	
Width (m):	1.53	Minimum Range:	3,000
Height (m):	1.0	Maximum Range:	10,800
Emplacement Time (min):	2.5	Warhead Weight (kg):	19.4
Displacement Time (min):	2.0	Rocket Length (m):	1.90
		Maximum Velocity (m/s):	450
Radio:	R-107M	Fuze Type:	PD
ARMAMENT	SPECIFICATIONS	122-mm Illuminating Rocket Projectile, 9M42	
Launcher:		Indirect Fire Range (m):	
Caliber, Type, Name:	122-mm, 9P123	Minimum Range:	1,000
Number of Tubes:	1	Maximum Range:	5,000
Launch Rate:	1 round per minute	Warhead Weight (kg):	27
Loader Type:	Manual	Rocket Length (m):	1.90
Reload Time:	67 min (approximately 40 seconds)	Maximum Velocity (m/s):	INA
Traverse (°):	Traverse (°):	Fuze Type:	INA
Left, Right, and Total:	7, 7, and 14		
Elevation (°) (-/+):	B +10/+40°	Other Ammunition Types:	Smoke

NOTES

THE 9P132 IS A LIGHTWEIGHT, MAN-PORTABLE ROCKET LAUNCHER USED BY GUERRILLA, SPECIAL PURPOSE FORCES, OR OTHER LIGHT FORCES. THE 9P132 IS ONLY EFFECTIVE AS A HARASSMENT OR INTERDICTION WEAPON. WHEN USED TO FIRE A NEW ILLUMINATION ROCKET (9M42) THE SYSTEM HAS BEEN REFERRED TO AS THE 9K510. THE 9P132 IS BROKEN DOWN FOR MANPACK TRANSPORT INTO TWO ONE-MAN LOADS – THE TUBE (27 KG) AND THE TRIPOD SIGHT ASSEMBLY WITH A REMOTE FIRING DEVICE (27 TO 28 KG). THE TRIPOD LEGS ALSO FOLD FOR EASE OF HANDLING. EACH 9M22M ROCKET IS BROKEN DOWN INTO TWO ONE-MAN LOADS FOR TRANSPORT. IT TAKES APPROXIMATELY 2 MINUTES FOR ASSEMBLY OF THE ROCKET. WHEN ASSEMBLED, THE LAUNCHER HAS THREE COURSE ELEVATION POSITIONS, WITH THE FINAL ELEVATION SET BY MEANS OF AN ELEVATION SCREW. THE CREW USES AN ELECTRICAL REMOTE CONTROL WITH AN ELECTRICAL IMPULSE GENERATOR AND BATTERY TO FIRE THE LAUNCHER. THE 9P132 IS INCAPABLE OF FIRING THE 9 FOOT VERSION ROCKETS OF THE BM-21 AND SIMILAR 122-MM SYSTEMS.

RUSSIAN 122-MM MULTIPLE ROCKET LAUNCHER 9A51/PRIMA



SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations:	9A51	Caliber, Type, Name:	122-mm, Prima
Date of Introduction:	1988	Number of Tubes:	50
Proliferation:	At least 2 countries	Full Salvo Time:	50 rounds in 30 seconds
Crew:	3	Single Rocket Interval:	0.6 seconds per rocket (est)
Chassis/Carriage:	Ural 4320 6x6 wheeled	Loader Type:	Transloader, crane hoist
Combat Weight (mt):	13.9	Reload Time (min):	10
Chassis Length Overall (m):	7.35	Traverse (°):	
Width (m):	2.50	Left:	58
Height (m):	2.50	Right:	58
AUTOMOTIVE	SPECIFICATIONS	Total:	116
Engine Type:	KAMAZ-740, 210 hp, diesel	Elevation (°):	-0/+55°
Cruising Range (km):	990	FIRE CONTROL	SPECIFICATIONS
Speed (km/h):		Indirect Fire:	PG-1M PANTEL
Max Road:	85	Collimator:	K-1
Max Off-Road:	40	Fire Control Computer:	None
Cross-Country:	INA	Position Location System:	None
Max Swim:	N/A	ARMAMENT	SPECIFICATIONS
Fording Depths (m):	1.5	Caliber, Type, Name:	
Emplacement Time (min):	3	122-mm Frag-HE, 9M53F:	
Displacement Time (min):	3	Indirect Fire Range (m):	
Radio:	R-173M FM-VHF	Minimum Range:	5000
PROTECTION	SPECIFICATIONS	Maximum Range:	20,500
Armor, Front (mm):	None	Warhead Weight (kg):	26
Armor Side (mm):	None	Rocket Length (m):	3.03
Armor Roof (mm):	None	Maximum Velocity (m/s):	INA
Self-Entrenching Blade:	No	Fuze Type:	Proximity
NBC Protection System:	No	Other Ammunition Types:	All standard 122-mm

NOTES

THE 9A51 PRIMA LAUNCHER ASSEMBLY INCORPORATES 50 LAUNCH TUBES, A THERMAL SHROUD, AND A REMOTE ELECTRONIC FUZE SETTER. THE REMOTE FUZE SETTER INCREASES THE EASE WITH WHICH THE CREW CAN ADJUST TO CHANGING TARGET SITUATIONS. SMALL BOXES ON THE UPPER RIGHT SURFACE OF THE EXIT END OF THE LAUNCHER TUBE CONTAIN THE FUZE SETTER FOR EACH ROCKET. THE LAUNCH TUBES ARE ARRAYED FROM TOP TO BOTTOM: 11-11-11-10-7. A 51ST TUBE IN THE CENTER OF THE FOURTH ROW IS BLOCKED AND USED FOR ELECTRONICS. THE ELEVATING ARMS ARE MOUNTED IN THE CENTER OF THE BOTTOM ROW (LIKE THE 9P138) IN ORDER TO REDUCE THE HEIGHT OF THE SYSTEM. THE 9A51 PRIMA IS CAPABLE OF FIRING OLDER 122-MM ROCKETS AS WELL AS THE NEWER 122-MM ROCKETS. THE NEW ROCKETS ARE EQUIPPED WITH A SEPARATING, PARACHUTE-RETARDED WARHEAD THAT HAS MORE LETHALITY. THE LAUNCHER VEHICLE AND THE 9T232M AMMUNITION RESUPPLY VEHICLE CONSTITUTE THE 9K59 ROCKET COMPLEX.

BOTH THE 9A51 PRIMA AND THE 9T232M AMMUNITION RESUPPLY VEHICLE ARE BASED ON THE SAME URAL-4320 5-TON, 6X6 TRUCK USED FOR THE BM-21-1. THE 9A51 PRIMA IS EQUIPPED WITH MANUALLY EMPLACED HYDRAULIC FIRING JACKS TO ENHANCE FIRING STABILITY. THE 9T232M AMMUNITION RESUPPLY VEHICLE CARRIES 50 ROCKETS ARRANGED IN RACKS ON THE VEHICLE'S REAR DECK. THE CREW MANUALLY RELOADS THE LAUNCHER. THE 9A51 PRIMA IS CAPABLE (UNDER OPTIMUM CONDITIONS) OF FIRING A 50-ROCKET SALVO THAT COVERS AN AREA OF 190,000M^2.

RUSSIAN 122-MM MULTIPLE ROCKET LAUNCHER BM-21



SYSTEM	SPECIFICATIONS	FIRE CONTROL	SPECIFICATIONS
Alternative Designations:	BM-21 GRAD (Hail) MRL	Indirect Fire:	PG-1M (PANTEL)
Date of Introduction:	1963	Collimator:	K-1
Proliferation:	At least 50 countries	Fire Control Computer:	None
Crew:	5 (8 with 9K51 Complex)	ARMAMENT	SPECIFICATIONS
Chassis/Carriage:	Ural 375-D 6x6 wheeled	Caliber, Type, Name:	122-mm Frag-HE, 9M22U
Combat Weight (mt):	13.7	Minimum Range Range (m):	5,000
Chassis Length Overall (m):	7.35	Maximum Range:	20,380
Width (m):	2.40	Warhead Weight (kg):	18.4 (M21OF)
Height (m):	3.09	Rocket Length (m):	2.87
AUTOMOTIVE	SPECIFICATIONS	Maximum Velocity (m/s):	INA
Engine Type:	URAL-375D, 180 hp water-cooled, V-8 gasoline	Fuze Type:	MRV-U (PD)
Cruising Range (km):	450		
Speed Max Road: 75		Caliber, Type, Name:	122-mm Frag-HE, 9M28F
Speed Max Off-Road: 35		Minimum Range Range (m):	1,500
		Maximum Range:	15,000
Speed Cross-Country: INA		Warhead Weight (kg):	21.0
Max Swim: N/A		Rocket Length (m):	2.87
Fording Depth	1.5	Maximum Velocity (m/s):	INA
Emplacement Time (min):	3	Fuze Type:	MRV-U (PD) or AR-6 (Prox)
Displacement Time (min):	2		
Radio:	R-123M	Caliber, Type, Name:	122-mm Frag-HE, Type 91A
PROTECTION	SPECIFICATIONS	Minimum Range Range (m):	12,700
Armor, Front (mm):	None	Maximum Range:	32,700
Armor Side (mm):	None	Warhead Weight (kg):	18.3
Armor Roof (mm):	None	Rocket Length (m):	2.75
Self-Entrenching Blade:	No	Maximum Velocity (m/s):	INA
NBC Protection System:	No	Fuze Type:	PD
Smoke Equipment:	No		
ARMAMENT	SPECIFICATIONS		
Caliber, Type, Name:	122-mm, 9P132		
Number of Tubes:	40		
Full Salvo Time:	40 rounds in 20 seconds		
Single Rocket Interval:	0.5		
Loader Type:	Manual		
Reload Time:	10 min		
Launcher Drive:	Electric		
Traverse Left:	102		
Traverse Right:	70		
Elevation (°):	-0/+55°		

NOTES

BM-21 IS UNQUESTIONABLY THE WORLD'S MOST WIDELY USED MRL. THE LAUNCHER AND SUPPORTING EQUIPMENT ARE CALLED COMPLEX 9K51. A SPECIAL GENERATOR POWERS THE LAUNCHER. THE 9V170 FIRING DEVICE IS CAB MOUNTED. ROCKETS CAN BE FIRED WITH A REMOTE-FIRING DEVICE AND A 64-M LONG CABLE. OTHER AMMUNITION TYPES: SMOKE, INCENDIARY, CHEMICAL, RF JAMMER, ILLUMINATION, ANTITANK AND, ANTIPERSONNEL MINES

VARIANTS
BM-21-1: UPGRADE ON MORE MOBILE URAL-4320 CHASSIS
BM-21V: RUSSIAN 12-TUBE VERSION FOR AIRBORNE DIVISIONS
BM-21B/GRAD-1: RUSSIAN 36-TUBE MRL ON A 6X6 ZIL-131 CHASSIS
GRAD-P: RUSSIAN 1 ROUND ROCKET LAUNCHER
BM-11: NORTH KOREAN 30-TUBE VERSION
BM-21K: UKRAINIAN UPGRADE ON KRAZ-260 TRUCK WITH ONBOARD NAV, FCS AND THERMAL SHIELD. ITS (40) 40-KM ROCKETS CAN LAUNCH IN 20 SEC
RM-70: CZECHOSLOVAKIAN 40-TUBE VERSION WITH ONBOARD RELOAD
FIROS 25/30: ITALIAN COMMERCIAL MRL RANGES 34 KM; MAY FIRE GRAD
SAKR: EGYPTIAN 40- TUBE MRL WITH 18/36/45-KM ROCKETS
TYPE 81: CHINESE BM-21 COPY. TYPE 85 HAS 40ROCKET AUTO-RELOAD
PHZ 89: CHINESE TRACKED 80-ROCKET MRL WITH AUTO-RELOAD
TYPE 90: CHINESE MRL WITH AUTOMATED FCS. TYPE 90A HAS GPS
T-122 SAKARYA: TURKISH INDIGENOUS LAUNCHER AND 40KM ROCKETS
GRADLAR: ISRAELI UPGRADE PACKAGE WITH IMPROVED FCS. CONVERTS MRLS TO LAUNCH MODULES OF 122-MM GRAD OR LAR ROCKETS TO 45 KM. ROMANIAN CONVERTED APR-21 MRLS ARE CALLED LAROM
LAR: ISRAELI 160-MM ROCKET WITH 45-KM RANGE
LYNX: ISRAELI TRUCK CHASSIS, WITH TWO MODULAR LAUNCHERS. EACH MODULE CAN LAUNCH: 20 X GRAD ROCKETS, 13 X 160-MM LAR ROCKETS OR ACCULAR (WITH GPS FUZE KIT TO 40 KM, 10 M CEP), OR 4 X 300-MM EXTRA ARTILLERY ROCKETS (10-M CEP TO 150 KM), OR 1 X DELILAH-GL 250-KM CRUISE MISSILE. THE SYSTEM IS FIELDED AND HAS BEEN EXPORTED

YUGOSLAV 128-MM MULTIPLE ROCKET LAUNCHER M77



SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations:	M-77 Oganj	Caliber, Type, Name:	128-mm Launcher
Date of Introduction:	Early 1970s	Number of Tubes:	32
Proliferation:	At least 4 countries	Launch Rate Full	32 rounds in 25.6 seconds
Description:		Launch Rate - Single	8 seconds per rocket
Crew:	5	Loader Type:	Hydraulic
Chassis/Carriage:	Modified FAP-2026 BDS/AV 6x6 wheeled	Reload Time:	2 min
Combat Weight (mt):	22	Launcher Drive:	Electric
Chassis Length Overall (m):	8.40	Traverse Left: (deg)	180
Width (m):	2.50	Traverse Right: (deg)	180
Height (m):	3.10	Traverse Total: (deg)	360
AUTOMOTIVE	SPECIFICATIONS	Elevation (°):	-0/+50°
Engine Type:	Model 2F/002A, 200 hp water-cooled, 8-cyl diesel		
Cruising Range (km):	600	AMMUNITION	SPECIFICATIONS
Max Speed Road:	80	Caliber, Type, Name:	128-mm Frag-HE
Max Speed Off-Road:	35	Range Minimum (m)	1,000
Cross-Country Speed:	INA	Range Maximum (m)	20,600
Max Swim:	N/A	Warhead Weight (kg):	20
Fording Depths (m):	1.2	Rocket Length (m):	2.60
Emplacement Time (min):	3	Maximum Velocity (m/s):	INA
Displacement Time (min):	2	Fuze Type:	PD
Radio:	R-123M		
PROTECTION	SPECIFICATIONS	Other Ammunition Types:	DPICM
Armor, Front (mm):	None		
Armor Side (mm):	None		
Armor Roof (mm):	None		
Self-Entrenching Blade:	No		
NBC Protection System:	No		
Smoke Equipment:	No		
FIRE CONTROL	SPECIFICATIONS		
Indirect Fire:	PG-1M PANTEL		
Collimator:	K-1		
Fire Control Computer:	None		
Position Location System:	None		

NOTES

THE M77 IS CONFIGURED AND OPERATED IN THE SAME MANNER AS THE CZECHOSLOVAKIAN 122-MM (40 ROUND) MULTIPLE ROCKET LAUNCHER RM-70. THE LAUNCHER IS MOUNTED OVER THE REAR AXLES WITH THE RELOADER LOCATED BEHIND THE CAB. DURING RELOADING, THE LAUNCHER IS ROTATED TO THE REAR, TWO

HYDRAULIC CYLINDERS RAISE THE RELOADER, AND THEN THE ROCKETS ARE PUSHED INTO THE LAUNCHER. UNLIKE THE RM-70, THE M77 USES HYDRAULIC CYLINDERS RATHER THAN A SPROCKET AND CHAIN DRIVE MECHANISM. THE MODIFIED FAP2026 TRUCK HAS FOUR HYDRAULICALLY EMPLACED FIRING JACKS TO PROVIDE FIRING STABILITY. THE ROCKETS CAN BE FIRED FROM INSIDE THE CAB OR WITH A REMOTE-FIRING DEVICE. THE M77 MRL IS CAPABLE OF MOUNTING AN ANTIAIRCRAFT MACHINEGUN FOR PROTECTION.

RUSSIAN 220-MM MULTIPLE ROCKET LAUNCHER 9P140



SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations:	9P140 Uragan	Caliber, Type, Name:	220-mm 9P140
Date of Introduction:	1977	Number of Tubes:	16
Proliferation:	At least 7 countries	Launch Rate Full	16 rounds in 20 seconds
Description:		Launch Rate - Single	1.25 seconds per rocket
Crew:	4	Loader Type:	Manual
Chassis/Carriage:	ZIL-135LM 8x8 wheeled	Reload Time:	15-20 min
Combat Weight (mt):	20	Launcher Drive:	Electric
Chassis Length Overall (m):	9.3	Traverse Left: (deg)	30
Width (m):	2.8	Traverse Right: (deg)	30
Height (m):	3.2	Traverse Total: (deg)	36
AUTOMOTIVE	SPECIFICATIONS	Elevation (°):	-0/+55°
Engine Type:	2 each - 177 hp, 8 cylinder, 4-stroke gasoline engines	AMMUNITION	SPECIFICATIONS
Cruising Range (km):	500	Caliber, Type, Name:	220-mm Frag-HE, 9M27F
Max Speed Road:	65	Range Minimum (m)	10,000
Max Speed Off-Road:	INA	Range Maximum (m)	35,000
Cross-Country Speed:	INA	Warhead Weight (kg):	100
Max Swim:	INA	Rocket Length (m):	5.1
Fording Depths (m):	1.2	Maximum Velocity (m/s):	INA
Emplacement Time (min):	3	Fuze Type:	Electronic timing (ET)
Displacement Time (min):	3		
Radio:	R-123M	Caliber, Type, Name:	220-mm DPICM, 9M27K
PROTECTION	SPECIFICATIONS	Range Minimum (m)	10,000
Armor, Front (mm):	None	Range Maximum (m)	35,000
Armor Side (mm):	None	Warhead Weight (kg):	90
Armor Roof (mm):	None	Rocket Length (m):	5.1
Self-Entrenching Blade:	No	Maximum Velocity (m/s):	INA
NBC Protection System:	No	Fuze Type:	Electronic timing (ET)
Smoke Equipment:	No		
FIRE CONTROL	SPECIFICATIONS	Caliber, Type, Name:	220-mm AT, 9M27K2
Indirect Fire:	PG-1M PANTEL	Range Minimum (m)	10,000
Collimator:	K-1	Range Maximum (m)	35,000
Fire Control Computer:	None	Warhead Weight (kg):	90
Position Location System:	None	Rocket Length (m):	5.1
		Maximum Velocity (m/s):	INA
		Fuze Type:	Electronic timing (ET)
		Caliber, Type, Name:	220-mm AT, 9M59
		Range Minimum (m)	10,000

		Range Maximum (m)	35,000
		Warhead Weight (kg):	90
		Rocket Length (m):	5.1
		Maximum Velocity (m/s):	INA
		Fuze Type:	Electronic timing (ET)

NOTES

THE 9P140 URAGAN (PREVIOUSLY REFERRED TO INCORRECTLY AS BM-22 OR BM-27) IS THE WORLD'S FIRST MODERN FIN AND SPIN-STABILIZED HEAVY ROCKET SYSTEM. ESSENTIALLY A SCALED-UP VERSION OF THE BM-21, THE 9P140 USE MANY OF THE SAME DESIGN FEATURES. THE LAUNCHER, 9T452 TRANSLOADER, ROCKETS, AND SUPPORT EQUIPMENT CONSTITUTES THE 9K57 COMPLEX.

THE 9P140 AND ITS TRANSLOADER ARE BOTH BASED ON VARIANTS OF THE GASOLINE-POWERED ZIL-135LM 8-TON 8X8 CHASSIS. THE TRUCK IS UNUSUAL IN THAT IT USES TWO ENGINES, EACH DRIVING THE WHEELS ON ONE SIDE OF THE TRUCK, AND ONLY THE FRONT AND REAR AXLES STEER. THE 9P140 CAB HAS A BLAST SHIELD THAT IS RAISED DURING FIRING, AND THE VEHICLE IS STABILIZED DURING FIRING BY TWO MANUALLY EMPLACED HYDRAULIC JACKS AT THE REAR OF THE CHASSIS.

THE LAUNCHER HAS ELECTRICALLY POWERED TRAVERSING AND ELEVATING MECHANISMS. DURING TRAVEL, THE LAUNCHER ASSEMBLY IS ORIENTED REARWARD AND A LIGHT SHEET METAL COVER OVER THE MUZZLE END OF THE TUBES PREVENTS FOREIGN MATERIAL FROM ENTERING THE TUBE. THIS IS A SAFETY FEATURE THAT IS DESIGNED FOR TRAVEL WHEN LOADED. THERE IS NO SUCH COVER FOR THE MUZZLE END OF AN UNLOADED LAUNCHER.

IRANIAN 240-MM MULTIPLE ROCKET LAUNCHER FADJR-3



SYSTEM	SPECIFICATIONS	FIRE CONTROL	SPECIFICATIONS
Alternative Designations:	INA	Indirect Fire:	None
Date of Introduction:	1996	Collimator:	None
Proliferation:	At least 1 country, Hezbollah	Fire Control Computer:	No
Description:		Position Location System:	No
Crew:	5	ARMAMENT	SPECIFICATIONS
Chassis/Carriage:	Mercedes Benz 6x6 wheel	Caliber, Type, Name:	240-mm, Fadjr-3
Combat Weight (mt):	Combat Weight (mt): 15	Number of Tubes:	12
Chassis Length Overall (m):	10.45	Launch Rate Full	12 rounds in 48 seconds
Width (m):	2.54	Launch Rate - Single	4 seconds per rocket
Height (m):	3.34	Loader Type:	Transloader, crane hoist
AUTOMOTIVE	SPECIFICATIONS	Reload Time:	12-15 minutes
Engine Type:	280 hp, V-8 liquid-cooled, diesel engine	Launcher Drive:	Manual
Cruising Range (km):	INA	Traverse Left: (deg)	90
Max Speed Road:	60	Traverse Right: (deg)	100
Max Speed Off-Road:	25	Traverse Total: (deg)	190
Cross-Country Speed:	INA	Elevation (°):	-0/+57°
Max Swim:	INA		
Fording Depths (m):	INA	AMMUNITION	SPECIFICATIONS
Emplacement Time (min):	INA	Caliber, Type, Name:	240-mm Frag-HE, Fadjr-3
Displacement Time (min):	INA	Range Minimum (m)	INA
Radio:	INA	Range Maximum (m)	43,000
PROTECTION	SPECIFICATIONS	Warhead Weight (kg):	90
Armor, Front (mm):	None	Rocket Length (m):	5.2
Armor Side (mm):	None	Maximum Velocity (m/s):	INA
Armor Roof (mm):	None	Fuze Type:	PD
Self-Entrenching Blade:	No		
NBC Protection System:	No		
Smoke Equipment:	No		

NOTES

THE SYSTEM IS STABILIZED BY 2 FIRING JACKS MOUNTED ON THE REAR OF THE VEHICLE AND 2 MORE LOCATED BEHIND THE CAB. THE SYSTEM HAS A DEDICATED RESUPPLY VEHICLE WITH A CRANE TO ASSIST IN RELOADING. SHAHID BAGHERI INDUSTRIES OF IRAN DEVELOPED THE SYSTEM WITH POSSIBLE TECHNICAL ASSISTANCE FROM NORTH KOREA.

CHINESE 273-MM MULTIPLE ROCKET LAUNCHER WM-80



SYSTEM	SPECIFICATIONS	FIRE CONTROL	SPECIFICATIONS
Alternative Designations:	None	Indirect Fire:	None
Date of Introduction:	INA	Collimator:	None
Proliferation:	At least 3 countries	Fire Control Computer:	No
Description:		Position Location System:	No
Crew:	5	ARMAMENT	SPECIFICATIONS
Chassis/Carriage:	TA 580 8x8 wheeled	Caliber, Type, Name:	273-mm
Combat Weight (mt):	34	Number of Tubes:	8
Chassis Length Overall (m):	9.55	Launch Rate Full	8 rounds in 5 seconds
Width (m):	3.06	Launch Rate - Single	.5 seconds per rocket
Height (m):	3.30	Loader Type:	Manual
AUTOMOTIVE	SPECIFICATIONS	Reload Time:	5-8 minutes
Engine Type:	525 hp air-cooled, diesel	Launcher Drive:	Electric
Cruising Range (km):	400	Traverse Left: (deg)	20
Max Speed Road:	70	Traverse Right: (deg)	20
Max Speed Off-Road:	25	Traverse Total: (deg)	40
Cross-Country Speed:	INA	Elevation (°):	-20/+60°
Max Swim:	INA		
Fording Depths (m):	INA	AMMUNITION	SPECIFICATIONS
Emplacement Time (min):	3 to 5	Caliber, Type, Name:	273-mm Frag-HE, WM-80
Displacement Time (min):	INA	Range Minimum (m)	34,000
Radio:	INA	Range Maximum (m)	80,000
PROTECTION	SPECIFICATIONS	Warhead Weight (kg):	150
Armor, Front (mm):	None	Rocket Length (m):	4.58
Armor Side (mm):	None	Maximum Velocity (m/s):	1,140
Armor Roof (mm):	None	Fuze Type:	MD-23A (Proximity)
Self-Entrenching Blade:	No		
NBC Protection System:	No		
Smoke Equipment:	No		

NOTES

THE WM-80 IS CURRENTLY BEING ADVERTISED HEAVILY ON THE OPEN MARKET BY NORINCO INDUSTRIES. THE WM-80 ROCKET SYSTEM IS COMPOSED OF THE MULTIPLE ROCKET LAUNCHER, THE AMMUNITION TRANSLOADER, FIRE COMMAND AND CONTROL VEHICLES, AND THE MAINTENANCE VEHICLES. THE FIRE COMMAND AND CONTROL IS COMPOSED OF A BRIGADE/REGIMENT COMMAND VEHICLE, BATTALION COMMAND VEHICLE, SURVEILLANCE/SPOTTING RADAR, AND METEOROLOGICAL RADAR.

BRAZILIAN 127-MM, 180-MM, & 300-MM MULTIPLE ROCKET LAUNCHER ASTROS II



SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations:	ASTROS II AV-LMU	Caliber, Type, Name:	127-mm, 180-mm, 300-mm, ASTROS
Date of Introduction:	1983	Number of Tubes:	127-mm (32), 180-mm (16), 300-mm (4)
Proliferation:	At least 6 countries	Launch Rate Full	INA
Description:		Launch Rate - Single	INA
Crew:	3	Loader Type:	Manual
Chassis/Carriage:	TECTRAN 10-ton 6x6 Wheel	Reload Time:	INA
Combat Weight (mt):	20	Launcher Drive:	Electric
Chassis Length Overall (m):	8.00	Traverse Left: (deg)	INA
Width (m):	2.4	Traverse Right: (deg)	INA
Height (m):	2.6	Traverse Total: (deg)	INA
AUTOMOTIVE	SPECIFICATIONS	Elevation (°):	INA
Engine Type:	280 hp water-cooled, turbocharged diesel	AMMUNITION	SPECIFICATIONS
Cruising Range (km):	INA	Caliber, Type, Name:	127-mm Frag-HE, SS-30
Max Speed Road:	70	Range Minimum (m)	9,000
Max Speed Off-Road:	40	Range Maximum (m)	30,000
Cross-Country Speed:	INA	Warhead Weight (kg):	INA
		Rocket Length (m):	3.9
Max Swim:	N/A	Other Types	None
Fording Depths (m):	1.0		
Emplacement Time (min):	INA	Caliber, Type, Name:	180-mm Frag-HE, SS-40
Displacement Time (min):	INA	Range Minimum (m)	15,000
Radio:	INA	Range Maximum (m)	35,000
PROTECTION	SPECIFICATIONS	Warhead Weight (kg):	INA
Armor, Front (mm):	None	Rocket Length (m):	4.2
Armor Side (mm):	None	Other Types	DPICM, HE-Incend, AT/AP mines, Runway Denial
Armor Roof (mm):	None		
		Caliber, Type, Name:	300-mm Frag-HE, SS-60
Self-Entrenching Blade:	No	Range Minimum (m)	20,000
NBC Protection System:	No	Range Maximum (m)	60,000
Smoke Equipment:	6 smoke grenade launchers	Warhead Weight (kg):	INA
FIRE CONTROL	SPECIFICATIONS	Rocket Length (m):	5.6

Indirect Fire:	**None**	**Other Types**	**DPICM, HE-Incend, AT/AP mines, Runway Denial**
Collimator:	**None**		
Fire Control Computer:	**FIELDGUARD or FILA**	**Caliber, Type, Name:**	**300-mm Frag-HE, SS-80**
Position Location System:	**No**	**Range Minimum (m)**	**22,000**
		Range Maximum (m)	**90,000**
		Warhead Weight (kg):	**INA**
		Rocket Length (m):	**5.6**
		Other Types	**DPICM, HE-Incend, AT/AP mines, Runway Denial**

NOTES

THE ASTROS (ARTILLERY SATURATION ROCKET SYSTEM) II IS A MODULAR MULTIPLE ROCKET LAUNCHER CAPABLE OF FIRING THREE DIFFERENT CALIBER WRAP-AROUND FIN ROCKETS (FOR IMPROVED ACCURACY) USING SEVERAL TYPES OF WARHEADS. THE UNIVERSAL MODULES ENABLE THE SYSTEM TO ACCOMPLISH FIRE MISSIONS WITH RANGES FROM 9 TO 90 KILOMETERS.

THE ASTROS II SYSTEM CONSISTS OF THE FOLLOWING VEHICLES: UNIVERSAL MULTIPLE LAUNCHER (AV-LMU), AMMUNITION SUPPLY VEHICLE (AV-RMD), COMMAND AND CONTROL VEHICLE/FIRE CONTROL UNIT (AV-VCC), MOBILE WORKSHOPS (FOR FIELD MAINTENANCE), AND THE OPTIONAL ELECTRONIC FIRE CONTROL UNIT (AV-UCF). ALL OF THE ASTROS II VEHICLES USE THE TECTRAN ENGINHARIA 10 TON, 6X6, WHEELED VEHICLE CHASSIS.

A TYPICAL FIRING BATTERY CONSISTS OF SIX AV-LMU LAUNCHERS, SIX AV-RMD AMMUNITION SUPPLY VEHICLES, AND ONE AV-VCC FIRE CONTROL UNIT. AN AV-VCC COMMAND AND CONTROL UNIT AND TWO MOBILE WORKSHOPS ARE FOUND AT BATTALION LEVEL. THE BATTALION LEVEL AV-VCC CAN COORDINATE AND DIRECT FIRE MISSIONS FOR THREE ASTROS BATTERIES. THE AV-RMD AMMUNITION SUPPLY VEHICLE CARRIES TWO COMPLETE LOADS FOR EACH LAUNCHER.

RUSSIAN 300-MM MULTIPLE ROCKET LAUNCHER 9A52-2



SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations:	9A52-2 Smerch-M	Caliber, Type, Name:	300-mm, 9A52
Date of Introduction:	1989	Number of Tubes:	12
Proliferation:	At least 4, 2 under contract	Launch Rate Full	12 rounds in 38 seconds
Description:		Launch Rate - Single	3 seconds per rocket
Crew:	4	Loader Type:	Transloader, crane hoist
Chassis/Carriage:	MAZ-543M 8x8 wheeled	Reload Time:	36 min
Combat Weight (mt):	43.7	Launcher Drive:	Electric
Chassis Length Overall (m):	12.1	Traverse Left: (deg)	30
Width (m):	3.05	Traverse Right: (deg)	30
Height (m):	3.05	Traverse Total: (deg)	60
AUTOMOTIVE	SPECIFICATIONS	Elevation (°):	-0/+55°
Engine Type:	Engine Type: 518 hp, V-12 diesel engine	AMMUNITION	SPECIFICATIONS
Cruising Range (km):	850	Caliber, Type, Name:	300-mm Frag-HE, 9M55F
Max Speed Road:	60	Range Minimum (m)	20,000
Max Speed Off-Road:	35	Range Maximum (m)	90,000
Cross-Country Speed:	INA	Warhead Weight (kg):	258
Max Swim:	N/A	Rocket Length (m):	7.6
Fording Depths (m):	1.1	Maximum Velocity (m/s):	INA
Emplacement Time (min):	3	Fuze Type:	Electronic Timing (ET)
Displacement Time (min):	3		
Radio:	R-123M	Caliber, Type, Name:	300-mm DPICM, 9M55K
PROTECTION	SPECIFICATIONS	Range Minimum (m)	20,000
Armor, Front (mm):	None	Range Maximum (m)	90,000
Armor Side (mm):	None	Warhead Weight (kg):	233
Armor Roof (mm):	None	Rocket Length (m):	7.6
Self-Entrenching Blade:	No	Maximum Velocity (m/s):	INA
NBC Protection System:	No	Fuze Type:	Electronic Timing (ET)
Smoke Equipment:	No		
FIRE CONTROL	SPECIFICATIONS	Caliber, Type, Name:	300-mm Sensor-fuzed (MOTIV-3M), 9M55K1
Indirect Fire:	PG-1M PANTEL	Range Minimum (m)	20,000
Collimator:	K-1	Range Maximum (m)	90,000
Fire Control Computer:	Baget-41 notebook	Warhead Weight (kg):	233
Position Location System:	GPS navigation	Rocket Length (m):	7.6
		Maximum Velocity (m/s):	INA
		Fuze Type:	Electronic Timing (ET)

NOTES

9A52-2 LAUNCHER WITH ALL SUPPORT EQUIPMENT (INCLUDING 9T234-2 TRANSLOADER, AND 1K123 VIVARY FIRE CONTROL SYSTEM) IS CALLED COMPLEX 9K58.

CURRENTLY, THE MORE COMMONLY ASSOCIATED FIRE CONTROL COMPLEX IS MP-32M1 ON A TATRA CHASSIS, WITH GLONASS/NAVSTAR GPS NAVIGATION.

9A52-2T: NEW RUSSIAN LAUNCHER MOUNTED ON A TATRA 816 TRUCK CHASSIS, AND WEIGHING 38.4 MT FULLY LOADED

9A52-4/TORNADO: RUSSIAN DEVELOPMENTAL "SMERCH-LIGHT" FOR EXPORT OR DOMESTIC USE ON A KAMAZ 8X8 CROSS-COUNTRY CHASSIS WITH REPLACEABLE OR RELOADABLE 6-ROCKET MODULE. WITH A NEWER FC COMPUTER, (LIKE BAGET-41), RESPONSE TIME IS REDUCED TO 3 MINUTES. MODULES FOR 122 MM AND 220 MM ROCKETS ARE IN DEVELOPMENT

9A53: RUSSIAN UNIVERSAL MRL ON A LARGER MZKT-7930 8X8 CHASSIS FOR ROCKET MODULES OF 24X122 MM (TORNADO-G), 15X220 MM (TORNADO-U), OR 12X300 MM (TORNADO-S). IT IS IN TESTING, WITH POSSIBLE FIELDING IN 2015 FOR 220 MM AND 300 MM VERSIONS

A-100: CHINESE VARIANT ON INDIGENOUS CHASSIS AND 10-TUBE LAUNCHER, WITH 120 KM RANGE AND 8-MINUTE PREP TIME. EXPORTED TO PAKISTAN

ISRAELI LYNX ROCKET/MISSILE LAUNCHER WITH EXTRA AND DELILAH MISSILES



Lynx Rocket/Missile Launcher



Vehicle with LAR-160 rockets



Delilah missile



LAROM

SYSTEM	SPECIFICATIONS	FIRE CONTROL	SPECIFICATIONS
Alternative Designations:		Indirect Fire:	INA
Date of Introduction:	By 2007	Collimator:	INA
Proliferation:	At least 3 countries	Fire Control Computer:	INA
Description:		Position Location System:	GPS navigation
Crew:	3	AMMUNITION	SPECIFICATIONS
Chassis/Carriage:	Mercedes 3341 6x6 wheel	Caliber, Type, Name:	LAR 160 Rocket, Composite solid-propellant
Combat Weight (mt):	INA	Range Minimum (m)	10
Chassis Length Overall (m):	INA	Range Maximum (m)	45
Width (m):	INA	Warhead Weight (kg):	110
Height (m):	INA	Rocket Length (m):	3.48
AUTOMOTIVE	SPECIFICATIONS	Maximum Velocity (m/s):	160
Engine Type:	INA	Fuze Type:	1,022
Cruising Range (km):	500	Options:	Frag-HE/PD or DPICM with time-fuze dispense
Max Speed Road:	INA		
Max Speed Off-Road:	INA		
Cross-Country Speed:	INA		
Max Swim:	INA		
Fording Depths (m):	INA		
Emplacement Time (min):	5		
Displacement Time (min):	INA		
Radio:	INA		
PROTECTION	SPECIFICATIONS		
Armor, Front (mm):	None		
Armor Side (mm):	None		
Armor Roof (mm):	None		
Self-Entrenching Blade:	No		
NBC Protection System:	No		
Smoke Equipment:	No		

NOTES

BECAUSE THE LAUNCHER CAN LAUNCH A VARIETY OF ROCKETS (122 MM OF VARIOUS, 160-MM ISRAELI LAR, WITH OR WITHOUT TCS), AND EITHER EXTRA OR DELILAH-GL MISSILES, IT IS LIKELY THAT THE PRIMARY MUNITION MIX WILL DEPEND ON ORGANIZATION LEVEL OF THE LAUNCHER. IF IT IS AT TACTICAL LEVEL, IT IS LIKELY TO BE USED PRIMARILY TO LAUNCH ROCKETS, WITH A FEW MAYBE DESIGNATED FOR EXTRA MISSILES. THOSE LAUNCHERS AT THE OPERATIONAL/STRATEGIC LEVEL ARE MORE LIKELY TO LAUNCH MISSILES, AND PERHAPS ACCULAR (LAR-160 WITH TCS) ROCKETS.

THE LAR-160 ROCKET OFFERS A LETHAL EFFECTS AREA PER ROCKET OF 31,400 M^2. WITH TCS (E.G., ACCULAR), ROCKETS PERFORM A PITCH-OVER FOR TOP ATTACK AND AN OPTIMIZED CIRCULAR PATTERN FOR FRAG-HE WARHEAD EFFECTS OR SUB-MUNITIONS. THUS, ACCULAR ROCKETS SHOULD HAVE EVEN GREATER LETHAL EFFECTS.

LYNX IS BOTH A VEHICLE, AND A LAUNCHER TO FIT ON VEHICLES. GROUND LAUNCHERS INCLUDE TRACKED ARMORED VEHICLES AND 8X8 TRUCKS. ISRAEL MARKETS THE LYNX 6X6 TRUCK (ABOVE). BUT THE LAUNCHER FITS ON OTHER USER-PREFERRED CHASSIS. OTHER USER COUNTRIES HAVE LICENSES FOR THE CONVERSION. MANY OF THE CUSTOMERS HAVE SUBSTANTIAL SUPPLIES OF 122-MM ROCKETS.

AZERBAIJAN LYNX: INDIGENOUS MRL/MISSILE TEL WITH LYNX LAUNCHER ON 8X8 KAMAZ-6350 TRUCK. WITH AUTONOMOUS FCS, IT LAUNCHES 122/ 160 MM ROCKETS, OR EXTRA BALLISTIC MISSILES

NAIZA: KAZAKH IMPORT/PRODUCTION MRL WITH LYNX FOR LAR-160 ON KAMAZ TRUCK

LAROM: ROMANIAN 2-MODULE MRL CAN LAUNCH 122-MM GRAD OR LAR-160 ROCKETS

GRADLAR: ISRAELI UPGRADE PACKAGE WITH IMPROVED FCS CONVERTS MRLS FOR MODULES OF 122-MM GRAD ROCKETS AND 21-45 KM RANGE. ANY TYPE OF GRAD 122-MM ROCKET CAN BE USED.

LAR-160 OR LAR: 160-MM ROCKET (13 PER MODULE) WITH A 45-KM RANGE. THE WARHEAD IS A CANISTER; TO CARRY FRAG-HE, SUB-MUNITIONS, OR ANY 155-MM ROUND

ACCULAR ROCKET IS A GPS FUZED VARIANT OF LAR-160, WITH 14-40 KM RANGE AND 10 M CEP). AT LEAST 4 COUNTRIES USE THESE ROCKETS

EXTRA (EXTENDED RANGE ARTILLERY): THE 300MM BALLISTIC MISSILE (4/LAUNCH MODULE) RANGES 150 KM WITH A 10-M CEP. IT HAS A 120-KG PAYLOAD, AND FLIES A BALLISTIC TRAJECTORY, CORRECTED WITH GPS. VARIOUS WARHEADS ARE OFFERED.

DELILAH: THIS CRUISE MISSILE HAS A LENGTH OF 3.2 M, WEIGHING 230 KG. IT CRUISES AT MACH 0.3-0.7, AND 8,600 M ALTITUDE. IT CAN BE LAUNCHED FROM SHIPS, AIRCRAFT, AND THE LYNX GROUND LAUNCHER (GL) TO 250 KM, WITH PROGRAMMABLE GUIDANCE, AND MULTIPLE WAYPOINTS. DELILAH-GL HAS LAUNCH ASSIST. AIR, SHIP, AND HELICOPTER VERSIONS ARE OFFERED. THE MISSILE USES GPS HOMING, OR CAN LOITER AND USE A CCD/FLIR SEEKER TO HOME TO TARGET.

Artillery Weapons: Mortars and Hybrid Systems

Even in the modern era of fewer new military systems, there is much activity in development of mortars and hybrid systems. This is, in part, due to emphasis on weapons for beyond line-of-sight (BLOS) and non-line-of-sight (NLOS) engagements. It also emphasizes the need for small unit commanders to have organic deep fire capability on-hand for rapid response.

Compared to cannon systems, mortars generally sacrifice range. Their high-angle fire enhances fragmentation effects and permits attack of targets in defilade. They are ideal weapons for attacking targets on reverse slopes, in narrow gullies, in ditches, in cities, and in other areas that are difficult to reach with low-angle fire. Mortars are especially effective, with their high-angle trajectories, for smoke and illumination missions. Their light weight offers mobility to move with units and provide the small unit maneuver commander his own close and direct support. Although mortars feature high trajectories, they often are used at targets within line of sight. Thus most have sights with both direct-fire aiming and indirect-fire settings.

Most mortars in the world are man-portable or towed ground-mounted systems. In motorized infantry brigades and older Tier 3 and 4 mechanized brigades, each battalion has an organic mortar battery. In the OPFOR, motorized infantry and selected other battalions may also have 60-mm mortars at company level. Many forces around the world use man-portable 51-mm, 60-mm, 81-mm, and 82-mm mortars with dismounted conventional and special forces.

Most modern forces recognize the need for vehicle-mounted systems which can move with motorized/mechanized forces. A variety of configurations are in use. The widely fielded Russian 120-mm 2S12 is “porteed” - towable but truck-borne for rapid off-loading, emplacement/displacement, and reloading. Most vehicle systems are conventional mortars on a rotating base on the vehicle floor. Another design is the Wiesel 2 Mortar System with the light Wiesel tracked chassis, a breech-loaded motor hinged to the rear, and motorized ground spades. The semi-automated Super Rapid Advanced Mortar System (SRAMS) is light enough to mount on a light strike vehicle and fire 18 rounds per minute.

Several 120-mm mortar vehicles are turreted breech-loading systems. These include systems with semi-automated loaders (rounds delivered to loading trays), e.g., the British Armoured Mortar System modular turret, and the Patria NEMO on a wheeled 8x8 chassis. Mortar vehicle systems with autoloaders include the Czech PRAM-S on BMP chassis, and the AMOS, twin-barrel mortar system).

Hybrid Systems include combination guns that can fire fin-stabilized and rifled mortar projectiles, as well as specially designed howitzer projectiles. These are also called howitzers, gun-mortars, and cannon. They usually fire more mortar rounds than cannon rounds, due to the large inventories of mortar projectiles available, and the wider variety of mortar rounds for different roles. In the OPFOR, Tier 1 and 2 battalions have generally replaced battalion mortars with 120-mm combination guns. Russia (on following pages), China (with its PLL-05), and selected other countries have these systems. Precision mortar projectiles as well as precision cannon projectiles can be fired from these systems.

Other hybrid systems include automatic mortars, such as the 82-mm 2B9/Vasilek automatic mortar with a high rate of fire and direct-fire sights. There are also rifled mortars such as the MO-120RT, which can fire lethal projectiles out to 13 km.

Traditionally, mortars have been area fire weapons due to their lack of accuracy. However, modern ammunition developments have led to the availability of precision munitions, as well as improved advanced mortar projectiles with terminal effects. These include semi-active laser-homing projectiles, IR-homing projectiles, GPS course-corrected projectiles, and projectiles with submunition fills.

FRENCH 120-MM MORTAR MO-120-RT





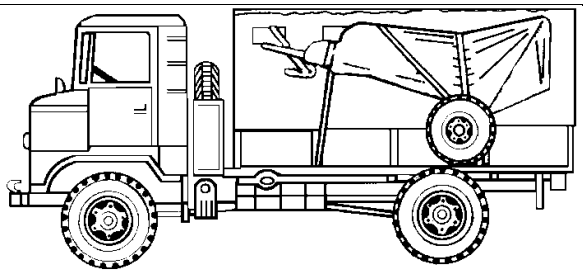
SYSTEM	SPECIFICATIONS	FIRE CONTROL	SPECIFICATIONS
Alternative Designations:	RT-61	Indirect Fire:	INA
Date of Introduction:	1961	Collimator:	INA
Proliferation:	At least 22 countries	Fire Control Computer:	None
Description:		Position Location System:	None
Crew:	4-6	AMMUNITION	SPECIFICATIONS
Prime Mover:	VAB M120 4x4 wheeled	Caliber, Type, Name:	120-mm Frag-HE, PR-14
Combat Weight (mt):	13.0	Range Minimum (m)	1,100
Chassis Length Overall (m):	5.98	Range Maximum (m)	8,135
Width (m):	2.50	Projectile Weight (kg):	18.60
Height (m):	2.06	Maximum Velocity (m/s):	INA
Tube Support (kg):	220	Fuze Type:	M557 PD
Baseplate (kg):	194		
Bipod (kg):	N/A	Caliber, Type, Name:	120-mm HE-RA, PRPA
Ground Clearance (m):	0.35	Range Minimum (m)	1,100
AUTOMOTIVE	SPECIFICATIONS	Range Maximum (m)	13,000
Engine Type:	Renault VI MIDS, 220hp, diesel	Projectile Weight (kg):	18.60
Cruising Range (km):	1,000	Maximum Velocity (m/s):	INA
Max Speed Road:	92	Fuze Type:	M557 PD
Max Speed Off-Road:	60		
Cross-Country Speed:	30		
Max Swim:	N/A		
Fording Depths (m):	Amphibious		
Emplacement Time (min):	1.5		
Displacement Time (min):	2		
Radio:	INA		
PROTECTION	SPECIFICATIONS		
Armor, Front (mm):	None		
Armor Side (mm):	None		
Armor Roof (mm):	None		
Self-Entrenching Blade:	No		
NBC Protection System:	No		
Smoke Equipment:	No		

NOTES

THE RT-61 IS A RIFLED MORTAR CAPABLE OF FIRING PRE-ENGRAVED SPIN-STABILIZED AND SMOOTHBORE 120-MM MORTAR PROJECTILES WITH OR WITHOUT ROCKET ASSIST. HOWEVER, IT IS NOT CAPABLE OF FIRING SMOOTHBORE MORTAR PROJECTILES WITH FOLD OUT FINS (SPRING-LOADED TAIL ASSEMBLIES WITH STRAIGHT FINS). THE RT-61 IS A THREE-PIECE MORTAR SYSTEM CONSISTING OF A RIFLED TUBE, A BASEPLATE, AND A WHEELED CARRIAGE. TRIGGER FIRING IS THE NORMAL METHOD OF FIRING FOR THIS MORTAR. DROP FIRING CAN BE ACCOMPLISHED ONLY WITH SMOOTHBORE MORTAR PROJECTILES.

OTHER AMMUNITION TYPES: ALL STANDARD 120-MM SMOOTHBORE MORTAR PROJECTILES WITHOUT FOLD-OUT FINS.

RUSSIAN 120-MM SELF-PROPELLED MORTAR 2S12





SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations:	120-mm 2S12 Sani (Sled)	Caliber, Type, Name:	120-mm mortar, 2B11
Date of Introduction:	early 1980s	Rate of Fire – Burst (rpm):	15
Proliferation:	At least 1 country	Rate of Fire – Normal (rpm):	10
Description:		Rate of Fire – Sust (rpm):	4
Crew:	5	Loader Type:	Manual
Prime Mover:	GAZ-66	Traverse Left: (deg)	5 (on bipod)/26 (moving)
Combat Weight (mt):	3.64	Traverse Right: (deg)	5 (on bipod)/26 (moving)
Chassis Length Overall (m):	5.66	Traverse Total: (deg)	10 (on bipod)/52 (moving)
Width (m):	2.34	Elevation (°):	+45/+80
Height (m):	2.44	AMMUNITION	SPECIFICATIONS
Tube Combat Weight (kg):	210	Caliber, Type, Name:	120-mm Frag-HE (3OF843B)
Combat Weight (kg):	87	Range Minimum (m)	450
Baseplate (kg):	80	Range Maximum (m)	7,000
Bipod (kg):	55	Projectile Weight (kg):	16.80
AUTOMOTIVE	SPECIFICATIONS	Muzzle Velocity (m/s):	325
Engine Type:	ZMZ-66, 115 hp V-8 water cooled gasoline	Fuze Type:	GVMZ-7 PD
Cruising Range (km):	600		
Max Speed Road:	87	Caliber, Type, Name:	120-mm Smoke
Max Speed Off-Road:	35	Range Minimum (m)	1,000
Cross-Country Speed:	INA	Range Maximum (m)	6,800
Max Swim:	N/A	Projectile Weight (kg):	16.70
Fording Depths (m):	.80	Muzzle Velocity (m/s):	INA
Emplacement Time (min):	3	Fuze Type:	PD
Displacement Time (min):	3		
Radio:	R-123M	Caliber, Type, Name:	120-mm Illumination, S-843
PROTECTION	SPECIFICATIONS	Range Minimum (m)	1,000
Armor, Front (mm):	None	Range Maximum (m)	5,300
Armor Side (mm):	None	Projectile Weight (kg):	16.80
Armor Roof (mm):	None	Muzzle Velocity (m/s):	INA
Self-Entrenching Blade:	No	Fuze Type:	T-1 TSQ
NBC Protection System:	No		
Smoke Equipment:	No		
FIRE CONTROL	SPECIFICATIONS		
Indirect Fire:	INA		
Collimator:	INA		
Fire Control Computer:	None		
Position Location System:	None		

NOTES

THE 2S12 IS A SELF-PROPELLED VERSION OF THE TOWED 120-MM MORTAR 2B11 (M-120) CARRIED ON THE BED OF GAZ-66 TRUCK. THE SP VERSION PROVIDES GREATER MOBILITY FOR THIS VERSATILE MORTAR. THE 2S12 HAS A SPECIAL SAFETY DEVICE TO PREVENT DOUBLE LOADING WHEN THE MORTAR ROUND IS NOT FIRED OR REMOVED FROM THE TUBE. WHEN A ROUND IS LOADED, IT TRIPS A TAB ON THE TUBE, PREVENTING ANOTHER

ROUND FROM BEING LOADED. THE TAB SHIFTS TO THE "READY" POSITION WHEN THE ROUND FIRES, ALLOWING THE 2S12 TO BE RELOADED.

AS NOTED FOR SOME 122-MM MRLS, THE 2S12 IS ON A MODIFIED GAZ-66 CHASSIS. IN MOST CASES WHEN UNDER CANVAS IT CAN ONLY BE DISTINGUISHED UNDER CLOSE EXAMINATION AS A MORTAR SYSTEM.

OTHER AMMUNITION TYPES: ALL STANDARD 120-MM MORTAR ROUNDS, INCLUDING FRAG-HE-RA TO 9,100M.

RUSSIAN 120-MM TOWED COMBINATION GUN 2B16



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designations:	Nona-K	Caliber, Type, Name:	120-mm Frag-HE-cannon (3VOF49)
Date of Introduction:	early 1986	Range Minimum (m)	15
Proliferation:	At least 4 countries	Range Maximum (m)	8,850
Description:		Projectile Weight (kg):	19.80
Crew:	5	Muzzle Velocity (m/s):	INA
Carriage:	Split Trail, 2-wheel torsion bar suspension	Fuze Type:	PD and Proximity
Combat Weight (mt):	1.1		
Chassis Length Overall (m):	5.66	Caliber, Type, Name:	120-mm HEAT (BK-19) cannon
Travel Position:	5.9	Range Minimum (m)	40
Firing Position:	INA	Range Maximum (m)	1,000
Height Overall (m):	1.70	Projectile Weight (kg):	13.20
Width Overall (m):	INA	Muzzle Velocity (m/s):	560
Travel Position:	1.79	Fuze Type:	PD and Proximity
Firing Position:	INA		
Towing Speed (km/h):		Caliber, Type, Name:	120-mm Frag-HE rocket assisted cannon (OF-50)
Max Road:	80	Range Minimum (m)	1,700
Max Off-Road:	35	Range Maximum (m)	12,800
Max Cross-Country:	INA	Projectile Weight (kg):	19.80
Fording Depths (m):	INA	Muzzle Velocity (m/s):	367
Emplacement Time (min): 2	2	Fuze Type:	B35 PD
Displacement Time (min): 2	2		
FIRE CONTROL	SPECIFICATIONS	Caliber, Type, Name:	120-mm Laser-Guided Projectile, cannon
Indirect Fire:	MP46M PANTEL	Range Minimum (m)	500
Direct Fire:	DF channel in the sight	Range Maximum (m)	9,000
Collimator:	K-1	Projectile Weight (kg):	25
Fire Control Computer:	None	Muzzle Velocity (m/s):	INA
Gun Display Unit:	None	Fuze Type:	PD
ARMAMENT	SPECIFICATIONS		
Caliber, Type, Name:	120-mm gun-mortar, 2A51	Caliber, Type, Name:	120-mm Frag-HE mortar (OF-843B)
Barrel Length (cal):	24.2	Range Minimum (m)	450
Rate of Fire – Burst (rpm):	8	Range Maximum (m)	7,100
Rate of Fire – Normal (rpm):	6	Projectile Weight (kg):	INA
Rate of Fire – Sust (rpm):	4	Muzzle Velocity (m/s):	INA
Loader Type:	Semi-automatic	Fuze Type:	PD and proximity
Breech Type:	Vertical sliding wedge		
Muzzle Brake Type:	Multi baffle		

Traverse Left: (deg)	30		
Traverse Right: (deg)	30		
Traverse Total: (deg)	60		
Elevation (°):	-10/+80°		

NOTES

GUN AND MORTAR FRAG-HE AMMUNITION FOR THE 2B16 CAN EMPLOY PROXIMITY FUZES FOR AIR BURST. THE 2B16 IS A TOWED VERSION OF THE 2S9. IT IS TOWED IN A TUBE-OVER-TRAILS CONFIGURATION. THE 2B16 IS A COMBINATION BREECH-LOADING RIFLED-BORE INDIRECT FIRE SYSTEM CAPABLE OF FIRING BOTH CANNON AND MORTAR PROJECTILES. THUS, IT COMBINES THE PROPERTIES OF A LIGHT HOWITZER AND A MORTAR. THE SPLIT-TRAIL CARRIAGE HAS A FIRING PEDESTAL, A VARIABLE-LENGTH RECOIL SYSTEM, AND A MANUALLY ACTIVATED PROJECTILE-RAMMING SYSTEM.

ADDITIONALLY, THE TRAILS ARE AUTOMATICALLY SPREAD AND CLOSED WITH THE ASSISTANCE OF A WINCH. MORE THAN LIKELY THE RAMMING DEVICE IS USED ONLY WHEN THE 2B16 IS FIRING AT HIGH ELEVATION ANGLES (GREATER THAN 600). THE MUZZLE BREAK ABSORBS APPROXIMATELY 30% OF THE RECOIL ENERGY.

THE 2B16 WAS DESIGNED AND DEVELOPED TO SUPPORT GROUND MANEUVER UNITS BASED ON THE RUSSIAN ARMY'S EXPERIENCES IN AFGHANISTAN. SOME RUSSIAN DESIGNERS DESCRIBED THE 2B16 AS A "BAD DESIGN". THERE IS NOTHING TO INDICATE WHAT LED TO THE UNVERIFIED CLAIMS THAT THE SYSTEM WAS FLAWED. HOWEVER, PRODUCTION OF THE COMBINATION GUN CEASED AND THE SYSTEM WAS BEING WITHDRAWN FROM SERVICE IN THE RUSSIAN ARMY UNTIL THE TOWED COMBINATION GUN WAS EMPLOYED WITH UNITS FIGHTING IN CHECHNYA DURING THE 1990'S. BASED UPON ITS SUCCESSFUL EMPLOYMENT AND PERFORMANCE IN CHECHNYA, THE 2B16 HAS EARNED THE DISTINCTION AS THE SYSTEM OF CHOICE FOR FIELDING WITH MOUNTAIN ARTILLERY UNITS. THE PRIME MOVER FOR THE COMBINATION GUN IS A GAZ-66 OR IT'S EQUIVALENT. HOWEVER, THE MANUFACTURER HAS INDICATED (IN RECENT SALES BROCHURES) THAT A UAZ-469 OR ITS EQUIVALENT CAN SUCCESSFULLY TOW THE COMBINATION GUN. THE ONLY DRAWBACK TO THE UAZ-469/2B16 TOWED CONFIGURATION IS THE UAZ-469'S LACK OF ON-BOARD CARGO SPACE FOR THE TRANSPORTATION OF AMMUNITION.

OTHER AMMUNITION TYPES: ALL STANDARD 120-MM MORTAR ROUNDS, INCLUDING FRAG-HE-RA TO 9,100M.

RUSSIAN 120-MM SELF-PROPELLED COMBINATION GUN 2S9-1



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designations:	Nona-S, 120-mm SP How M-1981	Caliber, Type, Name:	120-mm Frag-HE cannon (3VOF49)
Date of Introduction:	1981 for original 2S9	Range Minimum (m)	15
Proliferation:	At least 3 countries	Range Maximum (m)	8,850
Description:		Projectile Weight (kg):	19.80
Crew:	4, with 6-8 in section	Muzzle Velocity (m/s):	INA
Vehicle Platform (chassis):	Modified BTR-D APC	Fuze Type:	PD and Proximity
Combat Weight (mt):	8.50		
Chassis Length Overall (m):	6.02	Caliber, Type, Name:	120-mm HEAT (BK-19) cannon
Height Overall (m):	2.6	Range Minimum (m)	40
Width Overall (m):	2.63	Range Maximum (m)	1,000
		Armor penetration (mm):	600
AUTOMOTIVE	SPECIFICATIONS	Projectile Weight (kg):	13.20
Engine Type:	240-hp Diesel	Muzzle Velocity (m/s):	560
Cruising Range (km):	500	Fuze Type:	PD
Max Road Speed (km/h):	60		
Cross-Country (km/h):	35	Caliber, Type, Name:	120-mm Frag-HE rocket assisted cannon (OF-50)
Max Swim:	9	Range Minimum (m)	1,700
Fording Depths (m):	Amphibious	Range Maximum (m)	12,800
Emplacement Time (min):	1 (est)	Projectile Weight (kg):	19.80
Displacement Time (min):	1 (est)	Muzzle Velocity (m/s):	367
Radio:	R-123	Fuze Type:	B35 PD and proximity
PROTECTION	SPECIFICATIONS		
Armor, Turret Front (mm):	10	Caliber, Type, Name:	120-mm Laser-Guided Projectile, cannon
Applique Armor (mm):	N/A	Range Minimum (m)	500
Explosive Reactive (mm):	N/A	Range Maximum (m)	9,000
Mineclearing Equipment:	N/A	Lethality mechanism:	Frag-HE fill
Self-Entrenching Blade:	No	Projectile Weight (kg):	25
Active Protection System:	No	Muzzle Velocity (m/s):	INA
NBC Protection System:	Yes	Fuze Type:	PD
Smoke Equipment	No, but available		
FIRE CONTROL	SPECIFICATIONS	Caliber, Type, Name:	120-mm Frag-HE mortar (OF-843B)
Indirect Fire:	Collimator	Range Minimum (m)	450
Direct Fire:	DF telescopic sight	Range Maximum (m)	7,100
Collimator:	K-1	Projectile Weight (kg):	INA
Fire Control Computer:	None	Muzzle Velocity (m/s):	INA
Gun Display Unit:	None	Fuze Type:	PD and proximity
ARMAMENT	SPECIFICATIONS		
Caliber, Type, Name:	120-mm gun-mortar, 2A51		
Barrel Length (cal):	24.2		

Rate of Fire – Burst (rpm):	**10**		
Rate of Fire – Normal (rpm):	**6**		
Rate of Fire – Sust (rpm):	**4**		
Loader Type:	**Manual**		
Breech Type:	**Combined semi-auto breechblock with wedge locking mechanism and powder gases plastic obturator**		
Muzzle Brake Type:	**None**		
Traverse Left: (deg)	**35**		
Traverse Right: (deg)	**35**		
Traverse Total: (deg)	**70**		

NOTES
GUN AND MORTAR FRAG-HE AMMUNITION FOR THE 2S9-1 CAN EMPLOY PROXIMITY FUZES FOR AIR BURSTS.

RUSSIAN 120-MM SELF-PROPELLED COMBINATION GUN 2S23



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designations:	120-mm 2S23 Nona-SVK	Caliber, Type, Name:	120-mm Frag-HE cannon (3VOF49)
Date of Introduction:	1990	Range Minimum (m)	15
Proliferation:	At least 3 countries	Range Maximum (m)	8,850
Description:		Projectile Weight (kg):	19.8
Crew:	4	Muzzle Velocity (m/s):	INA
Vehicle Platform (chassis):	Modified BTR-80 APC	Fuze Type:	PD and Proximity
Combat Weight (mt):	14.5		
Chassis Length Overall (m):	7.5	Caliber, Type, Name:	120-mm HEAT (BK-19) cannon
Height Overall (m):	2.75	Range Minimum (m)	40
Width Overall (m):	2.9	Range Maximum (m)	1,000
AUTOMOTIVE	SPECIFICATIONS	Armor penetration (mm):	600
Engine Type:	260 hp V-8 water cooled diesel	Projectile Weight (kg):	13.2
Cruising Range (km):	600	Muzzle Velocity (m/s):	560
Max Road Speed (km/h):	80	Fuze Type:	PD
Max Off-Road:	60		
Cross-Country (km/h):	40	Caliber, Type, Name:	120-mm Frag-HE rocket assisted cannon (OF-50)
Max Swim:	10	Range Minimum (m)	1,700
Fording Depths (m):	Amphibious	Range Maximum (m)	12,800
Emplacement Time (min):	1	Projectile Weight (kg):	19.80
Displacement Time (min):	1	Muzzle Velocity (m/s):	367
Radio:	R-173	Fuze Type:	INA
PROTECTION	SPECIFICATIONS		
Armor, Turret Front (mm):	INA	Caliber, Type, Name:	120-mm Laser-Guided Projectile
Applique Armor (mm):	INA	Range Minimum (m)	500
Explosive Reactive (mm):	INA	Range Maximum (m)	9,000
Active Protection System:	NA	Lethality mechanism:	Frag-HE fill
NBC Protection System:	Yes	Projectile Weight (kg):	25
Smoke Equipment	6x grenade launchers	Muzzle Velocity (m/s):	INA
FIRE CONTROL	SPECIFICATIONS	Fuze Type:	PD
Indirect Fire:	INA		
Direct Fire:	DF telescopic sight	Caliber, Type, Name:	120-mm Frag-HE mortar (OF-843B)
Collimator:	K-1	Range Minimum (m)	400
Fire Control Computer:	None	Range Maximum (m)	7,100
ARMAMENT	SPECIFICATIONS	Projectile Weight (kg):	INA
Caliber, Type, Name:	120-mm gun-mortar, 2A60	Muzzle Velocity (m/s):	INA
Barrel Length (cal):	INA	Fuze Type:	PD and proximity
Rate of Fire – Burst (rpm):	10		
Rate of Fire – Normal (rpm):	6		
Rate of Fire – Sust (rpm):	4		

Loader Type:	**Autoloader**		
Breech Type:	**semi-auto breechblock**		
Muzzle Brake Type:	**None**		
Traverse Left: (deg)	**35**		
Traverse Right: (deg)	**35**		
Traverse Total: (deg)	**70**		
Elevation (°) (-/+):	**-4/+80°**		

NOTES

2S23 HAS A DEVICE FOR LOADING PROJECTILES FROM THE GROUND. DURING TRAVELING THE DEVICE IS EXTERNALLY ATTACHED ON THE RIGHT SIDE NEAR THE SIDE DOOR.

GUN AND MORTAR FRAG-HE AMMUNITION FOR THE 2S23 CAN EMPLOY PROXIMITY FUZES FOR AIR BURSTS.

PLL05: CHINESE SP COMBO GUN FITS A LONGER VARIANT OF THE 2S23 CANNON ON 6-WHEELED WZ-551 CHASSIS. IT CAN FIRE AMMO FOR THE 2S23 BUT CHINESE ROUNDS INCLUDE LONGER ROUNDS FOR THE NEWER RUSSIAN 2S31. IT ALSO MOUNTS A 12.7-MM MG.

Mortar Tables

The following tables reflect mortars which the US soldier is "most likely" to encounter on today's battlefields. A wide variety of other mortars and rounds are proliferated.

50/60-mm Mortars

Mortar	Cal (mm)	Origin	DOI	Range (Max/Min) (meters)	Munition Types	Rate of Fire (rpm)	Crew	Round Weight (HE)(kg)	Elevation/ Traverse (degrees)	Muzzle Velocity (m/s)	Mount Type	Weight (kg)	Emplace/ Displace (min)	Remarks
M-8	50.8	Bosnia Yugo		Max: 480 Min: 135	HE	25-30	1-2		E: 45-85		Hand-supported	7.3	1/1	One crewman carries the mortar, the other carries ammo
Al-Jaleel Commando Mortar (M70)	60	Iraq Yugo (M70)		Max: 2537	HE Illum Smoke	25-30	1-2		E: 45-85		Hand-supported	7.6	1/1	Iraqi version of the Bosnian M70 Commando mortar
Al-Jaleel Infantry Mortar (M57)	60	Iraq Yugo (M57)		Max: 2500	HE Illum Smoke	25-30	1-2		E: 45-85		Bipod & Base-plate	22	1/1	Iraqi version of the Yugo M57 60-mm infantry mortar (based on US M2 60-mm mortar) Easily separated from bipod and baseplate and used
M70 Com-mando	60	Bosnia		Max: 2537 Min: 100	HE Illum Smoke	15	1-2		E: 45-85		Hand-supported	10	1/1	Widely copied and proliferated
Brandt Com-mando	60	France		Max: 1050 Min: 100	HE Illum, Smoke Incendiary	15	1-2		E: 45-85		Hand-supported	8.9	1/1	Widely proliferated (20+ countries) Fires same ammo as CH Type 63 but reduced charge. One crewman carries mortar, the other carries ammo
T1 Com-mando	60	Iran		Max: 1050 Min: 100	HE	15	1-2		E: 45-85		Hand-supported	6	1/1	Appears to be Iranian version of the Brandt Commando T2 mortar has a round base and shorter range- 800 m
Hadib Infantry	60	Iran		Max: 2500 Min:	HE	30	1-2		E: 43-85		Bipod & Base-plate	Firing: 17.5 Baseplate: 6.5 Tube: 6 Site: 1 Bipod: 4	11/1	Appears to be Iranian version of the Yugo M57 class 60-mm mortar
Type 63-1	60	China	1970s	Max: 1550 Min: 95	HE Illum, Smoke	15-20	2-3	1.3	E: 40-80 T: 8	141	Bipod & Base-plate	Firing: 11.5	1/1	Widely proliferated. Small rectangular base-plate and carrying handle on the tube.

Type 85/ W85	60	China	1985	Max: 2700 Min: 145	HE HE Blast Illum, Smoke Incendiary	30	5	1.3	E: 45-80 T 8	203	Bipod & Base-plate	Firing: 12.7		Replaced Chinese Type 63-1
Type 90/ W90	60	China	1990	Max: (ext) 5700 Min: 130	HE HE Blast Illum Smoke Incendiary	30	2-3	2.3	E: 45-80 T: 7		Bipod & Base-plate	Firing: 21.5		Replaced Chinese Type 85

81/82-mm Mortars

Mortar	Cal (mm)	Origin	DOI	Range (Max/Min) (meters)	Munition Types	Rate of Fire (rpm)	Crew	Round Weight (HE) (kg)	Elevation/ Traverse (degrees)	Muz Vel (m/s)	Mount Type	Weight (kg)	Emplace/ Displace (min)	Remarks
Hadid	81	Iran		Max: 5200 Min:	HE	20			E: 43-85		Bipod & Base-plate	Firing: 50.5 Base: 17.5 Tube: 18 Site: 1.5 Bipod: 13.5		
L16/A1/A2 M252 (US) C3 (Can)	81	UK US Canada Japan	Mid 1960s (L16)	Max: 5650 Min:	HE Smoke Illum WP	15	5	4.3	E: 45-80 T: INA	255	Bipod & Base-plate	Firing: 35.3 Base: 11.6 Tube: 12.7 Bipod: 12.3 Site: 1.25		Widely proliferated (+39 counties)
W87	81	China	1987	Max: (ext) 5700 Min: 120	Frag HE HE Blast Smoke, Ill Incendiary Ext range	20	5-7	4.2	E: 45-80 T: 7	312	Bipod & Base-plate	Firing: 39.7		Replaced Type 67. Similar to Type 84
2B14-1	82	FSU	1983	Max: 4270 Min: 80	Frag-HE Illum Smoke	20	4	3.1	E: 45-85 T: 8		Bipod & Base-plate	Firing: 39		Podnos Muzzle loaded, smoothbore, manpack
2B9 Type 99 Automatic Mortar	82	FSU (2B9) China (Type 99)	1983	Max: 5000 4270 Min: 100 800	Frag-HE HEAT Smoke Illum	120 sustain : 40-60	3-4	3.2	E: -1 to 85 T: 30/30	270	Split rail carriage w/ emplace jack	635	1/5	Breech-loaded, recoil-operated mortar using 4-round clips. Towed by Light Truck
Al-Jaleel	82	Iraq		Max: 4900 Min:	HE	10-15	4		E: 45-85		Bipod & Base-plate	Firing: 63	1/1	Copy of Yugo M69A
M37, M1937 (1942-43 ver) Type 53	82	FSU China (Type 53)	1943	Max: 3040 Min: 90	Frag-HE HE Illum Smoke Incendiary	15-25	5	3.5	E: 45-85 T: 10 total	HE: 210	Bipod & Base-plate	55.8		Old, but widely proliferated
M69A	82	Yugo	Mid 1960s	Max: 6050 Ext Range: (M91=6700) Min: 160	HE Illum Smoke	10-15	4		E: 45-85 T: 3/3	HE: 330	Bipod & Base-plate	Firing: 54 Tube: Bipod: 14 Base: 15	1/1	Widely proliferated
Type 67	82	China	1971	Max: 3040 Min: 85	HE, Illum, Smoke Incendiary	10-15	3-4	3.16	E: 45-85 T: 6	HE: 211	Bipod & Base-plate	Firing: 35 Tube: 13 Bipod: 10 Base: 12		Widely proliferated. In service since 1971. Replaced Type 53 (copy of Sov M-37). Triangular baseplate with handle. SP variant mounted in a Chinese YW-304 APC

Type 84	82	China	1984	Max: (ext) 5700 Min: 120	Frag HE HE Blast Smoke, Ill Incendiary Ext range	20	5-7	4.2	E: 45-80 T: 7	HE: 265	Bipod & Base-plate	Firing: 39.7 Tube: 15.5 Bipod: 8.7 Base: 15.5		Similar to Chinese W87 81-mm Mortar

Note: Proximity fuzes are available for use with 81-mm and 82-mm HE projectiles, providing air burst capability.

100/120-mm Mortars

Mortar	Cal (mm)	Origin	DOI	Range (Max/Min) (meters)	Munition Types	Rate of Fire (rpm)	Crew	Round Weight (HE)(kg)	Elevation / Traverse (degrees)	Muz Vel (m/s)	Mount Type	Weight (kg)	Emplace / Displace (min)	Remarks
Type 71	100	China	Early 1970	Max: 4700 Min: 170	HE Illum Smoke	15-20	7	8	E: 45-80 Total: 4/4	250	Bipod & Base-plate	Firing: 75 Tube: 28 Bipod: 21 Base: 25.5		
Type 89	100	China	Early 1989	Max: (ext) 6400 Min: 215	HE Illum Smoke	15-20	7	8	E: 45-80 Total: 4/4	215	Bipod & Base-plate	Firing: 73 Tube: 29 Bipod: 16 Base: 28		Light. Designed for light infantry, mountains, and jungle environs, Manportable
2B11 Aka: M120 2S12	120	FSU		Max: (ext) 9100 Min: 450	Frag-HE and more	10-15	5	16	E: 45-80 Total: 5/5	325 (ext)	Bipod & Base-plate Trailer	Firing: 210 Travel: 297 Bipod: 55 Base: 80	3/3	2S12 includes the GAZ-66 light truck. Mortar is usually porteed, rather than towed
Al-Jaleel	120	Iraq		Max: 5400 Min:	HE Illum Smoke	5-8			E: 45-85		Bipod & Base-plate	148		
M1943 M-43 M120 Type 53	120	FSU NK China (Type 53)	1943	Max: (ext) 7200 Min: 450	Frag-HE and more	4-9	6	15.4	E: 45-85 T: 4/4	272	Bipod & Base-plate Trailer	Firing: 270 Travel: 522 Bipod: 80 Base: 95	5/3	Old, but widely proliferated. Old, but widely proliferated. Replaced by the newer 2B11/2S12 (FSU)
M74	120	Yugo		Frag-HE: Max: 5400 Min: 275 Extend: 6464 RAP: 9056	HE DPICM Smoke Illum Chemical ICM	5-12	4					Firing: 120 Travel: 208 Bipod: 25 Base: 49	2/.5	Similar to the M75. Lighter designed for mountain use
M75	120	Yugo		Frag-HE: Max: 5374 Min: 275 Extend: 6464 RAP: 9056	HE DPICM Smoke Illum Chemical ICM	4-6	4		E: 45 to 85 T: 6 total	307 (RAP)	Bipod & Base-plate. Trailer	Firing: 178 Travel: 261 Bipod: 25 Base: 87	<1/<1	
MO-120-RT Towed Mortar	120	France	1961	Max: 8,135 RAP: 13,000 Min: 1,100	Frag HE HE-RA	10	4-6	18.60	E: 30 to 85 T: 15 total		towed split trail	582	1.5/2	Widely proliferated (22+ countries including Iraq). Rifled mortar Towed by light truck/TUV Can fire all standard s 120-mm smoothbore rounds w/o fins.
SL	120	Spain		Max: 5,700 Min: 600	HE Smoke	3-5			E: 45 to 85 T: 6 total	295	Bipod & Base-plate. Trailer	Firing: 112 Travel: 250 Base: 50	3/3	Lighter version of the L w/lighter base plate and shorter range.

Type 55/ M-55	120	China	Late 1950 s	Max: 5520 Min: 450	HE Smoke Illum	15	6		E: 45-80 T: 4/4	272	Bipod & Base-plate Trailer	Firing: 275 Travel: 550		Improvement of the Chinese Type 53 (Clone of Russian M1943)
Type 86/ W86	120	China	mid 1980 s	Max: 7700 Min: 400	HE Frag-HE Smoke Illum Incendiary Chemical	20			E: 45-85 T: 04 left 04 right	341		Firing: 206 Travel: 291 Tube: 88 Bipod: 27 Base: 91		SP versions carried on Type 86 and Type 63 APCs

Note: Proximity fuzes are available for use with 120-mm HE rounds, and are used in DPICM rounds, providing air burst capability.

160/240-mm Mortars

Mortar	Cal (mm)	Origin	DOI	Range (Max/Min) (meters)	Munition Types	Rate of Fire (rpm)	Crew	Round Weight (HE) (kg)	Elevation/ Traverse (degrees)	Muzzle Vel (m/s)	Mount Type	Weight (kg)	Emplace/ Displace (min)	Remarks
M-160	160	FSU	1953	Max: 8,040 Min: 750	HE	3	6-7	41	E: 50-80 T: 25 total	343	Base-plate & wheels	Firing: 1,314 Travel: 1,470	?/7	Towed by light truck Breech loaded Barrel is 4550mm in length Replaced M-43
M-43 Type 56	160	FSU China (Type 56)	1943	Max: 5,150 Min: 630	HE	3	4-8	40.8	E: 45-80 T: 25 total		Base-plate & wheels	Firing: 1,170		Widely proliferated (+20 countries) Towed by light truck Replaced by the M-160
2S4 SP M1975	240	FSU	1975	Max: 9,700 HE Ext: 20,000 Min: 80 Max 9.2	HE Nuclear Chemical Laser-Guided			130	Limited Traverse	362 (HE	Tracked SP chassis			Replaces M-240. Mod SA-4 Ganef chassis. Short range is problem for Nuclear rounds LGP requires laser designator.
M-240 (Towed) M-53	240	FSU	1952	Max: 9,700 Ext: 20,000 Min: 800	HE Nuclear Chemical	1	8-9	130	E: 45-70 T: 17 total	362 (HE)	Base-plate & wheels	Firing: 3,610 Travel: 4,240	varies	Short range is problem for Nuclear rounds

Note: Proximity fuzes are available for use with 160-mm HE projectiles, providing air burst capability.

Combination Guns

Mortar	Cal (mm)	Origin	DOI	Munition Types (Fuze Types) Maximum Range (meters)	Round Weight (kg)	Rate of Fire (rpm)	Crew	Elevation/ Traverse (degrees)	Mount Type	Weight (kg)	Emplace/ Displace (min)	Remarks
2S31 (Vena) Tracked SP Combo Gun	120	FSU	1996	New Family 120-mm Howitzer Ammunition: Frag-HE-RA (RAP) (PD/Time/Prox) 18,000 Frag-HE (PD/Time/Prox) 13,000 DPICM (PD/Time) 13,000 Also fires all munitions listed below	Frag-HE: 16 Also fires munitions below.	10	4	E: -4 to 80 T: 360/	Mod BMP-3 amphibious chassis	19500	1/1 est	Rifled gun 2A80. 70 rounds carried onboard
2S9-1 (Nona-S) **Tracked SP** Combo Gun	120	FSU	1981	Howitzer: Frag-HE-RA (RAP) 13,000 Frag-HE PD/Prox 8,800 DPICM 12,000 Flechette 1,000 HEAT 1,000 (armor penetration 600mm) Kitolov-2 (laser-guided) 9,000 Mortar: Frag-HE-RA (RAP) 9,000 Frag-HE PD/Prox 7,100 Incendiary (White Phosphorus) 6,010 Smoke 5,850 Illum 5,850 Chem INA Strix (IR-homing) 8,000 Gran (laser-guided) 9,000 Rifled Mortar (French): Frag-HE-RA (RAP) PD/Prox 13,000 Frag-HE PD/Prox 8,100 Also other 120-mm rifled mortar rounds	HE-RA: 20 Frag-HE: 20 HEAT: 13 Laser Gd: 25 Frag-HE (mortar) 17.2	6	6-8 Total Mortar Crew 4	E: -4 to 80 T: 360/70 total	Mod BTR-D/ BMD amphibious chassis	8,500	1/1	Rifled gun 2A51. 40 rounds carried onboard
120 SP Wheeled SP Combo Gun	120	China	2001		HE-RA: 20 Frag-HE: 20 HEAT: 13 Laser Gd: 25 Frag-HE (mortar) 17.2	HE: 6-8 HEAT 4-6 Mortar 10	4	E: -8 to 80 T: 360/	WZ-551 amphibious chassis			Similar to 2S23. Exported 2001
2S23 (Nona-SVK) Wheeled SP Combo Gun	120	FSU	1990		HE-RA: 20 Frag-HE: 20 HEAT: 13 Laser Gd: 25 Frag-HE (mortar) 17.2	10	4	E; -4 to 80 T: 360/70 total	Mod BTR-80 APC amphibious chassis	14500	1/1	Rifled gun 2A60. 30 rounds carried onboard. WEG page 6-57
2B16 (Nona-K) Towed Combo Gun	120	FSU	1986		HE-RA: 20 Frag-HE: 20 HEAT: 13 Laser Gd: 25 Frag-HE (mortar) 17.2	6	5	E: -10 to 80 T: 60 total	Towed split trail carriage. Can be porteed on amphibious chassis.	1,100	2/2	Rifled gun 2A51 Towed by light truck, TUV, or APC

NOTE: Combination guns are actually howitzers that can also fire 120-mm mortar rounds. Therefore, they are also referred to as 120-mm howitzers, and as gun-mortar systems. They can fire all standard 120mm rifled cannon, 120mm rifled mortar, and 120mm smoothbore mortar ammunition. The howitzer rounds can be fired in a direct-fire role (0 meters-Flechette, 40 meters-HEAT, others >100 meters minimum safe distance). Mortar rounds have a shorter range than howitzer rounds. However, the system can fit more mortar rounds, can fire to higher angles. High angle fires can be more easily used in higher defilade terrain and in urban areas, and can impact at angles closer to 90 for more lethal area effects. The addition of mortar rounds also makes available to the weapon a wider array of specialized and precision munitions for different applications.

Artillery Weapons: Cannon Systems

OPFOR indirect fire support weapons include cannon systems, rocket launchers (RLs), mortars, and hybrid systems. These systems can be mounted on fixed launchers, towed or self-propelled (SP). The weapons generally use the indirect fire mode; but most can also deliver direct fires.

Traditional cannon artillery includes guns and howitzers. Guns generally have longer tubes, higher muzzle velocities, and longer ranges with lower trajectory fire. Howitzers can deliver both low- and high-angle fire. Each cannon type has advantages and tradeoffs for tactical conditions. Some guns sacrifice mobility and projectile lethality to increase range. Howitzers may sacrifice range and conventional precision for versatility. High-angle fire lends itself to attacking targets located behind cover or on reverse slopes. Howitzers can fire a wide variety of rounds and are used for long-term sustained fire.

In recent decades modern cannon are gun-howitzers employing the best features of both guns and howitzers. Most use “Gerald Bull technology” designs (longer barrels 39 caliber or greater, long breaches, and long-recoil), for long range, precision, and a higher rate of fire. They can handle older ammunition, and a new family of increased lethality munitions with extended range. Gun-howitzer SP systems with this technology are still usually called SP howitzers.

Towed cannon systems are lightweight, low-cost, simple, and extremely mobile on hard surfaces. Their disadvantages are lack of cross-country mobility and no gun crew protection against chemical, biological, radiological, and nuclear (CBRN) strikes or counter-battery fire. Tracked SP systems greatly enhance artillery’s ability to provide continuous support to mechanized infantry and tank brigades. Their cross-country mobility and speed allows them to keep pace with combined arms combat. Their armor protection improves crew and weapon survivability. These SP systems may still have ammunition resupply limitations because they depend on soft-skinned, wheeled vehicles for logistics support. For road-bound mechanized infantry forces with wheeled APCs, and for deep-firing artillery employed in depth, wheeled weapons can move on roads and pull off to the side for shoot-and-move fire missions.

RUSSIAN 122-MM TOWED HOWITZER D-30



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designations:	122-mm D-30A Lyagushka	Caliber, Type, Name:	122-mm Frag-HE, OF-81
Date of Introduction:	1963	Range Minimum (m)	1,000
Proliferation:	At least 50 countries	Range Maximum (m)	15,300
Description:		Projectile Weight (kg):	21.76
Crew:	5	Muzzle Velocity (m/s):	680
Combat Weight (mt):	3.2	Fuze Type:	RGM-2 PD
Length Firing (m):	5.4		
Length Travel (m):	INA	Caliber, Type, Name:	122-mm, HEAT-FS
Height Overall (m):	1.6	Range Minimum (m)	0
Width Travel (m):	1.9	Range Maximum (m)	1,000
Prime Mover:	MT-LB; Ural-375	Armor penetration (mm):	460
Emplacement Time (min):	1.5	Projectile Weight (kg):	21.58
Displacement Time (min):	3.5	Muzzle Velocity (m/s):	740
FIRE CONTROL	SPECIFICATIONS	Fuze Type:	GPV-2 PIBD
Indirect Fire:	PG-1M PANTEL		
Direct Fire:	OP 4M-45	Caliber, Type, Name:	122-mm Frag-HE Rocket Assisted
Collimator:	K-1	Range Minimum (m)	INA
Fire Control Computer:	None	Range Maximum (m)	21,900
Gun Display Unit:	None	Projectile Weight (kg):	21.76
ARMAMENT	SPECIFICATIONS	Muzzle Velocity (m/s):	INA
Caliber, Type, Name:	122-mm, 2A18M cannon	Fuze Type:	PD
Barrel Length (cal):	38		
Rate of Fire – Burst (rpm):	8		
Rate of Fire – Normal (rpm):	6		
Rate of Fire – Sust (rpm):	4		
Loader Type:	Semi-automatic		
Breech Type:	Vertical sliding wedge		
Muzzle Brake Type:	Multi-baffle		
Traverse Left: (deg)	360		
Traverse Right: (deg)	360		
Traverse Total: (deg)	360		
Elevation (°) (-/+):	-7/+70°		

NOTES

THE D-30A IS A MIDLIFE PRODUCT IMPROVEMENT OF THE D-30. THE ORIGINAL D-30 WAS FIELDED IN 1963 AND THE MIDLIFE PRODUCT IMPROVEMENTS OCCURRED IN THE MID TO LATE 1970'S.

VARIANTS

SADDAM: IRAQI PRODUCED VERSION OF THE D-30

D30J: YUGOSLAVIAN PRODUCED VERSION OF THE D-30

M1977: NORTH KOREAN SELF-PROPELLED HOWITZER WITH A VTT-323 APC CHASSIS AND A D-30 MOUNTED IN THE SIDE-ARMORED REAR BAY

SP 122: EGYPTIAN SELF-PROPELLED HOWITZER (M109A2 CHASSIS AND TURRET WITH AN EGYPTIAN MADE D-30 HOWITZER)

TYPE 85: CHINESE SELF-PROPELLED HOWITZER (CHINESE TYPE 85 APC CHASSIS AND A LICENSED PRODUCED VERSION OF THE D-30 IN A SEMI-OPEN SUPERSTRUCTURE)

TYPE 86: CHINESE COPY OF D-30

TYPE 89/PLZ89: CHINESE TURRETED SP HOWITZER WITH A D-30 GUN

RUSSIAN 130-MM TOWED GUN M-46



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designations:	None	Caliber, Type, Name:	130-mm Frag-HE, OF44
Date of Introduction:	1954	Range Minimum (m)	INA
Proliferation:	At least 25 countries	Range Maximum (m)	22,500
Description:		Projectile Weight (kg):	33.40
Crew:	8	Muzzle Velocity (m/s):	930
Combat Weight (mt):	8.45	Fuze Type:	V-429 PD
Length Firing (m):	11.10		
Length Travel (m):	11.73	Caliber, Type, Name:	130-mm, APC-T
Height Overall (m):	2.5	Range Minimum (m)	0
Width Travel (m):	2.45	Range Maximum (m)	11,140
Prime Mover:	AT-S, KrAZ-255	Armor penetration (mm):	INA
Emplacement Time (min):	6	Projectile Weight (kg):	33.49
Displacement Time (min):	7	Muzzle Velocity (m/s):	INA
FIRE CONTROL	SPECIFICATIONS	Fuze Type:	DBR BD
Indirect Fire:	PG-1 PANTEL		
Direct Fire:	OP 4-35	Caliber, Type, Name:	130-mm Frag-HE, OF-43
Collimator:	K-1	Range Minimum (m)	INA
Fire Control Computer:	None	Range Maximum (m)	27,500
Gun Display Unit:	None	Projectile Weight (kg):	33.40
ARMAMENT	SPECIFICATIONS	Muzzle Velocity (m/s):	930
Caliber, Type, Name:	130-mm cannon	Fuze Type:	V-429 PD
Barrel Length (cal):	52		
Rate of Fire – Burst (rpm):	8	Caliber, Type, Name:	130-mm Frag HE, OF-43
Rate of Fire – Normal (rpm):	6	Range Minimum (m)	INA
Rate of Fire – Sust (rpm):	4	Range Maximum (m)	38,000
Loader Type:	Manual	Projectile Weight (kg):	33.40
Breech Type:	Horizontal sliding wedge	Muzzle Velocity (m/s):	940
Muzzle Brake Type:	Multi-perforated (pepper pot)	Fuze Type:	ML-5 PD
Traverse Left: (deg)	25		
Traverse Right: (deg)	25		
Traverse Total: (deg)	50		
Elevation (°) (-/+):	-2.5/+45°		

NOTES

THE M-46 GUN CREW IS PROVIDED LIMITED FRONTAL PROTECTIONS BY VIRTUE OF A FRONTAL V-SHAPED SHIELD (APPROXIMATELY 7-MM THICK). OTHERWISE, THE CREW, AMMUNITION SUPPLY, AND EQUIPMENT ARE VULNERABLE TO CASUALTIES AND DAMAGE FROM SMALL ARMS FIRE, ARTILLERY FIRE, AND BOMB SHRAPNEL. THE EXTENDED RANGE FULL

BORE-BASE BLEED ROUND WAS SPECIFICALLY DESIGNED BY NORINCO INDUSTRIES (CHINA) FOR USE WITH THE CHINESE 130-MM TYPE 59 FIELD GUN. HOWEVER, THIS ROUND MAY BE FIRED BY THE M-46.

VARIANTS
TYPE 59: CHINESE COPY
TYPE 59-1 IS A REDUCED WEIGHT VARIANT
BEREG: RUSSIAN COASTAL DEFENSE SP GUN COMPLEX (SEE VOLUME 3)

OTHER AMMUNITION TYPES: SMOKE, CHEMICAL, ILLUMINATION
THE CANNON IS BALLISTICALLY MATCHED TO THE CANNON ON THE BEREG COASTAL DEFENSE SYSTEM (VOLUME 3). THUS IT CAN GENERALLY FIRE THE SAME AMMUNITION TO THE SAME RANGE, WHEN FCS IS COMPATIBLE.

RUSSIAN 152-MM TOWED GUN 2A36



SYSTEM	SPECIFICATIONS
Alternative Designations:	2A36 Giatsint-B
Date of Introduction:	1981
Proliferation:	At least 11 countries
Description:	
Crew:	8
Combat Weight (mt):	9.8
Length Firing (m):	8.7
Length Travel (m):	12.9
Height Overall (m):	2.7
Width Firing (m):	8.7
Width Travel (m):	2.7
Prime Mover:	KrAZ-4556, KrAZ-255B, or AT-S
Towing Speed Road (km/h):	70
Towing Speed Off Road (km/h):	20
Emplacement Time (min):	5
Displacement Time (min):	7
FIRE CONTROL	**SPECIFICATIONS**
Indirect Fire:	PG-1M PANTEL
Direct Fire:	N/A
Collimator:	K-1
Fire Control Computer:	None
Gun Display Unit:	None
ARMAMENT	**SPECIFICATIONS**
Caliber, Type, Name:	152-mm, cannon
Barrel Length (cal):	49
Rate of Fire – Burst (rpm):	6
Rate of Fire – Normal (rpm):	5
Rate of Fire – Sust (rpm):	4
Loader Type:	Semi-automatic
Breech Type:	Horizontal sliding wedge
Muzzle Brake Type:	Multi-baffle
Traverse Left: (deg)	25
Traverse Right: (deg)	25
Traverse Total: (deg)	50
Elevation (°) (-/+):	-2/+57°

AMMUNITION	SPECIFICATIONS
Caliber, Type, Name:	152-mm Frag-HE, OF-39 (RAP)
Range Minimum (m)	9,100
Range Maximum (m)	28,400
Projectile Weight (kg):	43.51 (OF-29)
Muzzle Velocity (m/s):	945
Fuze Type:	V-429 PD
Caliber, Type, Name:	152-mm, HEAT, BP-540
Range Minimum (m)	0
Range Maximum (m)	1000
Armor penetration (mm):	INA
Projectile Weight (kg):	27.00
Muzzle Velocity (m/s):	655
Fuze Type:	GPV-2 PD
Caliber, Type, Name:	152-mm Frag-HE, OF-86
Range Minimum (m)	INA
Range Maximum (m)	30,500
Projectile Weight (kg):	43.80 (OF-59)
Muzzle Velocity (m/s):	945
Fuze Type:	V-429 PD

Other Ammunition Types: DPICM, DPICM-BB, Incendiary, Chemical, Flechette, Semi-active laser-guided Krasnopol-M Frag-HE. The cannon is ballistically matched to the 2S5/2S5M self-propelled gun system. Thus it can generally fire the same ammunition to the same range.

NOTES

THE MOST DISTINGUISHING FEATURE OF THE 2A36 IS ITS LOWER CARRIAGE. THE LARGE SYSTEM WEIGHT REQUIRED THE USE OF TANDEM "WALKING-BEAM" AXLES AND FOUR WHEELS TO PROVIDE MOBILITY. A HYDRAULICALLY POWERED FIRING PEDESTAL IS MOUNTED ON THE FRONT OF THE LOWER CARRIAGE AND SERVES AS PART OF THE TRAVEL LOCK (SIMILAR TO THE D-20). ALTHOUGH THE TRAILS DO NOT HAVE THE FOLDING SUMMER SPADES OF THE D-20, THEY DO HAVE TWO LARGE

SPADES SIMILAR TO THOSE FOUND ON THE M-46/M-47. THE WEIGHT OF THE 2A36 NORMALLY REQUIRES IT TO BE TOWED BY A HEAVY TRUCK (LIKE THE KRAZ-255B). THE KRAZ-255B IS EQUIPPED WITH A SPECIAL WINCH USED TO LIFT THE TRAILS IN ORDER TO ATTACH THE GUN'S LUNETTE TO THE TOWING PINTLE.

RUSSIAN 152-MM TOWED GUN HOWITZER D-20



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designations:	None	Caliber, Type, Name:	152-mm Frag-HE, OF32
Date of Introduction:	1955	Range Minimum (m)	4,600
Proliferation:	At least 13 countries	Range Maximum (m)	17,400
Description:		Projectile Weight (kg):	43.56 (OF25)
Crew:	8	Muzzle Velocity (m/s):	655
Combat Weight (mt):	5.7	Fuze Type:	V-90 PD
Length Firing (m):	8.69		
Length Travel (m):	8.10	Caliber, Type, Name:	152-mm, HEAT, BP-540
Height Overall (m):	2.52	Range Minimum (m)	0
Width Firing (m):	2.35	Range Maximum (m)	1000
Width Travel (m):	INA	Armor penetration (mm):	INA
Prime Mover:	AT-S; MT-LB; Ural-375/4320	Projectile Weight (kg):	27.00
Towing Speed Road (km/h):	60	Muzzle Velocity (m/s):	655
Towing Speed Off Road (km/h):	30	Fuze Type:	GPV-3 PD
Emplacement Time (min):	2.5		
Displacement Time (min):	2.5	Caliber, Type, Name:	152-mm Frag-HE, OF-96
FIRE CONTROL	SPECIFICATIONS	Range Minimum (m)	INA
Indirect Fire:	PG-1M PANTEL	Range Maximum (m)	24,400
Direct Fire:	OP 4M	Projectile Weight (kg):	43.56 (OF-64)
Collimator:	K-1	Muzzle Velocity (m/s):	INA
Fire Control Computer:	None	Fuze Type:	PD
Gun Display Unit:	None		
ARMAMENT	SPECIFICATIONS		
Caliber, Type, Name:	152-mm, cannon		
Barrel Length (cal):	25		
Rate of Fire – Burst (rpm):	5-6		
Rate of Fire – Normal (rpm):	INA		
Rate of Fire – Sust (rpm):	1 (65 rounds the first hour)		
Loader Type:	Manual		
Breech Type:	Vertical sliding wedge		
Muzzle Brake Type:	Double flared		
Traverse Left: (deg)	29		
Traverse Right: (deg)	29		
Traverse Total: (deg)	58		
Elevation (°) (-/+):	-5/+45°		

NOTES

THE D-20 WAS THE FIRST 152-MM CANNON SYSTEM TO INCORPORATE A SEMIAUTOMATIC VERTICAL-SLIDING-WEDGE BREECH BLOCK. ALTHOUGH THE AMMUNITION FOR THE SYSTEM WAS NOT CHANGED, THIS MODIFICATION ALLOWED A SLIGHTLY HIGHER RATE OF FIRE TO BE ACHIEVED (6 ROUNDS PER MINUTE RATHER THAN 4), ALTHOUGH THE SUSTAINED

RATE OF FIRE WAS UNCHANGED. BECAUSE THE CARRIAGE IS BASED ON THAT OF THE 122-MM GUN D-74, THE D-20 CANNOT BE ELEVATED ABOVE 45°.

VARIANTS
M1974: NORTH KOREAN SELF-PROPELLED HOWITZER WITH A VTT-323 APC CHASSIS AND A D-20 MOUNTED IN THE SIDE-ARMORED REAR BAY
TYPE 66: CHINESE COPY OF D-30
TYPE 83: SELF-PROPELLED HOWITZER BASED ON THE TYPE 66, AND AN ARMORED TRACKED CHASSIS

OTHER AMMUNITION TYPES:
DPICM, DPICM-BB, INCENDIARY, EXPENDABLE JAMMER, CHEMICAL, FLECHETTE, SEMI-ACTIVE LASER-GUIDED KRASNOPOL-M FRAG-HE. THE CANNON IS BALLISTICALLY MATCHED TO THE 2S3M SELF-PROPELLED HOWITZER. THUS IT CAN GENERALLY FIRE THE SAME AMMUNITION TO THE SAME RANGE. SELECTION OF ROUNDS AVAILABLE MAY DIFFER BASED ON TIER OF THE SYSTEM.

RUSSIAN 152-MM TOWED GUN HOWITZER 2A65



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designations:	Msta-B; Giatsint-B	Caliber, Type, Name:	152-mm Frag-HE, OF-72
Date of Introduction:	1987	Range Minimum (m)	6500
Proliferation:	At least 6 countries	Range Maximum (m)	24,700
Description:		Projectile Weight (kg):	43.56 (OF-45)
Crew:	5 (Section: 6)	Muzzle Velocity (m/s):	864
Combat Weight (mt):	7.0	Fuze Type:	RGM-2 PD
Length Firing (m):			
Length Travel (m):	12.70	Caliber, Type, Name:	152-mm Frag-HEAT, BP-540
Height Overall (m):	2.95	Range Minimum (m)	0
Width Firing (m):		Range Maximum (m)	1,000
Width Travel (m):	2.50	Armor penetration (mm):	INA
Prime Mover:	Ural 4320	Projectile Weight (kg):	27.00
Towing Speed Road (km/h):	80	Muzzle Velocity (m/s):	655
Towing Speed Off Road (km/h):	20	Fuze Type:	GPV-3 PD
Emplacement Time (min):	3		
Displacement Time (min):	3	Caliber, Type, Name:	152-mm Frag-HE BB, OF-91
FIRE CONTROL	SPECIFICATIONS	Range Minimum (m)	6710
Indirect Fire:	PG-1M PANTEL	Range Maximum (m)	29,000
Direct Fire:	OP 5M	Projectile Weight (kg):	42.86 (OF-61)
Collimator:	K-1	Muzzle Velocity (m/s):	828
Fire Control Computer:	None	Fuze Type:	KZ-88 PD
Gun Display Unit:	None		
ARMAMENT	SPECIFICATIONS		
Caliber, Type, Name:	2A65 152.4-mm, cannon		
Barrel Length (cal):	48		
Rate of Fire – Burst (rpm):	8		
Rate of Fire – Normal (rpm):	6		
Rate of Fire – Sust (rpm):	4		
Loader Type:	Manual		
Breech Type:	Vertical sliding wedge		
Muzzle Brake Type:	Multi-baffle		
Traverse Left: (deg)	27		
Traverse Right: (deg)	27		

Traverse Total: (deg)	54		
Elevation (°) (-/+):	-4.0 (-3.5 actual)/+70°		

NOTES

THE D-20 WAS THE FIRST 152-MM CANNON SYSTEM TO INCORPORATE A SEMIAUTOMATIC VERTICAL-SLIDING-WEDGE BREECH BLOCK. ALTHOUGH THE AMMUNITION FOR THE SYSTEM WAS NOT CHANGED, THIS MODIFICATION ALLOWED A SLIGHTLY HIGHER RATE OF FIRE TO BE ACHIEVED (6 ROUNDS PER MINUTE RATHER THAN 4), ALTHOUGH THE SUSTAINED RATE OF FIRE WAS UNCHANGED. BECAUSE THE CARRIAGE IS BASED ON THAT OF THE 122-MM GUN D-74, THE D-20 CANNOT BE ELEVATED ABOVE 45°.

OTHER 152-MM AMMUNITION TYPES: ALL STANDARD 152-MM ARTILLERY ROUNDS, INCLUDING DPICM, DPICM-BB, HE-RA, INCENDIARY, CHEMICAL, FLECHETTE, SEMI-ACTIVE LASER HOMING. THE CANNON IS BALLISTICALLY MATCHED TO THE CANNON ON THE 2S19 SELF-PROPELLED HOWITZER. THUS IT CAN GENERALLY FIRE THE SAME AMMUNITION TO THE SAME RANGE.

SOUTH AFRICA 155-MM TOWED GUN HOWITZER G-5



SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations:	None	Caliber, Type, Name:	155-mm, cannon
Date of Introduction:	1981	Barrel Length (cal):	45
Proliferation:	At least 4 countries	Rate of Fire – Burst (rpm):	3
Description:		Rate of Fire – Normal (rpm):	2
Crew:	8	Rate of Fire – Sust (rpm):	2
Combat Weight (mt):	13.75	Loader Type:	Semi-automatic
Length Firing (m):	11.00	Breech Type:	Interrupted Screw
Length Travel (m):	12.10	Muzzle Brake Type:	Single baffle
Height Overall (m):	2.3	Traverse Left: (deg)	41
Width Firing (m):	8.7	Traverse Right: (deg)	41
Width Travel (m):	3.3	Traverse Total: (deg)	82
Prime Mover:	Samil 100 6x6 or equiv	Elevation (°) (-/+):	-3/+75°
Towing Speed Road (km/h):	90	AMMUNITION	SPECIFICATIONS
Towing Speed Off Road (km/h):	50	Caliber, Type, Name:	155-mm Frag-HE, M1 HE
Fording Depths (m):	0.6	Range Minimum (m)	3,000
Emplacement Time (min):	2	Range Maximum (m)	30,000
Displacement Time (min):	1	Projectile Weight (kg):	8.7
AUX PROPULSION	SPECIFICATIONS	Muzzle Velocity (m/s):	897
Engine Type	76 hp air-cooled diesel	Fuze Type:	PD M841
Cruising Range (km):	100		
Speed Road (km/h):	16	Caliber, Type, Name:	155-mm HE BB, M1 HE
Speed Off Road (km/h):	INA	Range Minimum (m)	INA
Swim	N/A	Range Maximum (m)	39,000
FIRE CONTROL	SPECIFICATIONS	Projectile Weight (kg):	8.7
Indirect Fire:	Digital Panoramic Telescope	Muzzle Velocity (m/s):	INA
Direct Fire:	Trunnion mounted telescopic	Fuze Type:	PD M841
Collimator:	INA		
Fire Control Computer:	None		
Gun Display Unit:	None		

NOTES

THE APU, COMBINED WITH THE TANDEM WALKING-BEAM SUSPENSION, GIVES THE G5 EXCELLENT SELF-PROPELLED MOBILITY OVER SHORT DISTANCES. THE FOUR WHEELS ARE ALL POWERED AND GIVE THE GUN EXCELLENT TRACTION OVER MOST TERRAIN. BUT, THE APU SERVES PURPOSES OTHER THAN MOBILITY. IT PROVIDES POWER TO OPEN AND CLOSE THE TRAILS, RAISE AND LOWER THE TRAIL WHEELS, AND RAISE AND LOWER THE FIRING PLATFORM. HOWEVER, THERE IS NO POWER TRAVERSE OR ELEVATION. ALTHOUGH DESIGNED FOR AN EIGHT-MAN SECTION, THE SOUTH AFRICAN DEFENSE FORCE NORMALLY OPERATES THE G5 WITH A FIVE-MAN SECTION. HOWEVER, THE G5 CAN OPERATE WITH MINIMUM OF TWO PEOPLE WHEN ALL OF THE POWERED SYSTEMS ARE WORKING. THE G-5 MKIII INCLUDES 35 RELIABILITY MODIFICATIONS AND PERFORMANCE IMPROVEMENTS. THE IMPROVEMENTS INCLUDE THE ADDITION OF THE AS2000 GUN

MONITOR, AN IMPROVED BRAKING SYSTEM, BIGGER DIAMETER AND WIDER TRAIL WHEELS (SPECIFICALLY DESIGNED FOR SAND), AND INCORPORATION OF THE REUTECH ACV 58 COMMUNICATIONS SYSTEM.

OTHER AMMUNITION TYPES:
DPICM, DPICM-BB, INCENDIARY, EXPENDABLE JAMMER, CHEMICAL, FLECHETTE, SEMI-ACTIVE LASER-GUIDED KRASNOPOL-M FRAG-HE. THE CANNON IS BALLISTICALLY MATCHED TO THE 2S3M SELF-PROPELLED HOWITZER. THUS IT CAN GENERALLY FIRE THE SAME AMMUNITION TO THE SAME RANGE. SELECTION OF ROUNDS AVAILABLE MAY DIFFER BASED ON TIER OF THE SYSTEM.

AUSTRIAN 155-MM TOWED GUN-HOWITZER GH N-45



SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations:	None	Caliber, Type, Name:	155-mm, cannon
Date of Introduction:	1980	Barrel Length (cal):	45
Proliferation:	At least 9 countries	Rate of Fire – Burst (rpm):	7
Description:		Rate of Fire – Normal (rpm):	3
Crew:	6	Rate of Fire – Sust (rpm):	2
Combat Weight (mt):	8.9; with APU: 11.00	Loader Type:	Semi-automatic
Length Firing (m):	11.53	Breech Type:	Interrupted Screw
Length Travel (m):	9.06	Muzzle Brake Type:	Multi-baffle
Height Overall (m):	2.15	Traverse Left: (deg)	30
Width Firing (m):	9.93	Traverse Right: (deg)	40
Width Travel (m):	2.50	Traverse Total: (deg)	70
Prime Mover:	10 ton 6x6 truck / tractor	Elevation (°) (-/+):	-5/+72°
Towing Speed Road (km/h):	90	AMMUNITION	SPECIFICATIONS
Towing Speed Off Road (km/h):	50	Caliber, Type, Name:	155-mm Frag-HE, SN-101
Fording Depths (m):	0.6	Range Minimum (m)	INA
Emplacement Time (min):	4	Range Maximum (m)	25,100
Displacement Time (min):	4	Projectile Weight (kg):	42.3
AUX PROPULSION	SPECIFICATIONS	Muzzle Velocity (m/s):	897
Engine Type	125 hp air-cooled diesel	Fuze Type:	PD
Cruising Range (km):	150		
Speed Road (km/h):	35	Caliber, Type, Name:	155-mm HE ERFB
Speed Off Road (km/h):	INA	Range Minimum (m)	INA
Swim	N/A	Range Maximum (m)	39,600
FIRE CONTROL	SPECIFICATIONS	Projectile Weight (kg):	45.4
Indirect Fire:	Digital Panoramic Telescope	Muzzle Velocity (m/s):	895
Direct Fire:	Trunnion mounted telescopic	Fuze Type:	PD
Collimator:	INA		
Fire Control Computer:	None		
Gun Display Unit:	None		

NOTES

THE APU, COMBINED WITH THE TANDEM WALKING-BEAM SUSPENSION, GIVES THE GH N-45 EXCELLENT SELF-PROPELLED MOBILITY OVER SHORT DISTANCES. THE FOUR WHEELS ARE ALL POWERED AND GIVE THE GUN EXCELLENT TRACTION OVER MOST TERRAIN. BUT, THE APU SERVES PURPOSES OTHER THAN MOBILITY. IT PROVIDES POWER TO OPEN AND CLOSE THE TRAILS, RAISE AND LOWER THE TRAIL WHEELS, AND RAISE AND LOWER THE FIRING PLATFORM. HOWEVER, THERE IS NO

POWER TRAVERSE OR ELEVATION. THE GH N-45 ALSO INCLUDES AN OPTIONAL CHAIN SYSTEM (REDUCING THE GROUND PRESSURE) TO IMPROVE CROSS-COUNTRY MOBILITY IN DEEP, MUDDY, OR SANDY TERRAIN. THE GH N-45 A1 INCLUDES RELIABILITY MODIFICATIONS AND PERFORMANCE IMPROVEMENTS.

VARIANTS
GH N-45 A1 UPGRADE OF GH N-45.

OTHER AMMUNITION TYPES:
IT IS FULLY COMPATIBLE WITH NATO STANDARD 155-MM AMMUNITION.

RUSSIAN 122-MM SELF-PROPELLED HOWITZER 2S1



SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations:	122-mm 2S1 Gvozdika	Caliber, Type, Name:	122-mm, cannon, 2A31
Date of Introduction:	1974	Barrel Length (cal):	36
Proliferation:	At least 12 countries	Rate of Fire – Burst (rpm):	5
Description:		Rate of Fire – Normal (rpm):	4
Crew:	4	Rate of Fire – Sust (rpm):	1-2
Vehicle Platform (chassis):	MT-LBu	Loader Type:	Semi-automatic
Combat Weight (mt):	15.7	Breech Type:	Horizontal sliding wedge
Chassis Length Overall (m):	7.26	Muzzle Brake Type:	Double baffle
Height Overall (m):	2.72	Traverse: (deg)	360
Width Overall (m):	2.85	Elevation (°) (-/+):	-3/+70°
AUTOMOTIVE	**SPECIFICATIONS**	**AMMUNITION**	**SPECIFICATIONS**
Engine Type:	V-8, 300 hp, diesel	Caliber, Type, Name:	122-mm Frag-HE, OF-81
Cruising Range (km):	500	Range Minimum (m)	1,000
Max Road Speed (km/h):	60	Range Maximum (m)	15,300
Cross-Country (km/h):	30	Projectile Weight (kg):	21.76 (OF-56)
Max Swim:	4.5	Muzzle Velocity (m/s):	680
Fording Depths (m):	Amphibious	Fuze Type:	RGM-2 PD
Emplacement Time (min):	2		
Displacement Time (min):	1	Caliber, Type, Name:	122-mm HEAT-FS
Radio:	R-123M	Range Minimum (m)	0
PROTECTION	**SPECIFICATIONS**	Range Maximum (m)	1,000
Armor, Turret (mm):	20	Armor penetration (mm):	460 (@ 0° obliquity any range)
Armor Turret Top (mm):	10	Projectile Weight (kg):	21.58
Armor Hull (mm):	15	Muzzle Velocity (m/s):	INA
Self-Entrenching Blade:	NO	Fuze Type:	GPV-2 PIBD
NBC Protection System:	YES		
Smoke Equipment:	NO	Caliber, Type, Name:	122-mm Frag-HE Rocket Assisted
FIRE CONTROL	**SPECIFICATIONS**	Range Minimum (m)	INA
Indirect Fire:	PG-2 PANTEL	Range Maximum (m)	21,900
Direct Fire:	OP 5-37	Projectile Weight (kg):	21.76 (3OF-56)
Collimator:	K-1	Muzzle Velocity (m/s):	INA

Fire Control Computer:	**None**	**Fuze Type:**	**PD**
Gun Display Unit:	**None**		

NOTES

THE 2S1'S AMMUNITION STOWAGE RACK IS NOT MECHANIZED. THE 2S1 IS MANUALLY LOADED WITH A SEMIAUTOMATIC RAMMING CAPABILITY. THE FOUR-MAN CREW CONSISTS OF THE COMMANDER, DRIVER, GUNNER, AND LOADER.

VARIANTS

2S1M: ADDS AN AMPHIBIOUS KIT TO INCREASE AMPHIBIOUS CAPABILITY

OTHER AMMUNITION TYPES:

INCLUDES SMOKE/INCENDIARY, CHEMICAL, FLECHETTE, EXPENDABLE JAMMER, SEMI-ACTIVE LASER-GUIDED KITOLOV-2M FRAG-HE, AND FRAG-HE EXTENDED RANGE FULL-BORE. THE CANNON IS BALLISTICALLY MATCHED TO THE CANNON ON THE D-30 TOWED HOWITZER. THUS IT CAN GENERALLY FIRE THE SAME AMMUNITION TO THE SAME RANGE.

RUSSIAN 152-MM SELF-PROPELLED HOWITZER 2S3M, 2S3M1, 2S3M2



SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations:	152-mm 2S3M Akatsiya	Caliber, Type, Name:	152-mm, 2A33M
Date of Introduction:	1973,1975:2S3M, 1987:2S3M1	Barrel Length (cal):	28
Proliferation:	At least 8 countries	Rate of Fire – Burst (rpm):	4
Description:		Rate of Fire – Normal (rpm):	3
Crew:	4	Rate of Fire – Sust (rpm):	1
Vehicle Platform (chassis):	Modified SA-4 Ganef	Loader Type:	Semi-automated
Combat Weight (mt):	27.5	Breech Type:	Vertical sliding wedge
Chassis Length Overall (m):	7.75	Muzzle Brake Type:	Double baffle
Height Overall (m):	3.13	Traverse: (deg)	360
Width Overall (m):	3.21	Elevation (°) (-/+):	-4/+60°
AUTOMOTIVE	**SPECIFICATIONS**	**AMMUNITION**	**SPECIFICATIONS**
Engine Type:	V-12, 520 hp V-59, multi fuel	Caliber, Type, Name:	152-mm Frag-HE, OF32
Cruising Range (km):	450	Range Minimum (m)	4,600
Max Road Speed (km/h):	60	Range Maximum (m)	17,400
Cross-Country (km/h):	25	Projectile Weight (kg):	43.56 (OF25)
Max Swim:	N/A	Muzzle Velocity (m/s):	655
Fording Depths (m):	1.00	Fuze Type:	V-90 PD
Emplacement Time (min):	3		
Displacement Time (min):	3	Caliber, Type, Name:	152-mm Frag-HE OF-96
Radio:	R-123M	Range Minimum (m)	INA
PROTECTION	**SPECIFICATIONS**	Range Maximum (m)	24,400
Armor, Turret (mm):	20	Projectile Weight (kg):	43.56 (OF-64)
Armor Turret Top (mm):	10	Muzzle Velocity (m/s):	INA
Armor Hull (mm):	INA	Fuze Type:	PD
Self-Entrenching Blade:	Yes		
NBC Protection System:	Yes		
Smoke Equipment:	No		
FIRE CONTROL	**SPECIFICATIONS**		
Indirect Fire:	PG-4 PANTEL		
Direct Fire:	OP 5-38		
Collimator:	K-1		
Fire Control Computer:	None		
Gun Display Unit:	None		

NOTES

THE 2S3M TURRET HAS THE CANNON, FIRE-CONTROL EQUIPMENT, AMMUNITION STORAGE SPACE, AND WORK POSITIONS FOR COMMANDER, GUNNER, AND LOADER.

VARIANTS

2S3M1: UPGRADE BEGUN IN 1987 WITH A NEW RG-4 SIGHT, 1V116 INTERVENE, AND A MONITOR WHICH CAN RECEIVE FIRE CALCULATIONS DIRECTLY FROM THE ACRV OR TRANSMIT SIGHT DATA BACK TO ACRV FROM THE SIGHT. RUSSIAN 2S3MS WERE UPGRADED TO 2S3M1 DURING OVERHAULS.

2S3M2: AFTER 2000 AN M1 UPGRADE ENABLES A NEW 39-CAL BARREL TO USE 2S19 ROUNDS (E.G., OF-61 HE-BB WITH A RANGE OF 25.1 KM). ALSO INCLUDED IS GPS-BASED NAV, AUTOMATED BATTLEFIELD INFORMATION, AND FCS. A NEW VERSION INCLUDES RADAR REFLECTIVE/IR-ABSORBENT PAINT. IT IS FIELDED IN 5 RUSSIAN UNITS, CONTINUES FIELDING IN RUSSIAN FORCES, AND WILL BE FITTED ON 2S3M1S DURING OVERHAULS.

2S3M3: OPTIONAL UPGRADE WITH RUSSIAN-MADE M-385 155-MM 39-CAL LENGTH BARREL, COMPUTERIZED GPS NAV AND FCS. RANGE IS 30 KM

OTHER AMMUNITION TYPES:

DPICM, DPICM-BB, INCENDIARY, CHEMICAL, FLECHETTE, SEMI-ACTIVE LASER HOMING, AND HEAT. THE CANNON IS BALLISTICALLY MATCHED TO THE D-20, AND CAN GENERALLY FIRE THE SAME AMMUNITION TO THE SAME RANGE.

RUSSIAN 152-MM SELF-PROPELLED GUN 2S5 AND 2S5M



SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations:	152-mm 2S5 Giatsint-S	Caliber, Type, Name:	152-mm, cannon, 2A37
Date of Introduction:	1981	Barrel Length (cal):	52
Proliferation:	At least 4 countries	Rate of Fire – Burst (rpm):	6
Description:		Rate of Fire – Normal (rpm):	5
Crew:	5	Rate of Fire – Sust (rpm):	1-2
Vehicle Platform (chassis):	Modified SA-4 Ganef	Loader Type:	Semi-automatic
Combat Weight (mt):	28.2	Breech Type:	Horizontal sliding wedge
Chassis Length Overall (m):	8.33	Muzzle Brake Type:	Multi baffle
Height Overall (m):	2.76	Traverse: (deg)	15 left and right, 30 total
Width Overall (m):	3.25	Elevation (°) (-/+):	-2/+57°
AUTOMOTIVE	**SPECIFICATIONS**	**AMMUNITION**	**SPECIFICATIONS**
Engine Type:	V-12, 520 hp V-59, multi fuel	Caliber, Type, Name:	152-mm Frag-HE, OF39
Cruising Range (km):	500	Range Minimum (m)	9,100
Max Road Speed (km/h):	63	Range Maximum (m)	28,400
Cross-Country (km/h):	25	Projectile Weight (kg):	43.51 (OF29)
Max Swim:	4.5	Muzzle Velocity (m/s):	945
Fording Depths (m):	1.05	Fuze Type:	V-429 PD
Emplacement Time (min):	2		
Displacement Time (min):	1	Caliber, Type, Name:	152-mm, HEAT, BP-540
Radio:	R-123M	Range Minimum (m)	0
PROTECTION	**SPECIFICATIONS**	Range Maximum (m)	1000
Armor, Turret (mm):	INA	Armor penetration (mm):	INA
Armor Turret Top (mm):	15	Projectile Weight (kg):	27.00
Armor Hull (mm):	15	Muzzle Velocity (m/s):	655
Self-Entrenching Blade:	Yes	Fuze Type:	GPV
NBC Protection System:	Yes		
Smoke Equipment:	No	Caliber, Type, Name:	152-mm Frag-HE OF-86
FIRE CONTROL	**SPECIFICATIONS**	Range Minimum (m)	INA
Indirect Fire:	PG-1M Panoramic Telescope	Range Maximum (m)	30,500
Direct Fire:	D-726	Projectile Weight (kg):	43.80 (OF-59)
Collimator:	K-1	Muzzle Velocity (m/s):	945
Fire Control Computer:	None	Fuze Type:	V-429 PD
Gun Display Unit:	None		

NOTES

THE 2S5 IS MORE POWERFUL, HAS A LONGER RANGE AND A HIGHER RATE OF FIRE THAN THE 2S3. HOWEVER, THE 2S5 HAS A LIMITED MAIN ARMAMENT TRAVERSE AND A NARROWER ELEVATION RANGE THAN THE 2S3.

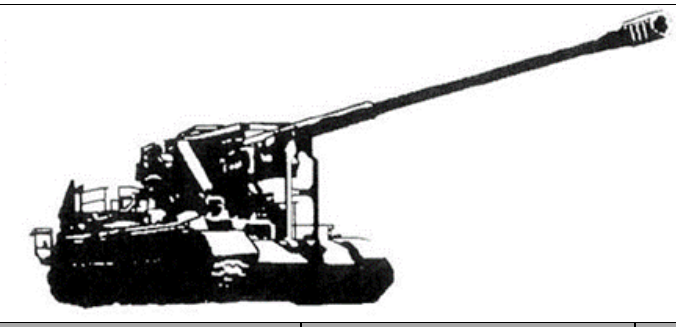
VARIANTS

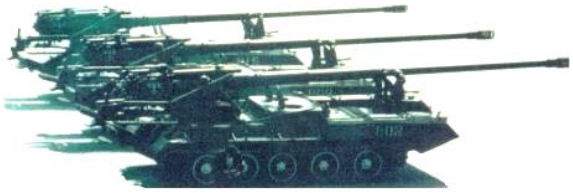
2S5M: UPGRADE VERSION WITH MEKHANIZATOR-M GPS-BASED NAV AND COMPUTER FCS. MODERNIZATION ALSO PERMITS NEW 152-MM ROUNDS (E.G., OF-60 HE-RA TO 37 KM). ALSO INCLUDED IS RA REFLECTIVE/ IR ABSORBENT PAINT. UPGRADES ARE MADE DURING OVERHAULS.

OTHER AMMUNITION TYPES:

DPICM, DPICM-BB, HE-RA (33 KM) INCENDIARY, CHEMICAL, FLECHETTE, SEMI-ACTIVE LASER HOMING FRAG-HE. THE CANNON IS BALLISTICALLY MATCHED TO THE CANNON ON THE 2A36 TOWED GUN. THUS IT CAN GENERALLY FIRE THE SAME AMMUNITION TO THE SAME RANGE.

NORTH KOREAN 170-MM SELF-PROPELLED GUN M1978 AND M1989 (KOKSAN GUN)





SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations:	M1978 and M1989	Caliber, Type, Name:	170-mm
Date of Introduction:	1978	Barrel Length (cal):	INA
Proliferation:	At least 3 countries	Rate of Fire – Burst (rpm):	1
Description:	Type 59 tank	Rate of Fire – Normal (rpm):	INA
Crew:	2	Rate of Fire – Sust (rpm):	INA
Vehicle Platform (chassis):		Loader Type:	Manual
Combat Weight (mt):	40.0	Breech Type:	Screw type
Chassis Length Overall (m):	14.90	Muzzle Brake Type:	Multi baffle
Height Overall (m):	3.10	Traverse: (deg)	5-10 left and right, 10-20 total
Width Overall (m):	3.27	Elevation (°) (-/+):	INA
AUTOMOTIVE	**SPECIFICATIONS**	**AMMUNITION**	**SPECIFICATIONS**
Engine Type:	V-12, 520 hp V-59, multi fuel	Caliber, Type, Name:	170-mm Frag-HE
Cruising Range (km):	300	Range Minimum (m)	INA
Max Road Speed (km/h):	40	Range Maximum (m)	40,000
Cross-Country (km/h):	20	Projectile Weight (kg):	INA
Max Swim:	INA	Muzzle Velocity (m/s):	INA
Fording Depths (m):	INA	Fuze Type:	INA
Emplacement Time (min):	<20		
Displacement Time (min):	<10	Caliber, Type, Name:	170-mm Frag-HE-RA (rocket asst)
Radio:	R-123M	Range Minimum (m)	INA
PROTECTION	**SPECIFICATIONS**	Range Maximum (m)	53,000
Armor, Turret (mm):	None	Projectile Weight (kg):	INA
Armor Turret Top (mm):	50	Muzzle Velocity (m/s):	INA
Armor Hull (mm):	79-97	Fuze Type:	INA
Self-Entrenching Blade:	No		
NBC Protection System:	N/A		
Smoke Equipment:	N/A		
FIRE CONTROL	**SPECIFICATIONS**		
Indirect Fire:	Range drum		
Direct Fire:	NA		
Collimator:	K-1 type		
Fire Control Computer:	None		
Gun Display Unit:	None		

NOTES

MANY OF THESE WEAPONS GENERALLY ARE KEPT IN UNDERGROUND HARDENED ARTILLERY SITES (HARTS), AND MOVED TO NEARBY PREPARED FIRING POSITIONS. THEY MAY THEN RETURN TO THE HARTS OR TO ALTERNATE POSITIONS FOR SUBSEQUENT FIRE MISSIONS.

VARIANTS

M1989: THE IMPROVED KOKSAN GUN USES A T-62 TANK CHASSIS. THE ONBOARD LOAD IS 12 ROUNDS, BUT IS SUPPLEMENTED BY THE SUPPLY VEHICLE.

OTHER AMMUNITION TYPES:
THERE ARE UNCONFIRMED REPORTS OF CHEMICAL ROUNDS AND ICM SUBMUNITION ROUNDS.

RUSSIAN 152-MM SELF-PROPELLED HOWITZER 2S19M1, AND 155-MM 2S19M1-155



SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations:	152-mm 2S19 Msta-S	Caliber, Type, Name:	152-mm, cannon, 2A64
Date of Introduction:	1989	Barrel Length (cal):	48
Proliferation:	At least 7 countries	Rate of Fire – Burst (rpm):	8
Description:		Rate of Fire – Normal (rpm):	6
Crew:	5	Rate of Fire – Sust (rpm):	2
Vehicle Platform (chassis):	Modified T-72	Loader Type:	Automated
Combat Weight (mt):	42	Breech Type:	Vertical sliding wedge
Chassis Length Overall (m):	11.91	Muzzle Brake Type:	Double baffle
Height Overall (m):	2.98	Traverse: (deg)	360 left, right, and total
Width Overall (m):	3.58	Elevation (°) (-/+):	-4/+68°
AUTOMOTIVE	**SPECIFICATIONS**	**AMMUNITION**	**SPECIFICATIONS**
Engine Type:	840-hp V84-A diesel	Caliber, Type, Name:	152-mm Frag-HE, OF-72
Cruising Range (km):	500	Range Minimum (m)	6500
Max Road Speed (km/h):	60	Range Maximum (m)	24,700
Cross-Country (km/h):	25	Projectile Weight (kg):	43.56 (OF-45)
Max Swim:	N/A	Muzzle Velocity (m/s):	864
Fording Depths (m):	1.5	Fuze Type:	RGM-2 PD
Emplacement Time (min):	1-2		
Displacement Time (min):	1-2	Caliber, Type, Name:	152-mm Frag-HEAT, BP-540
Radio:	R-173M	Range Minimum (m)	0
PROTECTION	**SPECIFICATIONS**	Range Maximum (m)	1,000
Armor, Turret (mm):	15	Armor penetration (mm):	INA
Armor Turret Top (mm):	15	Projectile Weight (kg):	27.00
Armor Hull (mm):	15	Muzzle Velocity (m/s):	655
Self-Entrenching Blade:	Yes	Fuze Type:	GPV-3 PD
NBC Protection System:	Yes		
Smoke Equipment:	6X Type 902 smoke launchers	Caliber, Type, Name:	152-mm Frag-HE BB, OF-91
FIRE CONTROL	**SPECIFICATIONS**	Range Minimum (m)	6710
Indirect Fire:	1P22 Panoramic Telescope	Range Maximum (m)	29,000
Direct Fire:	1P23	Projectile Weight (kg):	42.86 (OF-61)
Collimator:	K-1	Muzzle Velocity (m/s):	828
Fire Control Computer:	None	Fuze Type:	KZ-88 PD
Gun Display Unit:	None		

NOTES

THE 2S19'S GUN CREW CAN LOAD THE GUN AT ANY ANGLE OF ELEVATION. THE 2S19 CAN ALSO PRODUCE A SMOKESCREEN BY INJECTING DIESEL FUEL INTO THE EXHAUST OUTLET. THE 21-HP GAS TURBINE AP-18D AUXILIARY POWER UNIT PROVIDES POWER FOR TURRET OPERATIONS WHEN THE VEHICLE ENGINE IS SHUT DOWN.

THE 2S19 CAN DISPLACE QUICKLY EVEN WITHOUT A BARREL LOCK IMMEDIATELY AFTER COMPLETING A FIRE MISSION. AFTER SPADES ARE LIFTED AND AREA CLEARED, THE VEHICLE CAN DISPLACE 200-300 M AWAY, WHERE THE BARREL IS THEN LOCKED. REMOTE-OPERATED BARREL/TRAVEL LOCKS ARE ESPECIALLY USEFUL FOR RAPID EMPLACEMENT, AND TO EMPLACE/DISPLACE FOR SHORT FIRE MISSIONS FROM THE MOVE, WITHOUT NEED FOR FULLY OCCUPYING A BATTERY FIRING POSITION.

VARIANTS

2S19M1: UPGRADE VERSION WITH GPS NAVIGATION, AUTOMATED GUN LAYING, COMMS AND INFORMATION SYSTEM, ASUNO AUTOMATED FIRE MISSION DATA CALCULATION, AUTOMATIC GUN LAYING, AND AUTOMATED LOADING SYSTEM. ALTHOUGH THE HOWITZERS COULD OPERATE AUTONOMOUSLY, RELYING ON ACRV AUTOMATED FIRE MISSION LINKS, THEY ARE MORE LIKELY TO OPERATE IN SPLIT BATTERIES (3 OR 4-VEHICLE PLATOON FORMATIONS), FOR RAPID MOVEMENT, NO DISCERNIBLE FORMATIONS AND SHORT LETHAL PRECISION STRIKES. ABOUT 150 SYSTEMS CALLED MSTA-SM IS FIELDED IN RUSSIAN UNITS. OTHER UPGRADES, NOTED FOR THE 155 VERSION, SUCH AS NEW PAINT, POWERED TRAVEL LOCKS AND SPADES, ARE BEING FITTED TO THE 2S19M1.

2S19M1-155: IT HAS UPGRADES NOTED FOR THE M1 VARIANT (E.G., ASUNO-155 FCS), PLUS A 52-CAL LENGTH 155-MM GUN. OTHER FEATURES INCLUDE MOTORIZED SPADES AND TRAVEL LOCKS, ENABLING THE CREW TO STAY INSIDE THE VEHICLE DURING EMPLACE AND DISPLACE. AS A RESULT, EMPLACE TIME IS <2 MINUTES, AND DISPLACE IS < 1 MIN (EST). THE VEHICLE DESIGN WAS MODIFIED FOR REDUCED VISUAL, IR, AND RADAR SIGNATURES. FIRING RANGE IS 33.8 KM UNASSISTED, AND 41 ASSISTED (45 WITH FOREIGN ROUNDS). OTHER NOMENCLATURES USED FOR THIS SYSTEM INCLUDE 2S30 AND ISET

OTHER 155-MM AMMUNITION TYPES:

ALL STANDARD 155-MM ARTILLERY ROUNDS, INCLUDING DPICM, DPICM-BB, HE-RA, INCENDIARY, CHEMICAL, FLECHETTE. WITH AN L52-CAL LENGTH GUN, AMMUNITION AND RANGE CAPABILITIES ARE SIMILAR TO OTHER 155-MM WEAPONS SUCH AS CAESAR.

CHINESE 152-MM SELF-PROPELLED HOWITZER TYPE 83



SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations:	None	Caliber, Type, Name:	152-mm, Type 66 cannon
Date of Introduction:	1984	Barrel Length (cal):	29
Proliferation:	At least 1 country	Rate of Fire – Burst (rpm):	4
Description:		Rate of Fire – Normal (rpm):	INA
Crew:	5	Rate of Fire – Sust (rpm):	INA
Vehicle Platform (chassis):	Type 83	Loader Type:	Semiautomatic
Combat Weight (mt):	30.0	Breech Type:	Vertical sliding wedge
Chassis Length Overall (m):	7.33	Muzzle Brake Type:	Double baffle
Height Overall (m):	3.50	Traverse: (deg)	360 left, right, and total
Width Overall (m):	3.24	Elevation (°) (-/+):	-5/+65°
AUTOMOTIVE	**SPECIFICATIONS**	**AMMUNITION**	**SPECIFICATIONS**
Engine Type:	V-12, Type 12150L, 520-hp liquid-cooled diesel	Caliber, Type, Name:	152-mm Frag-HE, Type 66
Cruising Range (km):	450	Range Minimum (m)	9,600
Max Road Speed (km/h):	55	Range Maximum (m)	17,230
Cross-Country (km/h):	35	Projectile Weight (kg):	43.6
Max Swim:	N/A	Muzzle Velocity (m/s):	655
Fording Depths (m):	1.3	Fuze Type:	Liu-4 PD and Proximity
Emplacement Time (min):	1		
Displacement Time (min):	1	Caliber, Type, Name:	152-mm Frag-HE RAP
Radio:	Type 889D	Range Minimum (m)	INA
PROTECTION	**SPECIFICATIONS**	Range Maximum (m)	21,880
Armor, Turret (mm):	INA	Projectile Weight (kg):	INA
Armor Turret Top (mm):	INA	Muzzle Velocity (m/s):	INA
Armor Hull (mm):	INA	Fuze Type:	PD
Self-Entrenching Blade:	No		
NBC Protection System:	No	Caliber, Type, Name:	152-mm Frag-HE Type 83
Smoke Equipment:	No	Range Minimum (m)	INA
FIRE CONTROL	**SPECIFICATIONS**	Range Maximum (m)	30,370
Indirect Fire:	Panoramic	Projectile Weight (kg):	46.95
Direct Fire:	INA	Muzzle Velocity (m/s):	955
Collimator:	INA	Fuze Type:	Liu-4 PD and Proximity
Fire Control Computer:	None		
Gun Display Unit:	None		

NOTES

THE TYPE 83 152-MM SP HOWITZER IS CAPABLE OF FIRING ALL STANDARD TYPES OF 152-MM ROUNDS. THE MAIN ARMAMENT CANNON IS BASED ON THE CHINESE 152-MM TOWED TYPE 66 MOUNTED ON A VEHICLE HULL SIMILAR TO THE RUSSIAN 152-MM SP GUN-HOWITZER 2S3. THE CREW COMMUNICATES WITH EACH OTHER USING THE TYPE 803 INTERCOM SYSTEM. THERE ARE REPORTS OF THE TYPE 83 BEING EQUIPPED WITH AN ANTI-TANK ROCKET LAUNCHER REFERRED TO AS THE TYPE 40. HOWEVER, IT IS SUSPECTED THAT THE ROCKET LAUNCHER IS REALLY THE 40-MM ANTI-TANK ROCKET LAUNCHER TYPE 69-1 (AN UPGRADED VARIANT OF THE RUSSIAN RPG-7).

VARIANTS

THIS SYSTEM IS BASED ON THE TYPE 66, CHINESE COPY OF THE D-20 HOWITZER

425-MM MINECLEARING ROCKET LAUNCHER TYPE 462: 2-ROUND ROCKET LAUNCHER FOR USE IN CLEARING MINEFIELDS.

120-MM SP ANTI-TANK GUN: THE AT GUN IS FITTED WITH A 120-MM SMOOTHBORE MOUNTED INSIDE A TURRET ON A TYPE 83 GUN-HOWITZER CHASSIS

OTHER AMMUNITION TYPES: HE-I, ILLUMINATION, SMOKE

FRENCH 155-MM SELF-PROPELLED HOWITZER AU-F1 AND AU-F1T



SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations:	155-mm GCT (Export Version)	Caliber, Type, Name:	155-mm cannon
Date of Introduction:	1979	Barrel Length (cal):	40
Proliferation:	At least 4 countries	Rate of Fire – Burst (rpm):	8
Description:		Rate of Fire – Normal (rpm):	6
Crew:	4	Rate of Fire – Sust (rpm):	2-3 (manual loading)
Vehicle Platform (chassis):	Modified AMX-30	Loader Type:	Autoloader
Combat Weight (mt):	42.0	Breech Type:	Vertical sliding wedge
Chassis Length Overall (m):	10.25	Muzzle Brake Type:	Double baffle
Height Overall (m):	3.25	Traverse: (deg)	360 left, right, and total
Width Overall (m):	3.15	Elevation (°) (-/+):	-4/+66°
AUTOMOTIVE	SPECIFICATIONS	Caliber, Type, Name:	.50 (12.7x99) HMG, M2HB
Engine Type:	Hispano-Suiza HS110, 720-hp water-cooled multi-fuel	Mount Type:	Cupola AA mount
Cruising Range (km):	450	Direct Fire Range (m):	INA
Max Road Speed (km/h):	60	Max Effective Range Day:	1000
Cross-Country (km/h):	40	Max Effective Range Night:	INA
Max Swim:	N/A	Fire on Move:	Yes
Fording Depths (m):	2.10	Rate of Fire (rpm):	450-=550 (cyclic)
Emplacement Time (min):	1-2	AMMUNITION	SPECIFICATIONS
Displacement Time (min):	1-2	Caliber, Type, Name:	155-mm Frag-HE, OE-155-56/69
Radio:	TRC 559 (VHF-FM)	Range Minimum (m)	9,600
PROTECTION	SPECIFICATIONS	Range Maximum (m)	23,000
Armor, Turret (mm):	See NOTES	Projectile Weight (kg):	43.75
Armor Turret Top (mm):	See NOTES	Muzzle Velocity (m/s):	810
Armor Hull (mm):	See NOTES	Fuze Type:	PD
Self-Entrenching Blade:	No		
NBC Protection System:	Yes	Caliber, Type, Name:	155-mm Frag-HE RAP H3
Smoke Equipment:	4 grenade launchers	Range Minimum (m)	INA
FIRE CONTROL	SPECIFICATIONS	Range Maximum (m)	31,500
Indirect Fire:	M 589 Optical Goniometer	Projectile Weight (kg):	INA
Direct Fire:	INA	Muzzle Velocity (m/s):	830
Collimator:	INA	Fuze Type:	PD
Fire Control Computer:	None		
Gun Display Unit:	ATILA fire direction system		

NOTES

A FOUR-MAN GUN CREW CAN RELOAD THE AU-F1 IN 15 MINUTES. A TWO-MAN GUN CREW CAN RELOAD THE AU-F1 IN 20 MINUTES.

THE AU-F1'S ARMOR PROVIDES CREW PROTECTION AGAINST ARTILLERY SHRAPNEL AND SMALL ARMS FIRE.
VARIANTS
AU-F1T: UPGRADE OF AU-F1. THE AU-F1T IS FITTED WITH THE SAGEM CITA 20 INERTIAL NAVIGATION SYSTEM AS WELL AS A 20-24 HP GAS TURBINE AUXILIARY POWER UNIT (APU).

OTHER AMMUNITION TYPES: DPICM, ILLUMINATION, SMOKE

FRENCH 155-MM TRUCK-MOUNTED HOWITZER CAESAR





SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations:	155-mm GCT (Export)	Caliber, Type, Name:	155-mm gun-howitzer cannon.
Date of Introduction:	2007	Barrel Length (cal):	52
Proliferation:	At least 3 countries	Rate of Fire – Burst (rpm):	3
Description:		Rate of Fire – Normal (rpm):	
Crew:	6 (with driver).	Rate of Fire – Sust (rpm):	6
Vehicle Platform (chassis):	SOFRAME UNIMOG	Loader Type:	Manual
Combat Weight (mt):	17.7	Breech Type:	Screw breech block
Chassis Length Overall (m):	10.00	Muzzle Brake Type:	Double baffle
Height Overall (m):	3.70	Traverse: (deg)	Left or right: 17. Total: 34
Width Overall (m):	2.55	Elevation (°) (-/+):	-4/+66°
AUTOMOTIVE	**SPECIFICATIONS**	**AMMUNITION**	**SPECIFICATIONS**
Engine Type:	366 LA 6 turbo diesel, 240 hp	Caliber, Type, Name:	155-mm Frag-HE Extended Range Full-Bore/ Base Bleed
Cruising Range (km):	600	Range Minimum (m)	4,500
Max Road Speed (km/h):	100	Range Maximum (m)	35,000 ERFB, 42,000 ERFB-BB
Cross-Country (km/h):	50	Projectile Weight (kg):	INA
Max Swim:	N/A	Muzzle Velocity (m/s):	895
Fording Depths (m):	1.2	Fuze Type:	PD
Emplacement Time (min):	<1		
Displacement Time (min):	0.5	Caliber, Type, Name:	155- Cargo (DPICM) Ogre, with 63 submunitions
Radio:	INA. Digital encrypted	Range Minimum (m)	4,4500
PROTECTION	**SPECIFICATIONS**	Range Maximum (m)	35.000
Armor, Cab (mm):	Defeats small arms and frag	Penetration (mm):	90 top
NBC Protection System:	No	Projectile Weight (kg):	INA
Smoke Equipment:	No	Muzzle Velocity (m/s):	897
FIRE CONTROL	**SPECIFICATIONS**	Fuze Type:	Proximity on submunitions
Fire Control Computer:	FAST-Hit computer FCS with Sagem Signal 30 and GPS navigation, aiming, and command net combined. In French forces, it will link to the Atlas artillery C2 net.		

NOTES

CURRENTLY FIELDED IN 3 COUNTRIES, OTHER COUNTRIES ARE TRIALING THE SYSTEM. THIS SYSTEM REPRESENTS A GROWING TREND IN DEVELOPMENT OF LESS EXPENSIVE TRUCK-BASED ARTILLERY SYSTEMS WHICH OFFER MOBILITY AND PORTABILITY OF LONGER-BARRELED GUN-HOWITZERS, WHILE EMPLOYING MODERN PORTABLE AND ROBUST FIRE CONTROL SYSTEMS.

SYSTEM CAN FIT ON A C-130 TRANSPORT. IT IS SIMILAR TO OTHER 155-MM TRUCK-MOUNTED SYSTEMS, E.G., THE SWEDISH FH77BW, CHINESE SH1, AND ISRAELI ATMOS 2000. OTHER TRUCK MOUNTED SYSTEMS INCLUDE 105-MM AND 122-MM SYSTEMS. SEVERAL SYSTEMS, E.G., DANA, ZUZANA, CHINESE SH2, KAZAK SEMSER, AND SERB NORA B-52 ACTUALLY MOUNT THE GUN ON THE BED AND FIRE MOUNTED. OTHER SYSTEMS LIKE GHN-45 HAVE THEIR OWN APU. OTHER AMMUNITION TYPES: ILLUMINATION, SMOKE, BONUS SENSOR-FUZED SUBMUNITION ROUND

SOUTH AFRICAN 155-MM SELF-PROPELLED HOWITZER G6



SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations:	155-mm Rhino	Caliber, Type, Name:	155-mm cannon
Date of Introduction:	1988	Barrel Length (cal):	45
Proliferation:	At least 3 countries	Rate of Fire – Burst (rpm):	3
Description:		Rate of Fire – Normal (rpm):	2
Crew:	6	Rate of Fire – Sust (rpm):	1
Vehicle Platform (chassis):	Purpose built 6X6 wheeled	Loader Type:	Semiautomatic
Combat Weight (mt):	48.0	Breech Type:	Interrupted screw
Chassis Length Overall (m):	10.4	Muzzle Brake Type:	Single baffle
Height Overall (m):	3.5	Traverse: (deg)	40 left, 40 right, and 80 total
Width Overall (m):	3.4	Elevation (°) (-/+):	-5/+75°
AUTOMOTIVE	SPECIFICATIONS	Caliber, Type, Name:	.50 (12.7x99) HMG, M2HB
Engine Type:	525-hp air-cooled diesel	Mount Type:	Cupola AA mount
Cruising Range (km):	700	Direct Fire Range (m):	INA
Max Road Speed (km/h):	85	Max Effective Range Day:	1000
Cross-Country (km/h):	30	Max Effective Range Night:	INA
Max Swim:	N/A	Fire on Move:	Yes
Fording Depths (m):	1	Rate of Fire (rpm):	450-550 (cyclic)
Emplacement Time (min):	1	AMMUNITION	SPECIFICATIONS
Displacement Time (min):	1	Caliber, Type, Name:	155-mm Frag-HE, M1 HE
Radio:	INA	Range Minimum (m)	3,000
PROTECTION	SPECIFICATIONS	Range Maximum (m)	30,000
Armor, Turret (mm):	See NOTES	Projectile Weight (kg):	8.7
Armor Turret Top (mm):	See NOTES	Muzzle Velocity (m/s):	897
Armor Hull (mm):	See NOTES	Fuze Type:	PD M841
Self-Entrenching Blade:	No		
NBC Protection System:	Yes	Caliber, Type, Name:	155-mm Frag-HE BB, M1 HE
Smoke Equipment:	8X 81-mm grenade launchers	Range Minimum (m)	INA
FIRE CONTROL	SPECIFICATIONS	Range Maximum (m)	39,000
Indirect Fire:	Digital Panoramic Telescope	Projectile Weight (kg):	8.7
Direct Fire:	Trunion mounted telescopic	Muzzle Velocity (m/s):	895
Collimator:	INA	Fuze Type:	PD M841
Fire Control Computer:	None		
Gun Display Unit:	None		

NOTES

THE G6 IS A THREE-AXLE, SIX-WHEELED, HEAVILY ARMORED SYSTEM MOUNTING A MODIFIED VERSION OF THE G5 CANNON. THE G6 IS FULLY COMPATIBLE WITH NATO STANDARD 155-MM AMMUNITION AND HAS A DIRECT FIRE RANGE OF 3000 METERS (USING A FRAG-HE ROUND). THE RIGID CHASSIS IS ACTUALLY DIVIDED INTO TWO PARTS, A DRIVER'S/ENGINE COMPARTMENT AND A CREW COMPARTMENT. IN ORDER TO DISTRIBUTE ITS WEIGHT AND TO

MAINTAIN MOBILITY OVER SAND AND SOFT TERRAIN, THE G6 EMPLOYS LARGE 21X25 RUN-FLAT TIRES. THE DRIVER CONTROLS A CENTRAL TIRE-INFLATION SYSTEM TO VARY THE GROUND PRESSURE. THE SYSTEM CAN ALSO BE USED TO MAINTAIN SOME DEGREE OF TIRE PRESSURE IN CASE OF AIR LEAKAGE FROM SMALL PUNCTURES. THE G6 IS EQUIPPED WITH AN ELECTRONICALLY CONTROLLED HYDRAULIC FLICK RAMMER THAT PROVIDES AN INITIAL RATE OF FIRE OF 3 ROUNDS PER MINUTE.

THE VEHICLE HULL AND TURRET PROVIDE PROTECTION AGAINST 7.62-MM SMALL ARMS FIRE AND ARTILLERY SHRAPNEL. THE FRONTAL 60° ARC PROVIDES PROTECTION AGAINST 20-MM TYPE AMMUNITION. ADDITIONALLY, THE SHAPE AND ARMOR THICKNESS OF THE CHASSIS HULL ALLOWS IT TO WITHSTAND AT LEAST THREE MINE DETONATIONS (AGAINST TM46 ANTITANK LANDMINE OR EQUIVALENT) BEFORE BEING IMMOBILIZED. THE SEPARATION OF THE DRIVER/ENGINE COMPARTMENT FROM THE CREW COMPARTMENT ALSO FACILITATES SURVIVAL AGAINST MINES. THE CONNECTION BETWEEN THE TWO IS PERFORATED WITH BLOWOUT HOLES TO DIRECT THE FORCE OF THE BLAST UPWARDS, AWAY FROM ANY PERSONNEL COMPARTMENTS. THE SEPARATION ALSO ALLOWS THE DRIVER TO BE BEYOND THE DETONATION POINT BEFORE THE MINE IS ACTIVATED. THE DRIVER ALSO HAS BULLET-RESISTANT GLASS WINDOWS THAT CAN BE FURTHER PROTECTED BY ARMORED SHUTTERS, ALTHOUGH IT LIMITS HIM TO THE USE OF A PERISCOPIC VIEWING PORT. THE VEHICLE COMMANDER HAS LIMITED STEERING AND BRAKING CAPABILITY IF THE DRIVER BECOMES A CASUALTY. THE CREW COMPARTMENT HAS FOUR FIRING PORTS (TWO EACH SIDE) SO THE CREW CAN ENGAGE TARGETS WITHOUT EXPOSING THEMSELVES TO RETURN FIRE.

A 45-HP (34 KW) AUXILIARY POWER UNIT (APU) PROVIDES POWER FOR TURRET OPERATIONS, RECHARGING THE BATTERIES, AND THE DRIVER/CREW COMPARTMENT AIR CONDITIONING SYSTEM. A WIDE RANGE OF OPTIONAL SUBSYSTEMS IS AVAILABLE TO INCREASE THE EFFICIENCY OF THE G6 AND ITS CREW. THEY INCLUDE THE FOLLOWING:

- INERTIAL NAVIGATION AND LAYING OR BACK-UP LAYING SYSTEMS
- NIGHT VISION EQUIPMENT
- BARREL COOLING AND THERMAL WARNING SYSTEMS
- FIRE CONTROL COMPUTER INTERFACE
- MUZZLE VELOCITY ANALYZER
- EXPLOSION CONTROL FOR FUEL TANKS

COMMON AMMUNITION FOR SELECTED ARTILLERY

Artillery units, as with other combat and combat support units on the modern battlefield, will often have a mix of ammunition to support any missions required of them. Because the forces have accumulated ammunition for many years prior to a conflict, the ammunition mix may include older and newer ammunition. The mix may include ammunition designed for a specific artillery piece and rounds for use by various systems.

The OPFOR equipment spectrum, including artillery, permits scenario writers to organize forces realistically and flexibly, to reflect modern forces or older forces. Like equipment in other branches, artillery equipment can be categorized into capability tiers (see tables below and Chapter 15). It is generally expected that more modern capable systems are likely to have more modern and capable ammunition. Older systems may be part of a force updated to modern standards; or selected systems have been given "niche technology" updates to support those older forces. One good choice for an upgrade is improved ammunition for selected artillery systems.

The following tables illustrate rounds available to common artillery, with ***standard rounds*** available to systems listed in the Chapter 15 Tier Tables. A variety of other rounds are listed and available in the tables which follow them, for use in OPFOR training simulations.

122MM CANNON AMMUNITION

System	Ammunition	Range (km)	System	Ammunition	Range (km)
Tier 1/2	Frag-HE, OF-81	15.3	Tier 3/4	Frag-HE, OF-81	15.3
D-30, 2S1	Frag-HE-RA	21.9	D-30, 2S1	Frag-HE-RA	21.9
	Frag-HE-ERFB-HB	21.0		Frag-HE-ERFB-HB	21.0
Standard	HEAT, BK-6M	1.0	Standard	HEAT, BK-6M	1.0
	Flechette	15.3		Flechette	15.3
Special	Smoke/Incendiary (WP)	17.4	Special	Smoke/incendiary (WP)	17.4
	Illumination, S-462	15.3		Illumination, S-462	15.3
	Chem, various	15.3		Chem, various	15.3
	Scatter Mines	15.3		Scatter Mines	15.3
	Jammer round, various	15.3		Jammer round, various	15.3
ADHPM	LGP, Kitolov-2M	14.0	ADHPM	LGP, Kitolov-2M	14.0

LGP = Laser-Guided Projectile

HB = Hollow base (Base bleed-capable round without the BB unit)

ERFB = Extended-range full-bore

WP = White Phosphorus

152MM CANNON AMMUNITION

System	Ammunition	Range (km)	System	Ammunition	Range (km)
Tier 2	Frag-HE, OF-45	24.7	Tier 2	Frag-HE, OF-45	24.7
2A65	Frag-HE-BB, OF-61	29.0	2S19	Frag-HE-BB, OF-61	29.0
	DPICM, 3O23	21.0		DPICM, 3O23	21.0
Standard	DPICM-BB, EKK	28.2	Standard	DPICM-BB, EKK	28.2
	HEAT, BP-540	1.0		HEAT, BP-540	1.0
	Flechette	24.0		Flechette	24.0
Special	Concrete Piercing	24.0	Special	Concrete Piercing	24.0
	Smoke	24.0		Smoke	24.0
	Illumination	24.0		Illumination	24.0
	Chem	24.0		Chem	24.0
	Scatter Mines	24.0		Scatter Mines	24.0
	Jammer round, RB30	22.0		Jammer round, RB30	22.0
ADHPM	LGP, Krasnopol	20.0	ADHPM	LGP, Krasnopol	20.0
	Sensor-fuzed, MCS-E1	24.0		Sensor-fuzed, MCS-E1	24.0
Tier 3	Frag-HE, OF-29	28.2	Tier 3	Frag-HE, OF-25	17.4
2A36, 2S5	Frag-HE-BB, OF-59	30.5	2S3M	Frag-HE-BB, OF-22	20.5
	Frag-HE-RA, OF-60	37.0		Frag-HE-RA, OF-64	24.4
Standard	DPICM, 3O23	26.0		DPICM, 3O13	14.5
	DPICM-BB, EKK	28.2	Standard	DPICM-BB, EKK	20.5
	HEAT, BP-540	1.0		HEAT, BP-540	1.0
Special	Flechette	28.4		Flechette	17.2
	Concrete Piercing	28.4	Special	Concrete Piercing	17.2
	Smoke	28.4		Smoke	17.2
	Illumination	28.4		Illumination	17.2
	Chem	28.4		Chem	17.2
	Scatter Mines	28.4		Scatter Mines	17.2
ADHPM	Jammer round, RB30	22.0		Jammer round, RB30	17.2
	LGP, Krasnopol	20.0	ADHPM	LGP, Krasnopol	20.0
	Sensor-fuzed, MCS-E1	24.0		Sensor-fuzed, MCS-E1	17.2
Tier 4	Frag-HE, OF-25	17.4			

D-20	Frag-HE-BB, OF-22	20.5			
	Frag-HE-RA OF-64	24.4			
Standard	DPICM, 3O13	14.5			
	DPICM-BB, EKK	20.5			
	HEAT, BP-540	1.0			
	Flechette	17.2			
Special	Concrete Piercing	17.2			
	Smoke	17.2			
	Illumination	17.2			
	Chem	17.2			
	Scatter Mines	17.2			
ADHPM	LGP, Krasnopol	20.0			

LGP = Laser-Guided Projectile

155MM CANNON AMMUNITION

System	Ammunition	Range (km)	System	Ammunition	Range (km)
Tier 1/2	Frag-HE, ERFB	30.0	Tier 1/2	Frag-HE, LU 111 HB	23.3
G5, G6,	Frag-HE ERFB-BB,	40.0	AU-F1,	Frag-HE, LU 111 BB	28.0
GH N-45	Frag-HE Velocity		AU-F1T	Frag-HE-BB, OE 155 F1	30.4
Standard	Enhanced, VLAP	54.0	Standard	Frag-HE-RA, H3	31.5
	DPICM ERFB,	39.0		DPICM, OGRE	28.5
	DPICM ERFB-BB,	39.0		Frag-HE Direct-fire	2.0+
	Frag-HE Direct-fire	3.0			
Special	Illumination, -BB, Denel	39.0	Special	Illumination, OECL	21.2
	Smoke BE, ERFB-BB	39.0		Smoke-BB, LU 114	28.0
	Smoke	22.0		Scatterable mine, OMI	18.0
ADHPM	LGP, Krasnopol 155	22.0	ADHPM	LGP, Krasnopol 155	22.0
	Sensor-fuzed, Bonus	27.0		Sensor-fuzed, Bonus	27.0

LGP = Laser-Guided Projectile

HB=Hollow base (Base bleed-capable round without the BB unit)

ERFB=Extended-range full-bore

122MM ROCKET LAUNCHER AMMUNITION

System	Ammunition	Range (km)	System	Ammunition	Range (km)
Tiers 1/2	Frag-HE, 9M521	40.0	Tier 3	Frag-HE, 9M521	40.0
Prima	Frag-HE, 9M522	37.5	BM-21	Frag-HE, 9M522	37.5
MRL	(separating whd)		MRL	(separating whd)	
	DPICM, 9M218	30.0		Frag-HE, Type 90A	32.7
Standard	Frag-HE, 9M53F	20.5	Standard	Frag-HE, 9M22U	20.4
	(separating whd)			Frag-HE, 9M28F	15.0
Special	Smoke, 9M43	20.5		DPICM, 9M218	30.0
	Illumination	20.5	Special	Smoke, 9M43	20.5
	Chem	20.5		Illumination	20.5 est
	Scatter Mines, 9M28K	13.4		Chem	20.5
	Jammer round, 9M519	18.5		Scatter Mines, 9M28K	13.4
	LGP, Ugroza	32.0		Jammer round, 9M519	18.5
ADHPM	Sensor-fuzed, 9M217	33.0	ADHPM	LGP, Ugroza	32.0
				Sensor-fuzed, 9M217	33.0
Tiers 1-4					
9P132					
Single Lchr					
Standard	Frag-HE, 9M22M	10.8			
Special	Smoke	10.8			
	Illumination, 9M42	5.0			

LGP = Laser-Guided Projectile

120MM MORTAR AND COMBINATION GUN AMMUNITION

System	Ammunition	Range (km)	System	Ammunition	Range (km)
Tiers 1/2	Cannon Rounds			Mortar Projectiles	
2S9-1, 2S23	Frag-HE-RA (RAP)	12.8	2S9-1, 2S23	Frag-HE-RA (RAP)	9.0

Combo Gun	Frag-HE PD/Prox	8.8	Standard	Frag-HE PD/Prox	7.1
	DPICM	12.0	Special	Incendiary (WP)	6.0
Standard	HEAT	1.0		Smoke	5.9
	Flechette	1.0		Illum	5.9
ADHPM	LGP, Kitolov-2	9.0		Chem, est	5.9
	* **		ADHPM	THMP, Strix	8.0
				LGP, Gran	9.0
Tiers 1/2	Cannon Rounds			Mortar Projectiles	
2B16	Frag-HE-RA (RAP)	12.8	2B16	Frag-HE-RA (RAP)	9.0
Combo Gun	Frag-HE PD/Prox	8.8	Standard	Frag-HE PD/Prox	7.1
	DPICM	12.0	Special	Incendiary (WP)	6.0
Standard	HEAT	1.0		Smoke	5.9
	Flechette	1.0		Illum	5.9
ADHPM	LGP, Kitolov-2	9.0		Chem, est	5.9
	* **		ADHPM	THMP, Strix	8.0
				LGP, Gran	9.0
Tier 3	Rifled Mtr Projectiles			Mortar Projectiles	
MO-120-RT	Frag-HE-RA (RAP) PD/Prox	13.0	MO-120-RT	Frag-HE-RA (RAP)	9.0
Rifled Mortar			Standard	Frag-HE PD/Prox	7.1
Standard	Frag-HE PD/Prox	8.1	Special	Incendiary (WP)	6.0
	Frag-HE Anti-Armor (hvy frag),	8.1		Smoke	5.9
Special	Smoke			Illum	5.9
		8.1		Chem, est	5.9
			ADHPM	LGP, Gran	9.0
Tier 3	Mortar Projectiles		Tier 4	Mortar Projectiles	
2S12 Mtr	Frag-HE-RA (RAP)	9.0	M1943 Mtr	Frag-HE-RA (RAP)	7.2
Standard	Frag-HE PD/Prox	7.1	Standard	Frag-HE, OF-843B	5.7
Special	Incendiary (WP)	6.0	Special	Incendiary (WP)	5.7
	Smoke	5.9		Smoke	5.7
	Illum	5.9		Illum	5.7
	Chem, est	5.9		Chem, est	5.7
ADHPM	THMP, Strix	8.0	ADHPM	LGP, Gran	9.0
	LGP, Gran	9.0			

THMP=Terminally-Homing Mortar Projectiles

LGP = Laser-Guided Projectile

Mortar rounds are smoothbore if not stated as rifled.

*** Combo guns can also fire rifled mortar rounds for MO-120-RT.



OPFOR SPECIAL MUNITIONS CHART FOR TRAINING SIMULATION

WEAPON	SMOKE (km)	SCATTERABLE MINES (km)	CHEMICAL (km)
122-MM: 2S1 SP, D-30 TOWED HOWITZER	15.3	N/A	15.3
152-MM: 2S3M SP, D-20 TOWED HOWITZER	17.2	N/A	17.2
152-MM: 2S19 SP, 2A65 TOWED HOWITZER	24.0	N/A	24.0
152-MM: 2S5 SP, 2A36 TOWED GUN	28.4	N/A	28.4
122-MM: BM-21 MRL	20.5	13.4	20.5

REMARKS: Currently, Russia has developed and is testing 122-mm rockets with various warheads (Frag-HE, AT/AP mines, jammers, and sensor-fuzed munitions) achieving firing ranges between 32-35 kilometers.

Foreign Course Corrected Rocket Programs

NAME	COUNTRY	CALIBER (mm)	WEIGHT (kg)	LENGTH (mm)	WARHEAD TYPE	GUIDANCE SYSTEM	ACCURACY (CEP, m)	RANGE (km)	STATUS/ PROLIFERATION
9M55-series	Russia	300	~800	7,200	Varies - ICM, SFM, HE, thermobaric, scatterable mines	Inertial	150 @ max range (0.21% of range)	70	Fielded 2 countries
9M5xx-series	Russia	300	~800	7,200	Varies - ICM, DPICM, SFM, HE, thermobaric, scattererable mines	Inertial	171@ maximum range (.19% of range)	90	Production/ Exported 2 countries
AccuLAR	Israel/Romania	160	120	3,700	DPICM, SFM	RF Ground Track	90-135	45	Late development IOC 2003
MLRS-TCS	Israel	227	307	3,970	DPICM SFM	RF Ground Track	25	45	Fielded 1 country
Angel-100	China	300	~800	7,200	Varies - ICM, SFM, HE	Inertial	210 @ max range (0.21% of range)	100	Development IOC 2005-7
CORECT	Switzerland-Germany	227	308	3,940	DPICM, AT-4 mines	GPS+Inertial and magnetometer	50 (independent of range)	32	Late development IOC 2003-5
MARS-NAW	Germany	227	308	3,940	DPICM, SMArt-155	GPS+Inertial	50	65-70	Late development IOC 2003-2005
LT-2000 Mk45	Taiwan	227	308	3,940	DPICM	GPS+Inertial	50	75	Development IOC 2008
Diehl RM-70 Upgrade	Germany, France, Slovakia	122	77	3,220	DPICM, Multimode (HEAT, HE, Incendiary)	GPS+Inertial	50	36	Development IOC2008

Other countries with course corrected rocket development programs: Indonesia, South Africa, India, Ukraine, Brazil, Iraq.

Foreign Course Corrected Projectile Programs

NAME	COUNTRY	CALIBER (mm)	WEIGHT (kg)	LENGTH (mm)	WARHEAD TYPE	GUIDANCE SYSTEM	ACCURACY (CEP, m)	RANGE (km)	STATUS/ PROLIFERATION
TCM (Excaliber)	Sweden	155	48	970 Fuzed	Varies (DPICM, SFM, HE)	Inertial+GPS	10-30	60	Limited Production
Diehl GPS Geschoss	Germany	155	47	955	Varies (DPICM, SFM, HE)	Inertial+GPS	10	40	Development
Poleaxe	UK	155	54	1,650	DPICM, SFM	Inertial+GPS	50	80	Development
Pelican	France	155	50	1,350	DPICM, HE, SFM	Inertial+GPS	50-80	80	Development
BWB GPS Fin-stabilized	Germany	155	55	1,650	DPICM, SFM, HE	Inertial+GPS	20-50	100	Development
Ramjet Projectile	Holland-Sweden	155	55	1,500	DPICM, SFM	GPS+Inertial	20-50	80	Research IOC 2018
BROMSA	Sweden	105/155	Fuze	N/A	Any Projectile	GPS or MVV RF tracker	2-4X improvement over ballistic projectiles	25-30	Development
SAMPRASS	France	105/155	Fuze	N/A	Any Projectile	GPS	2-6X improvement over ballistic projectile	25-40	Development
STAR	UK	105/155	Fuze	N/A	Any Projectile	GPS	2-6X improvement over ballistic projectile	25-40	Development

Other countries with course corrected projectile development programs: Israel, South Africa, Ukraine, and others.

Advanced Artillery Munitions: Laser-Guided Projectiles

NAME	COUNTRY	CALIBER	WEIGHT (kg)	LENGTH (mm)	TYPE WARHEAD	GUIDANCE SYSTEM	TARGET DESIGNATION RANGE (km) [1]	RANGE (km) MIN	RANGE (km) MAX	STATUS / PROLIFERATION
BUSSARD	Germany	120-mm mortar	17	1,050	Tandem (precursor and main charge); 800+ mm RHA penetration	IR Focal plane array (3-5μ terminal homing), semi-active laser homing (SAL- 1.06μ)	3-5	.8	12	Developmental
Terminally Guided Mortar Bomb	Ukraine /Poland	120-mm mortar	18	1,200 (+)	HEAT; 550-mm RHA	SAL (1.06μ)	3-5	.5	7	Testing
Kitolov-2	Russia	120-mm combo gun	25	1,220	Frag-HE	SAL (1.06μ)	3-5	.5	9	Limited production/ 1 country
Smel'chak	Russia	240-mm mortar	134	1,635	Frag-HE	SAL (1.06μ)	3-5	3.6	9.2	Limited production/ 1 country
Gran	Russia	120-mm mortar	27	INA	Frag-HE	SAL (1.06u)	3-5	1.5	9.0	Marketed, production 1 country (poss)
Kitolov-2M (KM-3)	Russia	122-mm howitzer	27	1,225	Frag-HE	SAL (1.06μ)	3-5	.8	14	Limited production/ 2 countries
Krasnopol	Russia	152-mm howitzer	51	1,300	Frag-HE, 6.5 kg AL/RDX	Inertial (middle stage of flight) SAL (final stage of flight)	3-5	5	20	Full production/ 14 countries
Krasnopol-M (KM-2)	Russia	155-mm howitzer	43.0	955	Frag-HE, 6.2 kg AL/RDX	Inertial (middle stage of flight) SAL (final stage of flight)	3-5	4	17	Full production/ 2 countries
Santimeter-1	Russia	152-mm howitzer	49.5	1,195	Frag-HE, 6.5 kg AL/RDX	SAL (1.06μ)	3-5	3	18	Limited production/ 3 countries
Aurora	Russia	152-mm howitzer	47 (+)	955	Frag-HE, 12.0 kg AL/RDX	SAL (1.06μ)	3-5	5	25	Ready for production, waiting for export customer

Ugroza (2)	Russia	122-mm rocket	65.5 (est.)	3,037 (est.)	Tandem HEAT dual main charge; 600-mm penetration	SAL (1.06μ)	3-5	1	20-32	Limited production/ 2 countries
Copperhead	United States	155-mm cannon	62	1,370	HEAT	Inertial (middle stage of flight) SAL (final stage of flight)	3-5	4	16	Production complete/ 1 country

NOTES:

(1) The Target Designation Range column portrays an engagement of a tank size target moving at 10-15 km/h.

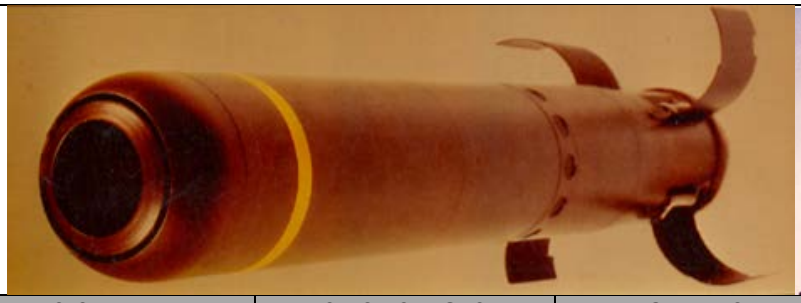
(2) The Ugroza's range is dependent upon the warhead being fitted on a rocket body containing either an older rocket motor (20 km) or new rocket motor (32 km).

Advanced Artillery Munitions: Sensor-Fuzed Munitions

NAME	COUNTRY	CALIBER DELIVERY SYSTEM	TARGETING SENSOR	SEARCH ALTITUDE	ARMOR PENETRATION	TYPE WARHEAD	RANGE (km)	STATUS/ PROLIFERATION
BONUS II	France/ Sweden	155-mm cannon	2-color IR sensor with laser altimeter	175	120-135-mm at 150 meter slant range (Est)	Tantalum EFP	27 (39-cal. cannon) 35 (52-cal. cannon)	Production
SMArt	Germany	155-mm cannon	94 Ghz MMW Sensor (Active and Passive), 3-5μ IR sensor	150	135-mm RHA penetration @ 150 meters	Tantalum liner, COMP-B fill with unique wave shaper	25	Production
Indian Sensor Fuzed Munition	India	120-mm mortar 155-mm cannon	MMW	100 (est)	50-70-mm RHA penetration @ 100 meters	Copper penetrator	7	Developmental
Israeli Top-Attack Sensing Submunition	Israel	227-mm rocket	Ka-Band (Active and Passive)	100 (est)	100-mm RHA penetration @ 100 meters	Copper penetrator	32	Developmental
Meteor	Poland	122-mm rocket	2 color IR sensor with laser diode altimeter	150	80-100-mm RHA penetration @ 100 meters	Copper penetrator	30	Developmental
Motiv-3M	Russia	300-mm rocket	2 color IR sensor	100 (est)	70-mm RHA penetration @ 150 meters and 30°	Copper penetrator, Ball slug	90	Full Production
Universal Submunition	Russia	120-mm mortar, 122-mm, 220-mm, and 300-mm rockets	W-band MMW Sensor (Active and Passive), 1-2μ and 8-14μ IR sensor	100 (est)	60-70-mm RHA penetration @ 100 meters and 30°	Copper penetrator, Ball slug	33 (122-mm) 35 (220-mm) 90 (300-mm)	Limited Production
MCS-E1	Russia	152-mm cannon	35 Ghz MMW (Active), 3-5μ IR sensor	100 (est)	90-mm RHA penetration	Copper penetrator,	24	Developmental

						Ball slug		
MCS-E2, 152-mm	Russia	152-mm cannon	W-band MMW Sensor (Active and Passive), 1-2μ and 8-14μ IR sensor	150 (est)	80-mm RHA penetration @ 125 meters and 30°	Copper penetrator, Ball slug	20	Developmental,
MCS-E2, 155-mm	Russia	155-mm cannon	W-band MMW Sensor (Active and Passive), 1-2μ and 8-14μ IR sensor	150 (est)	80-mm RHA penetration @ 125 meters and 30°	Copper penetrator, Ball slug	25	Developmental,
SADARM	US	155-mm cannon	35 Ghz MMW Sensor (Active and Passive), 8-14μ IR sensor	130 (est) 165 (est) P3I	135-mm RHA penetration @ 100 meters	INA	24	Limited Production

SWEDISH 120-MM TERMINAL-HOMING MORTAR PROJECTILE STRIX





SYSTEM	SPECIFICATIONS	GUIDANCE	SPECIFICATIONS
Alternative Designations:	Bofors (Producer)	Guidance System:	IR seeker, 12 thruster rockets
Date of Introduction:	1994	Acquisition Radius (m):	150
Proliferation:	At least 4 countries	LETHALITY MECHANISM	SPECIFICATIONS
Weight (kg):	17.60	Type:	Shaped-charge (HEAT)
Length Overall (m):	0.83	Fuze Type:	PD
Range (km):	1-4 with expulsion charge 1.7-8 with charge plus sustainer motor	Penetration:	600 (CE)
Crew:	1	Probability of Kill on Hit (%):	90
Loading Method:	Hand-load or auto-load	Number per kill, Moving:	4-6 (P-hit 20% est)
Equipment Required:	Notebook type computer	Number per kill, Stationary:	1-2 (P-hit 75% est)
LETHALITY MECHANISM	SPECIFICATIONS		
Type:	Shaped-charge (HEAT)		
Fuze Type:	PD		
Penetration:	600 (CE)		
Probability of Kill on Hit (%):	90		
Number per kill, Moving:	4-6 (P-hit 20% est)		
Number per kill, Stationary:	1-2 (P-hit 75% est)		

NOTES

EMPLOYMENT CONSIDERATIONS AFFECT FIELDING AND USE FOR TERMINAL-HOMING MUNITIONS, IN GENERAL, AND THIS PROJECTILE IN PARTICULAR. THMP ARE FAIRLY EXPENSIVE, AND SO MUST BE METED OUT FOR USE WHEN CONDITIONS ARE OPTIMIZED, AND WHEN THE TARGETS ARE OF HIGH PRIORITY. THE HIGH PRIORITY USUALLY MEANS WHEN THE TARGETS ARE A HIGH THREAT TO INTEGRITY OF THE FORCE. WHEN MORTARS/COMBINATION GUNS HAVE LASER TARGET DESIGNATORS (LTDS) AVAILABLE WITH A FIELD OF VIEW OF THE TARGET, LGP ARE PREFERABLE FOR USE AGAINST MOST TARGETS, BECAUSE OF THE HIGHER ASSURANCE OF A HIT. HOWEVER, CONDITIONS MAY LIMIT LGP USE. THOSE CONDITIONS INCLUDE LACK OF LTDS IN THE AREA, SHORT LINES OF SIGHT, OTHER LGP COMMITMENTS, EXCESSIVE LAZING ANGLES, DUST AND FOG INTERFERENCE, ETC. THMP CAN BE LAUNCHED BY ANY MORTARS WITH ACCOMPANYING COMPUTER TO LOAD DATA, AS LONG AS AN OBSERVER IS AVAILABLE. NOTE THE DISCUSSION UNDER EMPLOYMENT, ABOVE, AND OF THMP.

CM VULNERABILITY

IR ABSORBING PAINT, CAMOUFLAGE MATERIAL, OR TENTING CAN AFFECT THE SEEKER

IR-SUPPRESSIVE SMOKE CAN AFFECT THE SEEKER

TARGET CAN HIDE UNDER DENSE TREE CANOPY, BUILDING COVER, ETC

DECOY TARGETS SUCH AS HEATED PLATES MAY DEFLECT THE SEEKER

ANY CHALLENGE TO LOCATION ACCURACY, SUCH AS SMOKE, DUST, OR TARGET SPEED, MAY DECREASE THE POSSIBILITY THAT THE TARGET IS WITHIN THE SEEKER FOOTPRINT

IF TARGETS DISPERSE WHEN UNDER ATTACK, SOME MAY BE ABLE TO AVOID THE FOOTPRINT

SUPPORT REQUIRED

A CRITICAL NEED IS TARGET LOCATION WITHIN 75 M. MODERN (TIERS 1AND 2) MAN-PORTABLE ACQUISITION EQUIPMENT FOR OBSERVATION POSTS INCLUDE GPS, LRF BINOCULARS, LTDS (WITH LRF INCLUDED, AND PRECISION SCOPES OFFER RAPID ACQ WITHIN 5 M. A DIRECT LINK TO THE OP TO ASSURE TIMING AND ACCURACY, AND TO ADJUST FIRE. IF A MOVING TARGET MUST BE STOPPED, MINES OR OTHER OBSTACLES MUST BE LAID. IF THE MORTAR OR COMBINATION GUN, OR SUPPORTING ARTILLERY CAN FIRE DPICM ROUNDS, THE DUD FIELD CAN HALT MOVING VEHICLES

EMPLOYMENT TIME (MIN): 1-5 EST, DEPENDING ON SYSTEM

RATE OF FIRE (RPM): UP TO 9, ALTHOUGH MOST POINT TARGETS WILL REQUIRE 1-6 ROUNDS

DEC

2016

Worldwide Equipment Guide

Chapter 7: Engineer Vehicles



TRADOC G-2 ACE–Threats Integration

Ft. Leavenworth, KS

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Chapter 7: Engineers

Chapter 7 of the *Worldwide Equipment Guide* (WEG) provides the basic threat characteristics for selected engineering equipment and systems. The engineer chapter discusses the following topics: landmines, minelaying systems, mine-clearing systems, route clearing systems, and "gap-crossing" systems either in use or readily available to the OPFOR and therefore likely to be encountered by US forces in varying levels of conflict in the future.

The list of engineer systems within this chapter is not meant to be encyclopedic. This chapter provides the US training community with a list of representative engineering (systems based) capabilities that allow scenario developers and the rest of the training community to create a dynamic threat to prepare today's warfighter for tomorrow's battlefield.

The chapter is divided into three major categories—***The Land Mine Primer, the Unmanned Ground Vehicle (UGV) Primer, and WEG Sheets on mobility engineering assets***. The Land Mine Primer focuses on counter-mobility and examines types of mines, minefields, emplacement or mine delivery methods. The UGV Primer discusses provides an UGV overview and of how certain systems are used for detect hazards and supporting the defeat of explosive devices such as mines. The third section consists of WEG sheets on mobility engineering assets such as but not limited to bridge crossing and mine clearing assets.

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Land Mine Primer

The widespread proliferation and use of landmines on today's battlefield can be contributed to a combination of a number of factors, which include the following: the ability to easily mass produce items, the development of plastic devices, improved battlefield delivery systems, and ongoing research with regards to sophisticated fuzes. The advances in mass production techniques and the associated reduction in per-item cost along with the simplicity of manufacturing/automated production make landmines extremely easy and relatively inexpensive to produce. Technological improvements have also affected landmines in the form of the widespread use of plastic in the construction of the devices. This development has rendered metal detectors mostly ineffective for locating newer plastic-cased mines (unless the manufacture intentionally places a mass of metal in the mine). Remotely delivered mines have expanded the capability for quickly changing the tempo of battle with relation to counter mobility tactical actions and reinforcing defensive positions.

1. Types of Minefields. The following are basic types of OPFOR minefields: antitank (AT), antipersonnel (AP), mixed, decoy, and antilanding. AT minefields are the primary types of OPFOR engineer obstacle and serve to destroy or disable armored vehicles. They are primarily established in belts consisting of multiple rows on avenues that are favorable for tanks in front of the forward edge and on the flanks. Where difficult terrain is available, minefield belts will be tied into terrain obstacles to reduce the mine requirement. The OPFOR sets up conventional AP minefields on the forward edge of friendly defensive positions, in front of AT minefields, or along dismounted avenues of approach. Mixed minefields consist of both AP and AT mines. Decoy minefields are a significant form of deception to slow movement or deceive as to true unit locations. Antilanding minefields prevent landings by amphibious, airborne, or heliborne assault forces.

Minefields can also be categorized by their technical method of activation—uncontrolled, controlled, and intelligent. Controlled minefields consist of landmines with electronic switches that allow the operator (controller) control over the operational status of the minefield. The operator can change the status of the landmines either by a direct hardwire link or by radio. An entire minefield can be emplaced and turned on or off, as necessary to best support OPFOR operations. On a smaller scale, select passages in a conventional minefield can contain controllable landmines, allowing for the option of clearing safe lanes. The addition of selectable, anti-removal, and self-destruct features to controlled mines enhance flexibility and overall effectiveness.
Intelligent minefields have advanced technology that allows minefields to switch on and off and to deactivate at a certain time. When used in conjunction with unmanned ground sensors (UGS) they can communicate via a communications link and be activated remotely. Other advancements include acoustic and infrared signature activated mines. While many of these concepts are in the developmental stage, the technological means are available and have the potential to deploy as needs arise. They will be composed of "wide area coverage" mines.

2. Types of Mines. Mines may be AT/anti-vehicle, AP, antihelicopter, or area mines. They may also be defined by the manner in which they are emplaced such as scatterable (remote), or side-attack (generally AT or anti-vehicle) or their area coverage. As noted earlier for minefields, the OPFOR makes distinctions between controlled mines (command-operated by hard wire or radio linkage) and uncontrolled mines.

Side-attack mines are autonomous weapons that attack targets from the side as they pass by. These include anti-vehicle, anti-personnel, and anti-helicopter mines. They vary among manufactured side-attack mines, side-attack improvised explosive devices, and mines created by attaching manufactured or improvised sensor units to anti-tank grenade launchers (ATGLs) and anti-tank disposable launchers (ATDLs). Some side-attack mines can be used

for multiple roles. For instance, directional fragmentation mines and IEDs can be used against personnel and vehicles. Some like the MON-100 can tilt upward for anti-helicopter use.
Current developments in side-attack landmines use mature technology from other weapon programs. Since side-attack landmines have increased areas of coverage, the number required to hinder mobility of enemy forces is greatly reduced. Uses for these landmines include harassment throughout the area of operation and reinforcement of conventional minefields to make "cleared" lanes unsafe. Special Purpose Forces (SPF) and security patrols can also use these mines to economically cover multiple avenues of approach to alert on enemy encroachments. These types of mines can be used in ambush's kill zones.

Antitank. Conventional antitank mines, such as the TM-62 AT mine, are those that are emplaced either by hand or by mechanical means. These will continue to be the primary landmine threat throughout the foreseeable future. They are readily available to armies and insurgency groups worldwide and are inexpensive and effective. These mines are normally buried just below the surface of the ground but can be surface laid or buried with up to 30 cm of cover. Antitank mines can vary in size from as small as 1.4 kg for a scatterable mine (PTM-1S) to over 20 kg for a side attack mine (TM-83). The category of antitank mines includes side-attack and anti-vehicle mines.

Side-attack antitank. Commonly called "off-route mines", side-attack mines are an integral part of the adaptive battlefield and date back to the LGM trip-wire AT mines of the Vietnam War era. Today there are at least 18 different side-attack mines in use by 22 countries. Ten more side-attack mines are under development. Within the next few years these weapons will have proliferated to every combat environment. Some mines have been out fitted with acoustic and infrared signature detonation capabilities. The Polish Agawa comes in two variants, the legacy contact-fuzed MPB-ZK and the new non-contact, acoustic-activated MPB-ZN. Some mines and IEDs have warheads which produce an explosively formed penetrator (EFP), a metal sabot which penetrates light to heavy armor, depending on design. EFPs were used in the Iraqi theater against US and coalition forces. The majority of usage of such systems were by Shia Militias. Such mines include the Russian TM-83, and TEMP-30 sensor-fuzed mine. Sensor fuzed ATGL or ATDL based mines can also be effective. A shoulder-fired AT weapon placed on a tripod and fitted with an IR sensor can kill moving targets up to 100 meters away. Current warhead technology in these weapons allows penetration of up to 950 mm of rolled homogeneous armor.

Anti-vehicle. Many smaller antitank mines, or larger antipersonnel mines, have been developed (or modified) to severely damage or destroy vehicles other than tanks with a few pounds of high explosives or fragmentation. These may be either trucks, tactical utility vehicles such as UAZ-469, or light armored combat vehicles such as BTRs.

Side-attack sensor-fuzed mines such as Russian platter mines direct fragmentation to damage or destroy vehicles. Other mines and IEDs (e.g., PD Mi-Pk) initiate multiple EFPs for KE penetration. Blast effects from mines and IEDs can inflict kinetic energy damage by flipping over vehicles, bending metal, and tossing material about inside to kill or injure personnel.

Antipersonnel. Antipersonnel landmines injure by either blast or fragmentation. The small antipersonnel mine contains no more than a pound (usually only a few ounces) of high explosive. Blast injures by the force of the charge. The loss of a foot or a leg is the common result. Fragmentation mines contain hundreds to thousands of pellets. Plastic-cased landmines pepper their victims with small particles of plastic that are not detectable with x-

rays, making complete cleansing of wounds extremely difficult and increasing the risk of infection and amputation. On the battlefield, the modern AP mine is used to—

- Inflict personnel casualties.
- Hinder soldiers in clearing AT minefields.
- Establish defensive positions.
- Deny access to terrain.

Anti-helicopter. The modern attack helicopter, with increasing agility and weapons payload, is able to bring enormous firepower to bear on enemy forces. To counter this threat, a new type of mine—the antihelicopter mine—was developed. By borrowing technologies from the side-attack and wide-area landmines, antihelicopter mines may make use of acoustic fuzing to locate and target potential low-flying targets at significant distances. Their multiple-fragment warheads are more than capable of destroying light-skinned, non-armored targets at closer ranges.

A simple antihelicopter mine can be assembled from an acoustic sensor, a triggering IR sensor, and a large directional fragmentation mine. More advanced mines use a fairly sophisticated data processing system to track the helicopter, aim the ground launch platform, and guide/fire the kill mechanism toward the target. As the helicopter nears the mines, the acoustic sensor activates or cues an IR or MMW sensor. This second sensor initiates the mine when the helicopter enters the lethal zone of the mine. A typical large fragmentation warhead is sufficient to damage soft targets, such as aircraft. Alternate warhead designs include high-explosive warheads and single or multiple explosively formed penetrators.

Area Coverage. The terms “area” and “wide area” mines are often confusing and misleading. Mines classified as area mines range from antipersonnel “bouncing Betty” mines to side-attack mines, directional fragmentation mines “claymores”, and possibly antihelicopter mines. Wide area coverage mines with sophisticated fuzing and possibly a limited communications capability are weapons of the future and have not been fielded. The Polish Agawa MPB-ZN is a wide area coverage AT mine with an acoustic activated target detection range of around 150m and its EFP is described as effective against 100 mm of rolled homogenous steel armor at distances of 50 m.

3. Emplacement or Delivery Methods. In the past, landmines were generally emplaced manually one at a time. Mass mine delivery and distribution systems permit the rapid placement of large quantities of mines. Landmine emplacement vehicles are designed to automatically arm and bury a landmine every 3-10 meters. Landmines also may be placed with artillery, rockets, or aircraft at a rate of hundreds, even thousands, of mines per minutes. Emplacement means may be manual, mechanical, or remote. Manual emplacement is not possible when there is little time or during high-speed maneuver operations. Therefore, mechanical and remote means are more prevalent.

Manual. The OPFOR manually emplaces minefields when

- There is no contact with the enemy.
- Mechanical minelayers are unavailable.
- It is inadvisable to use mechanical minelayers because of terrain restrictions.

Mechanical. OPFOR engineers rely extensively on mechanized minelayers. These can bury or surface-lay AT mines. The layout of mechanically emplaced minefields is the same as those emplaced by hand. Mines can also be emplaced by helicopters or vehicles with the use of chutes (slides). Mine chutes can also be used to assist manual burial emplacement or to surface-lay mines.

Scatterable Mines. Known as "scatterable mines" in the US, other countries call them "remotely-delivered". They are landmines emplaced through a variety of means and are designed as such to be delivered by aircraft, tube artillery, multiple rocket launchers, missiles, ground vehicles, or they can be hand-thrown. Scatterable mines are not a standard item except in well-equipped armies of the world. While the number of countries possessing scatterable mines continues to increase, there will continue to be many areas of the world where scatterable mines are not a threat through the far term.

Minefield emplacement is progressing from manually and mechanically emplaced minefields to the more flexible and dynamic remotely, scatterable minefield. The ability to remotely deliver mines allows a rapid response with thousands of landmines at any point on the battlefield. Since many scatterable landmines feature self-destruct and anti-disturbance fuzing, they are well suited for operations that deny terrain for a specific period. After the allotted time has expired, the terrain can once again be used by friendly forces. Scatterable mines may be delivered by the following methods:

Artillery. Multiple rocket launchers are the primary means of remote minelaying. The principal advantage of MRL mine delivery is its ability to quickly emplace large minefields in a single volley, while minimizing exposure to enemy targeting and weapon systems. Both AP and AT mines can be delivered by artillery (which may include cannon and mortar rounds).

Ground Vehicles. Within recent years the trend has been to mount scatterable-mine dispensers on ground vehicles. Both AP and AT mines can be launched from ground vehicles. This also gives the engineers the ability to re-seed or reinforce an obstacle without entering the minefield itself.

Infantry. Lower level OPFOR infantry units may employ man-portable remote mine dispensers. These man-portable dispensers, weighing only a few pounds, are ideal for installing small, defensive, AP or AT minefields. Infantry-fired ground dispensers allow low-level units to remotely emplace minefields to protect their fighting positions, flanks, and boundaries between units, or to cover firing lines and gaps in combat formations. They can quickly close breaches in existing protective minefields and increase the density of mines on armor avenues of approach.

Aerial. Both AT and AP minefields can be laid using aerial minelaying systems. Bombers and fighter-bombers can lay remotely delivered minefields in the operational depths. Ground-attack aircraft lay these minefields in the enemy's tactical depths. Helicopter minelaying systems are used to emplace small mine belts or large barrier minefields in the execution of army or division offensive or defensive maneuver plans. This type of aerial minelaying is normally conducted over friendly territory along flanks or in rear areas.

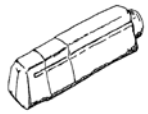
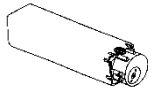
When supporting an airborne or air assault landing, helicopters may lay mines on enemy territory. Helicopter mine chutes are a tool available to even low-technology helicopter forces for installation on a variety of helicopters by low echelon maintenance units and rapidly dispensing conventional anti-tank mines in areas inaccessible to even

rapidly moving ground vehicles. Placement of a limited number of side-attack or conventional AT/AP mines along likely movement routes allows the OPFOR to harass traffic, slow movement rates, cause casualties, and affect enemy morale.

4. Fuzes. Some types of fuzes, such as pressure fuzes, are used in both AT and AP mines while other fuzes tend to be linked to more specific types of mines. For example, acoustic sensors are generally used with antihelicopter and advanced off-route mines while magnetic, tilt-rod, or seismic fuzes are used with AT mines. Most AT mines are detonated by the pressure of a vehicle driving over a buried mine or by the movement of a tilt rod attached to the mine.

Pressure and tilt-rod AT mine fuzes (contact fuzes) are being complemented and in certain cases replaced by mines with magnetic, optical, seismic, and acoustic influence mines. Some mines have a second fuze well to facilitate the installation of an antihandling fuze. Conventional antihandling devices and target-sensing fuzes have evolved into sophisticated booby traps, which virtually assure grievous injury or death to the de-miner. Some landmines may be detonated by metal detectors; others explode when their fuzes detect light when lifted from the ground. One version of the “Bouncing Betty” is activated by an array of seismic detectors. Other mines, for example the US M18A1, will accommodate a variety of fuzes, including tripwire and command detonation. Other mines, especially antihelicopter mines use a combination of sensors/fuzes to acquire the helicopter and initiate the mine when the helicopter enters the lethal zone. The following is a list of fuzes:

Pressure. The pressure fuze is the most common type of fuzes for both AT and AP mines. Also known as the contact fuze, it may require only a few ounces pressure to active the mine or as much as several hundred pounds.
Trip Wire. Also called pressure release, these fuzes may be attached to a thin wire stretched across a path or route. When the victim or vehicle passes and breaks the wire, the mine is detonated. Trip wires are used mainly with AP and side-attack mines.
Magnetic. Most armored vehicles contain a large quantity of steel and therefore create large magnetic disturbances that signal their presence to a magnetic influence fuzed landmine.
Optical. An optical fuze, using a small infrared or ultra-violet transmitting diode on a surface-placed landmine, sends a detonation signal with it senses light reflecting from the hull of a tank.
Radar. A small, micro-electronic radar can sense the underside of a tank by the magnitude and location of the radar reflection.
Seismic. Mines can be equipped with sensors that detect the vibrations caused by the weight and track movement of tanks or by the noise they make.
Acoustic. When a system approaches, antihelicopter or advanced off-route mines use an acoustic sensor to activate or cue an IR, seismic, or MMW sensor.
Infrared. IR sensors are generally used against vehicles, ground and aerial.

Proliferated land mines										
Antitank Mines										
Name	**Country of Manufacture**	**# of User Coun-tries**	**Emplacement Method Length (mm) Width (mm) Height (mm)**	**Armor Penetration (mm)/ Kill Mechanism**	**Effective Range (meter)**	**Detectability/ Composition**	**Anti-Handling**	**Fuze Type/ Self Neutralize**	**Explosive Type & Weight/Total Weight (kg)**	**Comment**
Scatterable										
PTM-1S/ PGMDM	FSU	17+	remote-surface: UMZ, MRL, aircraft, PKM portable inf L: 320 mm W: 65 H: 75	track breaker on contact/ blast	1	visual plastic	no	contact, pressure neutralize: yes- 0 to 24 hrs	PVV-12S liquid plastic: 1.4	 Anti-vehicle mine similar to German AT-1
PTM-3	FSU	12+	remote-surface: UMZ, helicopter, PKM portable inf L: 330 W: 84	70 mm: penetrates tank belly & destroys running gear	1	visual mine detectors cause detonation plastic	yes	proximity, magnetic self-destruct: yes-16 to 24 hrs	TG-40: 1.8 Total: 5	
Manual, Mechanical, and Chute Emplaced										
TM-57	FSU Bulgaria China	32+	manual mechanical chute	blast	1	easy sheet metal	yes	pressure (200/2.5/.5-6 kg) delay-armed,	TNT or TGA 60/24/16: 6.3 Total: 8.47	

	Iraq		D (max): 316 D (min): 204 H: 101					tilt rod, pull (booby trap) neutralize: no		 limited underwater
TM-62M/ P/B/D	FSU Poland Bulgaria	30+	manual mechanical chute D: 315 H: 110	27 RHAE blast	1	varies: M: metal-easy P: plastic B: caseless D: wood	Not built in	pressure (200 kg) magnetic (flux) seismic	Trotyl, RDX & aluminum/9.5 Total: 10	 limited underwater
TM-46/ TMN-46	FSU North Korea (ATM-46) Germany Bulgaria Egypt (M/71) Israel (No. 6)	28+	manual mechanical D: 306 H: 94	blast	1	easy to detect sheet metal	TMN-46 yes	pressure (180/132 kg), tilt rod neutralize: no	TNT, amatol 2.9 Total: 5.7	 The TM-46 and TMN-46 are identical except for the additional fuze well

Antitank Mines (continued)

Manual, Mechanical, and Chute Emplaced (continued)

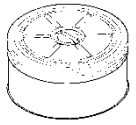
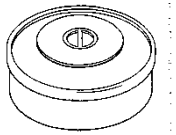
Name	Country of Manufacture	# of User Coun-tries	Emplacement Method Length (mm) Width (mm) Height (mm)	Armor Penetration (mm)/ Kill Mechanism	Effective Range (meter)	Detectability/ Composition	Anti-handling	Fuze Type/ Self Neutralize	Explosive Type & Weight/Total Weight (kg)	Comment
PMZ-40	FSU	18+	manual D: 280 H: 120	blast	contact	Easy steel	possible-no 2nd fuze well or AD features	pressure (225 AT or 68 AP) self-destruct or neutralize : no	TNT 3.6 Total: 9	 The AP/AT feature allows a single type mine to be used in a mixed minefield. Preferable in roadblocks. Replaced by the TM-41 AT mine
PT-Mi-Ba-III	Czech	17 + terrorist groups	manual mechanical chute D: 330 H: 108	blast defeats known belly armor	1	plastic /bakelite (metal in fuze only-2.9 gr)	yes with RO-4 fuze	pressure (200 kg) self-destruct or neutral: no	TNT 7.2 Total: 9.9	
Mk 7	United Kingdom	16+	manual D: 325 H: 130	blast	1	Easy detect metal	Yes	pressure (150 kg), tilt rod available	TNT 8.9 Total: 13.6	

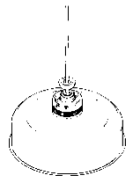
TMD-B	FSU Namibia	16+	manual L: 315 W: 280 H: 160	blast	1	difficult with hand held detectors - wood	Possible	pressure (200-500 kg) self-destruct or neutral: no	TNT 9.0 kg Total: 9.7	
M19	US Chile Iran South Korea Turkey	13	manual L: 332 W: 332 H: 94	Blast	1	difficult with hand held detectors plastic	Yes	pressure (182 kg)	COMP B 9.5 Total: 12.6	
TMK-2	FSU	13+	manual D max: 301 D min: 75 H: 262 w/o Tilt-rod	250 RHAE belly attack plate charge	1	Easy Metal	Possible	tilt rod (8-12 kg) self-destruct or neutral: no	TG-50, TNT Total: 12.5	

Antitank Mines (continued)

Manual, Mechanical, and Chute Emplaced (continued)

Name	Country of Manu-facture	# of User Coun-tries	Emplacement Method Length (mm) Width (mm)	Armor Penetra-tion (mm)/ Kill	Effective Range (meter)	Detectability/ Composition	Anti-handling	Fuze Type/ Self Neutralize	Explosive Type & Weight/Total Weight (kg)	Comment

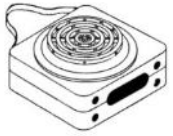
			Height (mm)	Mech-anism						
TMA-3	Former Yugoslavia	13	manual mechanical D: 262 H: 140 w/fuze H: 100 w/o fuze	blast	1	very difficult with hand held detectors plastic coating	Yes	pressure (180 kg) self-destruct or neutral: no	cast TNT 6.5 Total: 7.0	
PRB M3/ A	Belgium	12	manual L: 230 W: 230 H: 130	blast	1	very difficult with hand held detectors plastic	yes two secondary fuze wells	pressure (250 kg)	RDX/TNT 6.5 Total: 6.8	 aka PRB ATK-M3, waterproof
TM-41	FSU China North Korea Cambodia	10+	manual H: 145 D: 252	blast	contact	Metal	No	pressure (160 kg no)	TNT: 4 Total: 5.4	 Can be used underwater
Type 72	China S. Africa	10+	manual mechanical scatterable D: 270	blast	contact	very difficult plastic	possible	pressure (300 to 800 kg) self-destruct or neutralize : no	TNT/RDX 5.4 Total: 6.5	 Very difficult to detect with hand held detectors

			H: 100							underwater: yes
M15	US	7+	manual D: 334 H: 150	blast	0, typical with contact mine	Easy Metal	yes 3 fuze wells	pressure (159-340 kg) tilt-rod	COMP B 10.3 Total: 14.27	

Antitank Mines (continued)

Manual, Mechanical, and Chute Emplaced (continued)

Name	Country of Manu-facture	# of User Coun-tries	Emplacement Method Length (mm) Width (mm) Height (mm)	Armor Penetra-tion (mm)/ Kill Mechani sm	Effective Range (meter)	Detectability / Composi-tion	Anti-handling	Fuze Type/ Self Neutralize	Explosive Type & Weight/Total Weight (kg)	Comment

M7A2	US	7+	manual L: 178 W: 114 H: 63	blast	see note	Easy metal	Yes Two Fuze wells	pressure (159-340 kg)	Tetryl 1.62 Total: 2.19	 Designed more as anti-vehicle (trucks and LAVs) For tanks 2–5 mines used
P2 Mk 3	Pakistan	6+	manual D: 262 H: 120	blast	0, typical with contact mine	very difficult plastic	probable 2nd fuze well	pressure (204-250 kg)	TNT 6.02 Total: 7.05	 Very difficult to detect w/hand held-detectors. Can also be used as very large AP mine
PT-Mi-K	Czech	6+	manual mechanical D 300 H: 106	blast	contact	easy detect metal	possible	pressure (200-400KG)	TNT: 4.9 Total: 7.6	
P2 Mk 2	Pakistan	5+	manual D: 270x270 H: 130	blast	0, typical with contact mine	very difficult plastic, only metal is spring, striker tip, and shear wire	probable- 2nd fuze well	pressure (180-300 kg)	6 Total: 6.5	 Very difficult to detect w/hand held-detectors. Can also be used as very large AP mine

PM-60 (K-1)	Former E. Germany	5+	manual D (max): 320 D (min): 237 H: 125	blast	0, typical with contact mine	somewhat difficult (only 20 gr metal) plastic	probable 2nd fuze well	pressure (200-500 kg)	TNT 9.9 Total: 11	 waterproof

Antitank Mines (continued)

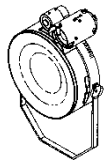
Manual, Mechanical, and Chute Emplaced (continued)

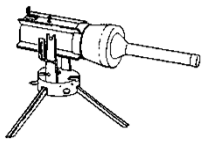
Name	Country of Manufacture	# of User Coun-tries	Emplacement Method Length (mm) Width (mm) Height (mm)	Armor Penetra-tion (mm)/ Kill Mechanis m	Effective Range (meter)	Detectability/ Compo-sition	Antihandling	Fuze Type/ Self Neutralize	Explosive Type & Weight/Total Weight (kg)	Comment
PT-Mi-Ba II	Czech	4+	manual L: 397 W: 230 H: 135	blast	1	difficult plastic or metal	probable-1 or 2 fuzes. Any disturbance detonates the mine after it has been emplaced.	Pressure (200 to 450 kg)	RO-7-II: 6.44 Total: 10.2	

UKA-63	Hungary	4+	manual mechanical scatterable chute D: 300 H: 75	explosively formed fragments	Plate charge. Track-attack; side-attack effective 0 to 50 meters (see note)	easy metal	Probable	pressure, seismic, magnetic, and electrically fired command detonated, tilt-rod neutralize: no	TNT 6 Total: 9	 Can operate as a belly-attack, track-attack, or side-attack mine. The plate-charge will probably have only limited success against tank armor in side-attack mode but is successful against lightly armored vehicles.
TMM-1	Yugoslavia	2+	manual mechanical D: 326 H: 90	blast	contact	easy to detect metal	probable- 2nd fuze well	Pressure (130 w/pressure plate-70 w/o plate) self-destruct	TNT 5.6 Total: 8.7	 Commonly surface laid and use extensively in roadblocks. Limited underwater to .25 m
TM-89	FSU	15+	manual mechanical D: 320 H: 132	blast	proximity	Metal	Probable	pressure, magnetic, and electrically	TG-40 6.7 Total: 11.5	

Antitank Mines (continued)

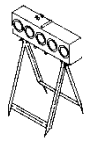
Side-Attack (Antitank and Anti-vehicle) Mines

Name	Country of Manufacture	# of User Coun-tries	Emplacement Method	Armor Penetration (mm)/ Kill Mechanism	Effective Range (meter)	Detectability/ Composition	Anti-Handling	Fuze Type/ Self Neutralize	Explosive Type & Weight/Total Weight (kg)	Comment
LMG	FSU	13+	manual	rocket propelled shaped-charge	27	visual metal	No	Tension (1 kg), tripwire neutralize: no	TNT: 3.2 Total: 10	
TM-83	FSU	13+	manual H: 440 L: 250	100 RHAE EFP (explosively formed penetrator)	50	visual case metal	possible	IR & seismic, or break wire	explosive 9.6 Total: 20.4	
Panzer-faust 3	Germany	8+	manual L: 1,200 D: warhead 110	700 rocket propelled shaped-charge	150 target speed- 30-60 kmp	visual metal	No	IR & acoustic, seismic, break wire. Targets detected by acoustic which activates IR	HEAT MP-Frag BASTEG	 SIRA sensor package

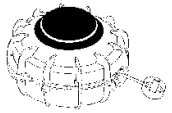
PARM 1 (DM-12)	Austria Germany UK Sweden Finland	5+	manual L: 390 D: 128	600 rocket propelled shaped-charge	40	visual metal	No	neutralize: 20, 40, 60 days	Total: 10	
MIACAH F1	France UK (L14A1) Netherlands (# 29)	4+	manual L: 260 D: 200	70 RHAE @ 40 m shaped-charge	80	visual metal	No	Break wire, command, IR influence neutralize: no	Hexolite: 7 Total: 12	

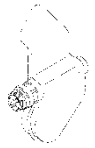
Antitank Mines (continued)

Side-Attack (Antitank and Anti-vehicle) Mines

Name	Country of Manufacture	# of User Coun-tries	Emplacement Method	Armor Penetration (mm)/ Kill Mechanism	Effective Range (meter)	Detectability/ Composition	Anti-Handling	Fuze Type/ Self Neutralize	Explosive Type & Weight/Total Weight (kg)	Comment
PD Mi-PK (Horizontal)	Czech	1+	manual L: 401 W: 125 H: 80	50 RHAE 5-EFPs	30	visual metal	possible	contact wire, command Can be linked to IR sensor	explosive: 5.5 Total: 12 (8.5 w/o stand)	

MPB-ZN/K	POL	1+	manual	EFP	50	visual metal	Yes	Acoustic and Infrared Contact (K Model)	TNT: 22(est.) Total: 45	

Anti-Personnel Mines										
Name	**Country of Manufacture**	**# of User Coun-tries**	**Emplacement Method**	**Kill Mecha-nism**	**Effective Range (m)**	**Detectability/ Composition**	**Anti-Handling**	**Fuze Type/ Self Neutralize**	**Explosive Type & Weight/Total Weight (kg)**	**Comments**
Scatterable										
VS-50	Italy Singapore (SPM-1) Egypt (T/79)	14+	manual remote-surface D: 90x90 H: 45	blast	limited	Plastic difficult	yes, the VS-50AR variant	pressure- 10 kg self neutral: no	TNT: .075 Total: .185	 Designed to be scattered from helicopters. Countermeasure blast (fuel- air-explosive line charge)-resistant. Underwater 1 meter

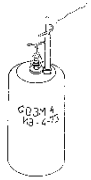
Anti-Personnel Mines										
Name	**Country of Manufacture**	**# of User Coun-tries**	**Emplacement Method**	**Kill Mecha-nism**	**Effective Range (m)**	**Detectability/ Composition**	**Anti-Handling**	**Fuze Type/ Self Neutralize**	**Explosive Type & Weight/Total Weight (kg)**	**Comments**
Scatterable										
PFM-1S	FSU	12+	remote-surface (UMZ, MRL, helicopter, PKM portable) H: 120 W: 61	blast	1	Visual plastic	no	pressure (5 kg) Self-destruct: 85% over 40 hr	liquid plastic-VS-6D: .040 Total: .070	 copy of US BLU-43B
POM-1S	FSU	12+	remote-surface (UMZ, helicopter, PKM portable) Ball 80x80 mm	fragmen-tation	4	Visual	yes	tripwires, S=Self-destruct	.1 Total: .750	 copy of US BLU-42B

POM-2S	FSU	12+	remote-surface (UMZ, helicopter, PKM portable) cylinder: D: 60	fragmen-tation	16	visual, readily	no	tripwires (.2 kg) Self-destruct: 4 to 100 hr	TNT: .14 Total: 1.6	
SB-33	Italy, Spain Greece (EM-20), Portugal (M412)	10+	manual scatterable D: 85 H: 30	blast	contact	Plastic difficult w/handheld detectors	yes: antihandling SB-33/AR	pressure 10 kg	RDX: .35 Total: .140	 Countermeasure blast (fuel air/explosive line charge) resistant.

Anti-Personnel Mines (continued)

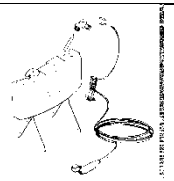
Manual, Mechanical, and Chute Emplaced

Name	Country of Manufacture	# of User Coun-tries	Emplacement Method	Kill Mechanism	Effective Range (m)	Detectability/ Composition	Anti-handling	Fuze Type/ Self Neutralize	Explosive Type & Weight/Total Weight (kg)	Comments
PMN	FSU China Iraq	35+	manual chute D: 112 H: 562	blast	1	readily- plastic case metal in fuze & cover	cannot be disarmed Fuze arm delay	pressure plate-very sensitive (8-25 kg) self-neutral: no	Trotyl: 0.20 Total: 0.55	 Most common AP mine in the world. waterproof
POMZ-2M	FSU China (Type 59) North Korea Germany	33+	stake mine manual D: 107 H: 60	fragmen-tation	Max: 8 Min: 0	visual, detection cast iron	possible	tripwire (1 kg force) self-neutralize: no	TNT: 75 Total: 1.7	 Normally emplaced on stake 30 cm above ground. Fuze delay arm Underwater: no
MON 100	FSU Bulgaria	27+	manual D: 220 H: 80	directional fragmen-tation 400 pieces	100 width of kill zone @ 100 m= 6.5-9.5	metal case	possible but not likely	electric command, tension-release (2 to 5 kg)	TNT: 2 Total: 5	 Effective against lightly armored vehicles. At 100m 50% of frag will strike w/in 5 m of aim.

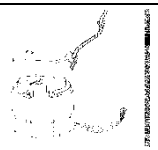
OZM-4	FSU	26+	manual D: 90 H: 140	bounding fragmen-tation (.6-.8 m above ground)	15	readily detectable case cast iron	possible	tripwire (2-5 kg), electrical, pressure, tension release self-neutralize: no	Total: 5	 Replaced the OZM-3
MON 200	FSU Bulgaria	25+	manual L: 431 H: 130	directional fragmen-tation 900 pieces	200 m width of kill zone @ 200 m= 10.5-14.5	visual metal case	possible but not likely	electrical, self-neutralize: no	TNT: 12 Total: 25	 Larger version of MON-100 Also effective against LAVs

Anti-Personnel Mines (continued)
Manual, Mechanical, and Chute Emplaced (continued)

Name	Country of Manufacture	# of User Coun-tries	Emplacement Method	Kill Mechanism	Effective Range (m)	Detectability/ Composition	Anti-handling	Fuze Type/ Self Neutralize	Explosive Type & Weight/Total Weight (kg)	Comments
PP-Mi-Sr II	Czech	25+	manual D: 102 H: 152	bounding fragmen-tation	max: 20 m min: 0 bound height 1 m	Easy metal case and fragmentation	possible	tripwire (4 to 8 kg), pressure (3 to 6 kg) command detonated self-neutralize: no	TNT: .36 Total: 3.2	 Fielded in 1955. Exact copy of its predecessor the PP-Mi-Sr

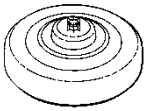
PMD-6	FSU Namibia Serbia	24+	manual L: 196 W: 87 H: 50	blast	1	detectable wood metal in fuze	possible	pressure, tripwire (1 kg) self-neutralize: no	TNT: .20 Total: .40	 Probing for low pressure threshold fuze is dangerous
MON 50	FSU	23+	manual L: 220 W: 45 H: 105	directional fragmen- tation 485 pieces.	width of kill zone @ 50 m=45	visual plastic case	possible	electric cmd, tripwire, tension, tension release self-neutralize: no	RDX: .70 Total: 20	 Copy of US M18A1 claymore Chopped wire fragments (5x5mm).
M18A1/ Claymore	US, South Korea (K440) Pakistan (P5 Mark I) Iran, Chile S. Africa (No.2) FSU (MON-50)	22+	manual L: 216 W: 35 H: 83	directional steel fragments	50	visual plastic case (fiberglass)	possible	electric command, tripwire, tension, tension release	C4: .68 Total: 1.60	
OZM-72	FSU	21+	manual D: 105 H: 172	bounding fragmen- tation	max: 25 min: 0 bound height .66 m is adjustable	Easy Metal	possible no 2nd fuze well	tripwire (2 to 5 kg) or command detonated (electrical) or pressure self-neutralize: no	TNT: .70 Total: 5.0	 Successor to the OZM-4. Same chopped wire fragments (5x5mm) as in the MON-50 Not waterproof

Anti-Personnel Mines (continued)
Manual, Mechanical, and Chute Emplaced (continued)

Name	Country of Manufacture	# of User Coun-tries	Emplacement Method	Kill Mechanism	Effective Range (m)	Detectability/ Composition	Anti-Handling	Fuze Type/ Self Neutralize	Explosive Type & Weight/Total Weight (kg)	Comments
M14	US India (M-14) Vietnam (MN-79 & MD 82B)	20+	manual D: 56 H: 40	blast	1 contact	very difficult with hand-held detector plastic body (only metal is steel striker tip)	possible	pressure (9-16 kg)	TNT: .029 Total: 1	
OZM-3	FSU	19+	manual D: 75 H: 120	bounding fragmentation	max: 25 lethal: 10 min: 0 bound height 1.5 to 2.4 m	Easy metal	possible no 2nd fuze well	tripwire (2 to 5 kg) or cmd detonated (electrical) or pressure self-neutralize no	TNT: .075 Total: 3	 not waterproof
PMN 2	FSU	16+	manual mechanical D: 125 H: 54	blast	limited	plastic easy-metal content	possible	pressure-15 kg self neutral: no	TG-40: .115 Total: .450	 Successor to PMN. Blast resistant
PPM-2	China Former E. Germany	15+	manual D: 125 H: 63	blast	0	Easy due to fuzing and detector foil plastic	possible	delay-armed (1 to 2 hr), pressure (12.5 kg) self-neutralize; no	TNT: 0.13 Total: 0.39	 Not waterproof
Type 72	China S. Africa	11+	manual D: 79 H: 39	blast	0 contact	very difficult for hand held detectors, plastic	very difficult plastic with rubber cover (see note for hand	pressure (5 to 7 kg) self-neutralize: no Types B & C detonate if moved	TNT/TNT RDX (50/50): 0.05 Total: 0.14	 Also used as booby-trap. "Look-a-likes" Type 72B=booby-trap

							held detectors)			Type 72C=both AP and booby trap, Magnetic detector detonation limited to very shallow water use
Valmara 69	Italy S. Africa (# 69 Mk 1), Singapore	10+	manual D (Top):130 D: (Bottom) 107 H:205	bounding .45m frag	27	plastic case easy to detect: fragments are steel	probable, 2nd fuze well	pressure: 6, 10 kg tripwire self neutral: no	Comp B: .4 Total: 3.2	

Anti-Personnel Mines (continued)
Manual, Mechanical, and Chute Emplaced (continued)

Name	Country of Manufacture	# of User Coun-tries	Emplacement Method	Kill Mechanism	Effective Range (meter)	Detectability/ Composition	Anti-Hand-ling	Fuze Type/ Self Neutralize	Explosive Type & Weight/Total Weight (kg)	Comments
DM-11	Germany Sweden (LI-II)	7+	manual D: 82 H: 34	blast	limited (typical for contact-fuzed blast-effect mines)	very difficult plastic	possible. no 2nd fuze well	pressure (5 kg)	TNT: 0.12 Total: 0.23	 waterproof
M16A1	US India	6+	manual D: 103 H: 203	bounding fragmen-tation	27 bound height 1	easy metal	possible no 2nd fuze well	tripwire, pressure (2, 5 kg) self-neutralize: no	TNT: 0.6 Total: 3.67	 not waterproof

M3	US Taiwan	5+	manual L: 76 W: 76 H: 134	fragmen-tation	4 increased when above ground	easy metal	probable 3 fuze wells	tripwire, (1.4 to 4.5) pressure (3.6 to 9.1)	TNT: 0.45 Total: 4	
PMP-7 ½	Former E. Germany	5+	manual Truncated cone D (top): 125 D (bottom): 60 H: 150	fragmen-tation	4	easy plastic due to metal fragments	possible	pressure (6 to 8 kg)	TNT: 0.1 Total: 1.25	 The lethality of the mine is relatively small because the mine is emplaced below the surface.
PROM-1	Former Yugoslavia	5+	manual D: 75 H: w/o fuze 178 H: w/fuze 260	bounding fragmen-tation	max: 22 min: 0 bound height .7	Easy Steel	possible	pressure (9 kg) tripwire (3 kg) self-neutralize; no	TNT: 0.43 Total: 3	 Delayed ejection and detonation by 1 to 2 seconds to ensure target is clear of the upward path.

Anti-Personnel Mines (continued)
Manual, Mechanical, and Chute Emplaced (continued)

Name	Country of Manufacture	# of User Coun-tries	Emplacement Method	Kill Mechanism	Effective Range (meter)	Detectability/ Composition	Anti-Hand-ling	Fuze Type/ Self Neutralize	Explosive Type & Weight/Total Weight (kg)	Comments
Type 69	China	5+	manual D: 60 H: w/o fuze 114 H: w/fuze 168	fragmen-tation iron body breaks into approx 240 fragments	max: 11 m min: 0 bound height 0 to 1.5 m	easy iron case	possible has detonato r well	pressure (7 to 20 kg) tripwire (1.5 to 4) command detonated self-neutralize: no	TNT: 0.105 Total: 1.35	 Closely patterned after the OZM-4., waterproof
P2 Mk2	Pakistan	4+	manual D: 70 H: 38	blast	limited	difficult Plastic	Possible no 2nd fuze well	pressure (10 kg)	TNT: 0.05 Total: 0.14	
PRB M35	Belgium	4+	manual D: 64 H: 40	blast	0	plastic	possible	pressure (5 to 15 kg)	TNT/KN03: 0.1 Total: 0.58	
MI AP DV PIQUET (Picket) PIG 63 (Model 63)	France	2+	manual D: 35 H: 270	blast	limited (typical for contact-fuzed blast-effect mines)	very difficult plastic	yes-will detonate if pulled from the ground	pressure, anti-removal	Tetryl: .030 Total: .10	 waterproof

V	Italy	2+	manual D: 38 H: 394	fragmen-tation stake mine	14 m	visually detectable	possible metal	tripwire (2 to 3 kg)	TNT: .09 Total: .91	
MI AP ID 51	France	1	manual D: 70 H: 52	blast	limited	very difficult plastic-no metal content	possible no 2nd fuze well self-neutralize: no	pressure (14 to 24 kg)	PETN: .051 Total: .09	 waterproof

Anti-helicopter Mines										
Name	**Country of Manufacture**	**# of User Countries**	**Emplacement Method**	**Armor Penetration (mm)/ Kill Mechanism**	**Effective Range (meter) Maximum /Minimum**	**Detectability/ Composition**	**Target Velocity (m/s)**	**Fuze Type/**	**Warhead Type/Total Weight (kg)**	**Status**
AHM-200	Bulgaria	1	manual	10 @ 100 m	max 200	visual		combined acoustic & Doppler SHF	Total weight: 90 kg	
HELKIR	Austria	1	manual	6 @ 50 m 2 @ 150 m		visual		dual acoustic & IR	Total weight: 43 kg	in production
TEMP-20	Russia	0	manual		detection 1,000 max 200	visual	100	dual acoustic & IR	Total weight: 12 kg	development
AHM	UK	0	manual remote		200/50	visual		dual acoustic & IR	multiple EFP	development

RUSSIAN ANTITANK MINE TM-62M/P/B/D



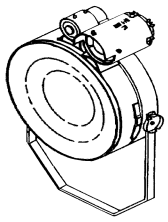
SYSTEM	SPECIFICATIONS	PERFORMANCE	SPECIFICATIONS
Alternative Designations:	none	Armor Penetration (mm):	27
Date of Introduction:	1960	Effect:	Blast
Proliferation:	Over 30 countries	Effective Range (m):	1
Shape:	Circular	Self-Destruct:	No
Color:	Green	Underwater Emplacement:	Yes
Length (mm):	110	Remotely detonated:	Yes
Height (mm):	101.8	Detonation Height:	N/A
Diameter (mm):	320		
Total Weight (kg):	8.5	VARIANTS	SPECIFICATIONS
Burial Depth:		TM-62M:	Metallic case
Maximum:	20	TM-62P:	Plastic case
Minimum:	None	TM-62B:	Caseless
Fuze types: Pressure, seismic, magnetic.	Yes	TM-62D:	Wooden
Actuation Force (kg):	200 /150 to 550	EXPLOSIVE COMPOSITION	SPECIFICATIONS
Resistant to Explosive Neutralization:	Yes	Type:	Trotyl, RDX and aluminum power
		Weight:	7.5 to 8.3
		Booster:	Yes
		Type:	Pentryt
		Weight (gr):	0.75

NOTES

DETECTABILITY VARIES. TM-62M (METAL CASE) IS READILY DETECTABLE. THE TM-62P (PLASTIC) IS THE MOST DIFFICULT TO DETECT.

LIMITED DURATION CAPABILITIES WHEN USED UNDERWATER. DELIVERY PLATFORMS (EXAMPLES): TRACKED MINELAYING VEHICLE GMZ/GMZ-2/3; TOWED MECHANICAL MINELAYER PMR-3 AND PMZ-4 .HELICOPTER (WITH VMP-2 MINELAYER)

RUSSIAN SIDE-ATTACK ANTITANK MINE TM-83



SYSTEM	SPECIFICATIONS	PERFORMANCE	SPECIFICATIONS
Alternative Designations:	none	Armor Penetration (mm):	100
Date of Introduction:	INA	Effect:	EFP, side-attack
Proliferation:	Over 13 countries	Effective Range (m):	50
Shape:	Cylinder	Self-Destruct (days):	30
Color:	Green	Underwater Emplacement:	INA
Length (mm):	INA	Remotely detonated:	Yes
Height (mm):	400	Detonation Height:	INA
Diameter (mm):	250		
Total Weight (kg):	20.4	VARIANTS	SPECIFICATIONS
Burial Depth:		None	INA
Maximum:	INA	EXPLOSIVE COMPOSITION	SPECIFICATIONS
Minimum:	INA	Type:	TG40/60
Fuze types: 2-color IR sensor, seismic, or MVZ-7 breakwire	Yes	Weight (kg):	9.6
Actuation Force (kg):	INA	Booster:	INA
Resistant to Explosive Neutralization:	Yes	Booster:	INA
		Type:	INA
		Weight (gr):	INA

NOTES

THE TM-83 IS BASICALLY A PLATE CHARGE MOUNTED ON A STAND. THE MINE USES SEISMIC SENSORS TO IDENTIFY APPROACHING TARGETS AND TO ACTIVATE THE IR SENSOR. WHEN A TARGET PASSES INTO THE FIELD OF VIEW OF THE SENSOR, THE WARHEAD IS FIRED. THE SEISMIC SENSOR IS STORED ON THE BACK OF THE MINE AND IS CONNECTED BY AN ELECTRONIC CABLE. IT CAN ALSO BE FIRED ELECTRONICALLY. THE MINE MAY BE MOUNTED ON A TRIPOD, THE STORAGE BOX, OR TREE, ETC.

AUSTRIAN ANTI-HELICOPTER MINE HELKIR



SYSTEM	SPECIFICATIONS	PERFORMANCE	SPECIFICATIONS
Alternative Designations:	none	Armor Penetration (mm):	6 @ 50 m or 2 @ 150 m
Date of Introduction:	INA	Effect:	Directed fragmentation
Proliferation:	1	Effective Range (m):	150
Shape:	Rectangular	Self-Destruct:	INA
Color:	Green	Underwater Emplacement:	INA
Length (mm):	INA	Remotely detonated:	Yes
Height (mm):	INA	Detonation Height:	INA
Diameter (mm):	INA		
Total Weight (kg):	43	VARIANTS	SPECIFICATIONS
Burial Depth:	No	None	
Maximum:	None	EXPLOSIVE COMPOSITION	SPECIFICATIONS
Minimum:	None	Type:	INA
Fuze types: acoustic and IR.	Yes	Weight (kg):	INA
Actuation Force (kg):	INA	Booster:	INA
Resistant to Explosive Neutralization:	Yes	Type:	INA
		Weight (gr):	INA

NOTES

THE HELKIR ANTIHELICOPTER MINE IS DESIGNED TO ENGAGE NAP-OF-THE-EARTH TARGETS. THE SENSOR IS A DUAL ACOUSTIC-IR. THE ACOUSTIC SENSOR LISTENS FOR A VALID NOISE INPUT AND TURNS ON THE IR SENSOR. THE IR SENSOR IS LOCATED COAXIALLY TO THE WARHEAD. WHEN A HOT IR SIGNATURE IS DETECTED, THE WARHEAD IS FUNCTIONED.

PKM man-portable infantry mine laying system

In the late 1980s, the Soviet Army began issuing the PKM, a man-portable infantry mine laying system, to its motorized rifle battalions. The original issue was three per battalion. One Russian map was found to portray a motorized rifle platoon strongpoint incorporating PKM-laid minefields in its defense. Even though the Soviet Union dissolved its military's influence can be seen throughout many areas of operations.

The PKM, portable, minelaying system consists of a mounting-base assembly, blasting machine, and wire communications link. The mine dispensing canister containing an internal framework or magazine holding one or more scatterable mines depending on type is loaded onto the mounting base. The internal magazine is then launched from the canister.

The PKM weighs 2.63 kg (5.8 lbs.) without the mine canister and consists of a single launch tube with a base mount, a blasting machine and a reel of electric ignition wire. The operator loads a propelling charge and mine canister into the launch tube, mounts the tube on the edge of a trench or firing parapet, aims the tube, connects the wire to the tube, moves off a safe distance and connects the wire to the blasting machine and then cranks the blasting machine. The PKM propels the canister some 30-100 meters (depending on the type of mine) and lays an antipersonnel mine field of 10X20, 10X40 or 20X10 meters (again depending on the type of mine used). It takes a trained operator five minutes to set up the PKM and create a minefield. The POM-1S (AP) mine canister most likely produces the 10X20 meter field while the POM-2S (AP) mine canister most likely produces the 10X40 meter field. The PFM-S mine canister (AP) most likely produces the 20X10 meter field. The PKM can also be used to launch POM-2S AT mines and PTM-1S and PTM-3 antitank mines. Numbers of mines per canister are: 64 PFM-1S, 4 POM-2S, and 1 PTM-1S or PTM-3.

The portable minelaying set is capable of remotely laying a minefield with an area of 200-400 m2 at a distance up to 100 meters from the position in any threatened sector, can be used in the course of battle to combat enemy infantry ahead of the FEBA or when it wedges into platoon flanks or gaps between squad positions.

Like the UMZ (the truck mounted mine scattering system), the Russians use the PKM to lay minefields to protect subunit positions, flanks and boundaries between subunits. PKM-laid minefields also cover firing lines and gaps in combat formations. The PKM can quickly close reaches in existing minefields and increase the density of mines on armor avenues of approach. Here are the specifications: Weight of set, kg: 2.6. Dimensions for traveling, mm: 380X150X140. Laying method: fire from cluster (remote). Types of mines laid: PFM-1S, POM-2, and PTM-3. Time required to prepare the set for laying mines: up to 5 min.

RUSSIAN TRACKED MINELAYING VEHICLE GMZ-3



SYSTEM	SPECIFICATIONS	FEATURES (CONT.)	SPECIFICATIONS
System		Max Swim:	N/A
Alternative Designations:	INA	Fording Depths (M):	N/A
Date Of Introduction:	1963	Radios, Frequency, And Range:	
Proliferation:	Russia and Former Soviet Union	R-123	
Description:		Operating Speed (km/h):	
Crew:	3	Burying:	6
Troop Capacity:	N/A	Surface Laying:	16
Chassis:	Based on the SA-4 (GANEF) SAM	Mine Spacing (m):	5 and 10
Combat Weight (Mt):	28.5	Minelaying Pattern: (Straight line or staggered)	yes
Length Overall (M):	8.62	Mine Combat Load:	208
Height Overall (M):	2.7	Mine Weight (kg):	<12
Width Overall (M)	3.25	Time Required to Load Minelayer with One Basic Mine Load (min)	15-20
Ground Pressure (Kg/Cm2):	UNK	Main Armament:	7.62-mm PKT MG
Automotive Performance:		Max Effective Range (m):	Day: 2,000
Engine Type:	multi-fuel diesel	Rate of Fire (rd/min):	Practical: 250
HP:	513	Fire on Move:	Yes
Cruising Range (Km):	500	Loading Mines with (Crew Only) (m):	60
Speed (Km/H):		NBC Protection:	Yes
Max Road:	60	Smoke Screening System:	Yes
Max Off-Road:	30		

NOTES
MINES: TM-57 W/FUZE MVZ-57; TM-62 SERIES W/FUZES; TM-46; TMD-B; MV4-62; MVP-62 & W/PROX FUZE MVN-80. CREW: VEHICLE COMMANDER, DRIVER-MECHANIC, AND THE MINELAYER OPERATOR. COMMANDER AND DRIVER IN THE FORWARD SECTION THE OPERATOR COMPARTMENT IS LOCATED IN THE REAR PORTION OF THE VEHICLE. THE GMZ-3 HAS A DIGITAL NAVIGATION SYSTEM ALLOWING PRECISE TOPOGRAPHIC TIE-IN OF THE MINEFIELD BEING LAID. VARIANTS: GMZ; GMZ-2. SMOKE: 6 81-MM LAUNCHERS, 3 ON EACH SIDE.

RUSSIAN TOWED MECHANICAL MINELAYER PMZ-4 AND PMR-3





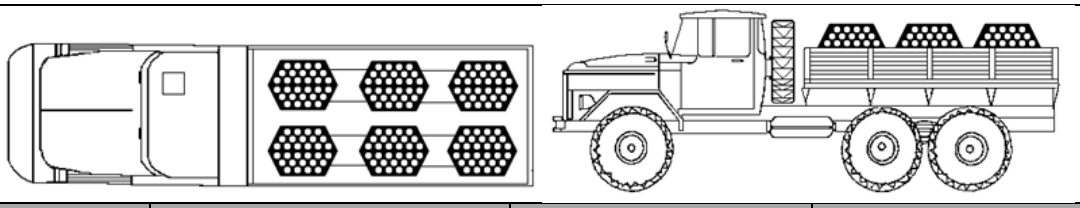
SYSTEM	SPECIFICATIONS	FEATURES (CONT.)	SPECIFICATIONS
System		Max Swim:	Not Applicable
Alternative Designations:	INA	Fording Depths (M):	Not Applicable
Date Of Introduction:	INA	Radios, Frequency, And Range:	Not Applicable
Proliferation:	At least 17 countries	None	
Description:		Operating Speed (km/h):	
Crew:	6	Burying:	2 to 3
Troop Capacity:	None	Surface Laying:	4 to 10
Chassis:	Not applicable	Mine Spacing (m):	3 to 4
Combat Weight (Mt):	1.3	Minelaying Pattern: (Straight line or staggered)	Straight line
Length Overall (M):	5.6	Mine Combat Load:	See notes
Height Overall (M):	2.7	Mine Weight (kg):	INA
Width Overall (M)	3.25	Minelaying Rate (min):	10 to 12
Ground Pressure (Kg/Cm2):	Not applicable	Main Armament:	None
Automotive Performance:		Max Effective Range (m):	None
Engine Type:	Not applicable	Rate of Fire (rd/min):	None
HP:	Not applicable	Fire on Move:	No
Cruising Range (Km):	Not applicable	Time Required to Load Minelayer with (Crew Only) (m):	
Speed (Km/H):		NBC Protection:	No
Max Road:	Not applicable	Smoke Screening System:	No
Max Off-Road:	Not applicable	Variants	Yes

NOTES

PRIME EQUIPMENT MOVER: 6X6 ZIL-131 TRUCK (200 MINES) OR 4X4 URAL-375D (350 MINES) OR BTR-152 (120 MINES). TYPES OF MINES: TM-44, TM-46, TM-57, TM-62 SERIES, TM-72, TMD-B. MAX BURIAL DEPTH (CM): 20. PMR-3, (AND THE SIMILAR PMZ-4) CONSISTS OF A SINGLE CHUTE AND A PLOW ATTACHMENT. DIFFERENCES: PMZ-4 (PIC LEFT) HAS A CABLE LAYER USED FOR LAYING CONTROLLED MINEFIELDS AND DOES NOT HAVE A CONVEYER-BELT CHAIN DRIVE ON THE WHEELS. PMZ-4 HAND LOADED ONLY. TOWED-MINELAYERS ARE USED IN SECTIONS OF THREE OR FOUR AND OPERATE 20 TO 40 METERS APART WITH EACH MINELAYER LAYING A STRAIGHT-LINE ROW. MINES IN DIFFERENT

ROWS ARE STAGGERED WITH THE DISTANCE BETWEEN MINES DEPENDING ON WHETHER THE MINES ARE PRESSURE-INITIATED OR FULL-WIDTH ATTACK (INFLUENCED OR TILT-ROD FUZED).

RUSSIAN SCATTERABLE MINELAYING SYSTEM UMZ



SYSTEM	SPECIFICATIONS	FEATURES (CONT.)	SPECIFICATIONS
System		Max Swim:	INA
Alternative Designations:	Multipurpose Minelayer	Fording Depths (M):	1.4
Date Of Introduction:	Designed Late 1970s	Radios, Frequency, And Range:	
Proliferation:	Russia and Former Soviet Union	R-159	Yes
Description:		Operating Speed (km/h):	10 to 40
Crew:	2	Burying:	Not applicable
Troop Capacity:	N/A	Surface Laying:	See Notes
Chassis:	ZIL-131 Truck (see VARIANTS)	Mine Spacing (m):	See Notes
Combat Weight (Mt):	10	Minelaying Pattern: (Straight line or staggered)	See Notes
Length Overall (M):	7.1	Mine Combat Load:	See Notes
Height Overall (M):	2.5	Mine Weight (kg):	See Notes
Width Overall (M)	3	Time Required to Load Minelayer with One Basic Mine Load (min)	60-90
Ground Pressure (Kg/Cm2):		Main Armament:	None
Automotive Performance:		Max Effective Range (m):	Not applicable
Engine Type:	V8, gas	Rate of Fire (rd/min):	Not applicable
HP:	150	Fire on Move:	Not applicable
Cruising Range (Km):	525	Time Required to Load Minelayer with (Crew Only) (m):	INA
Speed (Km/H):		NBC Protection:	INA
Max Road:	80	Smoke Screening System:	No
Max Off-Road:	30		

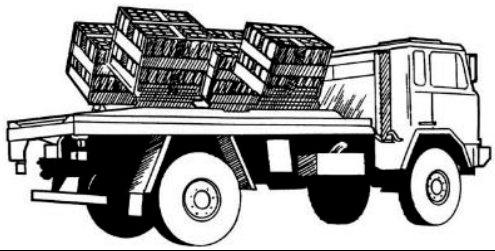
NOTES

THE UMZ HAS BEEN DISCLOSED AS THE LIKELY REPLACEMENT FOR THE GMZ-SERIES. THE UMZ CONSISTS OF THREE LAUNCHERS MOUNTED ON EACH SIDE OF THE VEHICLE FOR A TOTAL OF SIX MINE LAUNCHERS PER VEHICLE. EACH FULL TURN LAUNCHER IS HEXAGONALLY SHAPED AND CONTAINS 30 LAUNCH TUBES TOTALING 180. IT CAN FIRE THE MINES TO ONE OR BOTH SIDES, OR TO THE REAR. BOTH AP AND AT MINES ARE LAUNCHED FROM THE 140-MM LAUNCH TUBES. THE UMZ USES THE SAME MINE CANISTERS AS THE PKM SYSTEM. DEPENDING ON THE POSITION OF THE LAUNCH TUBES, ONE-, TWO-, OR THREE-LANE MINE FIELDS CAN BE LAID. MINEFIELD (M): LENGTH: 1,000 TO 1,200. DEPTH (M): 30 TO 120. MAX LENGTH OF MINEFIELD WITH ONE BASIC LOAD (M): AP, PFM-1S: 3,200. AP, POM-2: 5,000. AT, PTM-3: 600. MINE CAPACITY: FROM 180 TO 11,520 DEPENDING ON THE TYPE OF MINE NUMBER OF MINES IN ONE BASIC LOAD: AP, PFM-1S: 11,520. AP, POM-2: 720. AT, PTM-3: 180. VARIANTS: ALTHOUGH PRIMARILY MOUNTED ON THE ZIL-131, THE UMZ MINELAYING SYSTEM HAS BEEN OBSERVED MOUNTED ON SEVERAL



DIFFERENT CARRIERS SUCH AS A MODIFIED MTLB-U CHASSIS OR ON A PT-S TRACKED AMPHIBIOUS PERSONNEL CARRIER.

ITALIAN MINE LAUNCHING SYSTEM VALSELLA LSTRICE-VS-MTLU-1



SYSTEM	SPECIFICATIONS	FEATURES (CONT.)	SPECIFICATIONS
System		Max Swim:	INA
Alternative Designations:	INA	Fording Depths (M):	1.4
Date Of Introduction:	1987	Radios, Frequency, And Range:	INA
Proliferation:	At least 17 countries	Vertical Step (m):	.53
Description:		Operating Speed (km/h):	10 to 40
Crew:	2	Burying:	Not applicable
Troop Capacity:	INA	Surface Laying:	See Notes
Chassis:	Iveco Fiat-90-PM	Mine Spacing (m):	See Notes
Combat Weight (Mt):	10	Minelaying Pattern: (Straight line or staggered)	See Notes
Length Overall (M):	7.1	Mine Combat Load:	See Notes
Height Overall (M):	2.5	Mine Weight (kg):	See Notes
Width Overall (M)	3	Time Required to Load Minelayer with One Basic Mine Load (min)	INA
Ground Pressure (Kg/Cm2):	INA	Main Armament:	Not applicable
Automotive Performance:		Max Effective Range (m):	Not applicable
Engine Type:	V8, gas	Rate of Fire (rd/min):	Not applicable
HP:	150 hp	Fire on Move:	Not applicable
Cruising Range (Km):	525	Time Required to Load Minelayer with (Crew Only) (m):	90-120
Speed (Km/H):		NBC Protection:	INA
Max Road:	80	Smoke Screening System:	INA
Max Off-Road:	INA		

NOTES

MINE TYPES: VS-MK2, EM-20, VS-50, TS-50, VS-1.6, VS-1.6/AR, VS-1.6/AN, VS-2.2. MINELAYING EQUIPMENT: MAGAZINE LAUNCHER SIZE: 1.15 M X 0.86M. DISTANCE MINES LAUNCHED FROM VEHICLE (M): 30-60. MINEFIELD (M): LENGTH: 3,200 TO 5,000. DEPTH: 60 TO 120. MAX LENGTH OF MINEFIELD WITH ONE BASIC LOAD (M): AP, VS-MK2: 3,200. AP, TS-50: 5,000. AT, VS-1.6, VS-2.2: 600. LENGTH OF TRIPLE-ROW MINEFIELD (M): 150 TO 1,250 (DEPENDENT). MINE CAPACITY: FROM 256 TO 6,144 (DEPENDENT). NUMBER OF MINES IN ONE BASIC LOAD (A SERIES): AP, VS-MK2: 6,144. AP, TS-50: 6,144. AT, VS-1.6: 512. AT, VS-2.2: 512. NUMBER OF MINES IN ONE BASIC LOAD (B SERIES): AP, VS-MK2: 2,560. AP, TS-50: 2,560. AT, VS-1.6: 256. AT, VS-2.2: 256. TIME FROM TRAVEL TO OPERATING POSITION (MIN): 5.

Explosive Charge Minefield Breaching Systems

Minefield breaching explosive line charge systems are in use throughout the world. These systems provide the maneuver commander a method to expeditiously breach antitank or antipersonnel minefields. Once identified on the battlefield however, these systems can become a priority target. Some systems, single or double line, are mounted on tanks while others are mounted on trailers, armored vehicles, and trucks. Some other systems are man-portable. The larger vehicle and trailer-mounted systems are designed to clear lanes through minefields/obstacles, large enough for the passage of ground combat vehicles. Man-portable (infantry) systems clear passage for at least one person to transit. The explosive filled lines are usually connected to a launcher by a cable, fired over a minefield (within which it lands) and then detonated to create a breach through the minefield. Standoff between the explosive charge and launcher varies. For instance, the Japanese CX has a standoff of 800 meters from the launcher.

Truck or Trailer Mounted Mine breaching Systems

Motorized and infantry units may have either wheeled or towed antitank mine breaching systems. While some of these systems can be dismounted, most are fired from the back of cargo trucks or from trailers. A typical "truck-mounted explosive minefield breaching system" is the FSU UR-83P (below).

Name	Country of Origin	Chassis	System (or Shell) Weight (kg) Overall: Rocket: Explosive Explosive/m	Range (m)	Length (m)	Standoff (m)	Effectiveness Lane Width (m): Lane Length (m) Lane clearing time (min)	Type Launcher/ # Line Charges	Rocket Diameter (mm)	Operators	Explosive Type /#/ Notes
UR-83P	FSU	Truck (ZIL-131) or trailer	Dimensions (m) (ready for launch) Length: 1.5 Width: 1.5 Height: 2.6 Launcher Wt (kg): Total: 230 Packaged: 360 Charge: 1,380	440	114		LL: 115 LW: 6 Assembly time by engineer squad (min): 90	Line UZP-83 charge		2	portable dismountable
Type 81	CH	EQ-240 Truck chassis	Loaded: 5,112 Unloaded: 4,082 Exp: unk Exp/m: unk	3,000	na	2,900 +	LL: 60+ LW: 10+	10 tube	2,530	3	HE, FAE ea round clears 18 m radius in AP.

The Type 81 mine clearing rocket system consists of a 10-tube launcher mounted on the rear of a modified EQ-240 chassis. Rockets are loaded manually by three persons. Although it is uncertain, warheads for this system are filled with conventional HE, FAE or a combination of both. The Chinese have stated that this system is effective against AP mines, but its effectiveness against AT mines is unknown. The range of this system is 3,000 meters, which provides the system with a maximum standoff of approximately 2,900 meters. Each round clears an 18-meter radius within an AP minefield. It is not known whether this is for the FAE or high-explosive warhead. The Type 1987 has 24 launch tubes and is mounted on a Type 59/69 tank chassis.

Mine Breaching Systems and Tracked-Vehicle-Mounted Systems

This section provides information on minefield breaching systems including system "additions" for tracked vehicles. There are a number of systems that are used to breach obstacles such as minefields. Some systems use tracked (tank) chassis as launch carriers that allow the mine breaching system to have similar mobility and maneuverability on the battlefield as mechanized units; however, the use of these systems does not allow tanks or mechanized vehicles to conduct a "Blitzkrieg" type rush across the minefield. Systems found in armor and mechanized divisions will generally be mounted on tracked vehicles due to mobility requirements. Although these minefield breaching systems may (or may not) be mounted on tanks they also may or may not belong to the maneuver commander depending on the task organization of the Threat. Many of these assets belong organically to engineer units. Further information on engineer elements can be found within TC 7-100.2, *Opposing Force Tactics* (CH12), and TC 7-100.4, Hybrid Threat Force Structure Organization Guide for the order of battle (non-task organized). The following tables provides information on OPFOR mine breaching systems:

Truck or Trailer Mounted Mine breaching Systems

Motorized and infantry units may have either wheeled or towed antitank mine breaching systems. While some of these systems can be dismounted, most are fired from the back of cargo trucks or from trailers.

Name	Country of Origin	Chassis	System (or Shell) Weight (kg) Overall: Rocket: Explosive Explosive/m	Range (m)	Length (m)	Standoff (m)	Effectiveness Lane Width (m): Lane Length (m) Lane clearing time (min)	Type Launcher/ # Line Charges	Rocket Diameter (mm)	Operators	Explosive Type /#/ Notes
UR-83P	FSU	Truck (ZIL-131) or trailer	Dimensions (m) (ready for launch) Length: 1.5 Width: 1.5 Height: 2.6 Launcher Wt (kg): Total: 230 Packaged: 360 Charge: 1,380	440	114		LL: 115 LW: 6 Assembly time by engineer squad (min): 90	Line UZP-83 charge		2	portable dismountable
Type 81	CH	EQ-240 Truck chassis	Loaded: 5,112 Unloaded: 4,082	3,000	na	2,900 +	LL: 60+ LW: 10+	10 tube	2,530	3	HE, FAE ea round clears 18 m radius in AP.

			Exp: unk Exp/m: unk								
The Type 81 mineclearing rocket system consists of a 10-tube launcher mounted on the rear of a modified EQ-240 chassis. Rockets are loaded manually by three persons. The Chinese have stated that this system is effective against AP mines, but its effectiveness against AT mines is unknown. The range of this system is 3,000 meters, which provides the system with a maximum standoff of approximately 2,900 meters. Each round clears an 18-meter radius within an AP minefield. The Type 1987 has 24 launch tubes and is mounted on a Type 59/69 tank chassis.											

Tracked-Vehicle-Mounted Systems

Systems mounted on the rear of tanks increase the survivability of the platform and therefore increase the likelihood that it may be successfully employed prior to its destruction. The use of a tracked chassis as the launch carrier gives the system the same mobility and maneuverability on the battlefield as mechanized units; however, use of these systems does not allow tanks or mechanized vehicles to conduct a "Blitzkrieg" type rush across the minefield. Systems found in armor and mechanized divisions will generally be mounted on tracked vehicles due to mobility requirements. Although these minefield breaching systems may (or may not) be mounted on tanks they do not belong to the maneuver commander. They are engineer assets and are found in rather limited numbers. Two of these systems are in the Mine clearing Platoon, Mine Warfare Company, Division Engineer Company, and Engineer Battalion of a mechanized/armored division, engineer brigade, or Corps. Further information on these elements can be found in TC 7-100.2.

Tracked-Vehicle-Mounted Systems											
Name	**Country of Origin**	**Chassis**	**System (or Shell)** **Weight (kg)** Overall: Rocket: Explosive Explosive/m	**Range (m)**	**Length (m)**	**Standoff (m)**	**Effectiveness** Lane Width (m): Lane Length (m) Lane clearing time (min)	**Type Launcher/# Line Charges**	**Rocket Diameter (mm)**	**Crew**	**Explosive Type /#/ Notes**

Type 84	CH	Tank or other armored vehicle	OA: 800 Rocket: unk Exp: 400 Exp/m: 5	300	80	200	LL: 60 LW: 5	1	unk	unk	Line charge
The Type 84 mounts in a box on the rear of a tank or other vehicle. Inside the box is a rocket in a launch rail attached to the box lid, an 80-meter-long explosive hose, and a drag chute. The rocket pulls the explosive hose over the minefield or other obstacle, arming the fuze in flight. After a short delay, the hose explodes leaving a cleared path. The box is automatically discarded after firing. With a published range of 300 meters and a length of 80 meters, the standoff of the system is estimated to be approximately 200 meters.											
Type 762	CH	Type 83, 152-mm tracked howitzer	OA: unk Rocket: 760 Exp: 400 Exp/m: 3	1,000	130	800-900	LL: 130 LW: 12-22	2	425	unk	line charge. 32 charges 12 kg ea
The Type 762 is a twin-rail rocket launcher mounted on a Type 83, 152-mm tracked howitzer chassis. It carries two 425-mm GSL 211 mineclearing rockets. The warheads on GSL 211 rockets contain an explosive line charge that is extracted during flight. The line charge is composed of 32 fixed-interval explosive charges, each weighing 12 kg. When the explosive charge is at a specific height above the minefield, specially designed detonation fuzes at the head and tail of the line charge activate and simultaneously detonate the charges. The system is equipped with an ordinary rangefinder with questionable accuracy; it is uncertain how the system will perform when deployed over a minefield.											
SVO	CZ	BMP-1	Shell size: Length (mm): 1,457 Dia (mm): 246 Weight (kg): 42				LL: 100-120 LW: 5 Time btwn rounds (sec): 2.5	24 explosive rockets			fuze initiation rod length (m): .3
The Czech Republic's SVO is an armored, tracked, mine clearing vehicle used for combat breaches of AT and mixed minefields. The breach is conducted by the launching of mine clearing shells in a specific pattern in order to detonate all the mines along a pathway through the minefield. The entire system is contained in a modified BMP-1 chassis. The turret on the chassis has been removed and exchanged for a rocket firing platform. The firing platform contains 24 launch rods angled at different elevations											

and deflections in order to provide full warhead coverage for a path through the minefield. The front half of the compartment is for storing and launching the warheads, the other is the operator's position. The shells fit over the 24 launch rods and are projected into the air by the initiation of explosive cartridges. Piezoelectric fuzes located at the base of the fuze extension rods detonate the shells .3 meters above the ground. The SVO reportedly has a 95% probability of initiating single impulse, nonblast resistant, pressure-fuzed mines.											
UZ-67	F S U	2S1 mod	weight (kg): 2,400		93	200 and 350	LL: 75-80 LW: 6 Time: 3-5	2	unk	2	basic load of 2 line charges
UZ-77	F S U	2S1 mod	unk		93	200 & 500 water 200	LL: 80-90 LW: 6 Time: 3-5	2	unk	2	basic load of 2 line charges

Man-Portable Rocket Propelled Line Charges

Many countries and some insurgent groups produce small (1 or 2 man-portable) explosive line charges with a wide variety of capabilities and performance. Mechanized infantry units normally do not have these since the tracked vehicles clear a way for the dismounted infantry. The basis of issue of these systems for use by dismounted (or regular) infantry units is generally three per infantry battalion; nine per brigade/regiment; 27 per division. They are used only in the primary avenue of attack (or as a deception). Battlefield employment dictates that the line is fired and detonated. The infantry then moves as quickly as possible (probably under fire) along the cleared path ensuring they do not step on any uncovered/ unexploded mines. The line charges may be carried by one or more soldiers therefore the overall weight of the charges is important. The bullet trap line charge delivery method realizes a significant weight savings by eliminating the additional weight of a rocket. The soldier simply uses his standard issue weapon to deliver the detonating cord/hose across the minefield. This places limitations on the length and weight of the delivered charge. A typical "infantry explosive minefield breaching system" is the FSU ZRP-2. It is a mine demolition charge designed to blast lanes through AP minefields. The ZRP-2 consists of a detonating cable, powder rocket engine, connecting cable, fuze, braking cord, launching table, launching device, anchor and carrying pack. The charge is launched into an AP minefield with the aid of launching device UP-60 from a position prepared on the ground surface. The charge is detonated remotely by a mechanical fuze. The charge is straightened in the minefield manually with the braking cord while the fuze retarder is burning.

ZRP-2 (FSU) Mine demolition charge	
Type	extended, single-line, made of detonating cable DKR-150A
Weight of set (kg)	50 packaged, 34 in pack
Crew, men	1 or 2
Length of charge (m)	60
Charge launching range (m)	140-160
Size of passage through AP minefield (m)	55 length x 0.4 width
Launch preparation time (min)	5

Infantry Line Charges				
Name	**Country**	**Delivery Method**	**Explosive Weight (kg/m)**	**Length (m)**
Type 73	China	Rocket	2.40	106
Type 74	China	Rocket	2.40	100
Type 81	China	Rocket	0.10	100
Type 84	China	Rocket	0.40	28
ODMIRA-60	Czech Rep	Rocket	NA	60
FATEH-1	Egypt	Rocket	0.42	120
Comet No 3001	Germany	Rocket	0.10	72
Comet No 3010	Germany	Rocket	0.57	53
Ladder 80	Germany	Rocket	NA	70
Unknown	Iraq	Bullet trap	NA	40
POMINS I	Israel	Bullet trap	0.27	50
POMINS II	Israel	Rocket	NA	50

Type 70	Japan	Rocket	1.41	136
Unknown	North Korea	Rocket	NA	180
Clap/M	Pakistan	Rocket	0.05	300
M/60	Sweden	Rocket	NA	150
Unknown	South Africa	Rocket	NA	35
Unknown	South Africa	Rocket	NA	120
RAMBS	UK	Bullet Trap	0.02	40
RAMBS 2	UK	Bullet Trap	unknown	60
ROMANS	UK	Rocket	unknown	50

UGV Primer

Unmanned Ground Vehicles or UGVs have been in service for close to forty years, detecting hazards, marking and clearing roads, and supporting the defeat of explosive devices such as mines, and explosive hazards. This mission traditionally was performed by combat engineers such a Sappers and explosive ordnance disposal (EOD), personnel and specialized police forces. The work can be extremely dangerous as it requires human contact with potentially lethal explosive devices, and hazardous materials. For this reason, UGVs have found a niche in identifying, disarming and disposing of explosives and other hazardous materials while providing combat engineers the standoff distance necessary to increase survivability. It is estimated that the global market for these types of devices will increase to $8.26 billion by the year 2020.

UGVs are credited with reducing ground troop's exposure to danger through a combination of tactics, techniques, and procedures (TTP) used to leverage this new technology. Some of the new technology that is emerging from this sector includes UGVs that are self-aware, multi-functional, energy efficient, and can operate in a variety of terrain. There are a variety of systems on the market that are designed for explosive disposal ranging in size and capability. The categories are mini, mid, and large size UGVs. Most explosive disposal UGVs fall into the Mid-sized category, as they are easy to remotely control, have a small enough profile to provide access to an emplaced explosive device, while at the same time being large enough to manipulate the devices in order to disable them. Some larger UGVs are being used in other types of combat Engineer support activities such as route clearance, and logistics support. These UGVs can look like modified tractors or forklifts with a special sensors for identifying targets, rollers and scoops to defeat mines or remove obstacles.



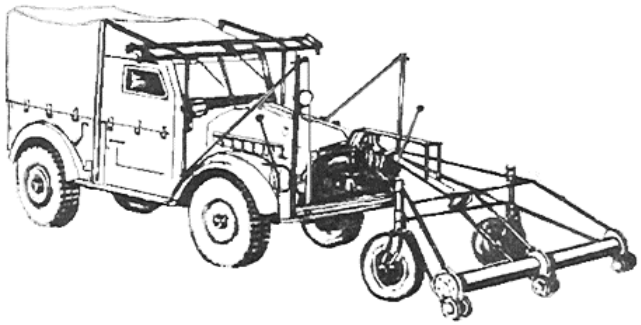
Figure 1: Inspector Mid-Sized Robot, Poland

Many UGVs have tracked belt and wheel system for driving over complex terrain in all types of weather. UGV's that perform reconnaissance functions usually move with relatively large treaded wheels for speed and maneuverability. Usually logistical UGVs are have wheels in order to keep supplies close to maneuver units on the battle field. Legged robots like Boston Dynamics Legged Squad Support System, (LS3) otherwise known as Big Dog, attempt to achieve an all-terrain capability through the employment of a quadrupedal gait. The Big Dog program has been "shelved" by the US Marines.

Challenges with UGVs are mainly with maintaining reliable command and control links between the device and the operator. This critical link, requires the operator to gaze into a computer screen while interpreting everything the UGV sees with its usually limited optical sensor. While the operator is engaged in controlling the UGV the Soldier is unable to perform other security duties and has limited situational awareness. One way to handle this

problem is to make UGVs self-aware by installing automatic target recognition (ATR), algorithms that instruct the device on how to approach and defeat obstacles. Additionally the onboard data base is loaded with the most current map data and a satellite based navigation system in order for the device to move autonomously to its target. The link between robot and operator will not be completely severed in the near future as artificial intelligence is unable to build into the device's electronics the ability to make decisions in a complex combat environment, so operators will still be needed to have a way to give commands and establish control when necessary.

RUSSIAN VEHICLE-MOUNTED MINE DETECTOR DIM



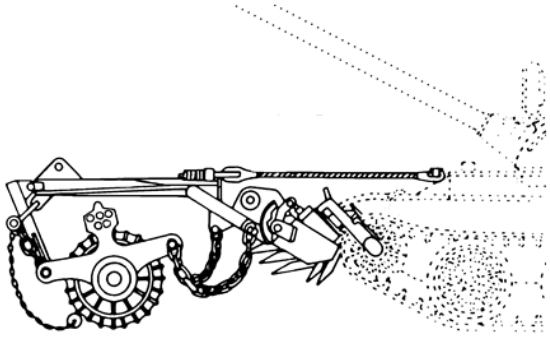
SYSTEM	SPECIFICATIONS	FEATURES (CONT.)	SPECIFICATIONS
System		Max Swim:	INA
Alternative Designations:	None	Fording Depths (M):	INA
Date Of Introduction:	Pre-1975	Radios, Frequency, And Range:	INA
Proliferation:	Widespread	Vertical Step (m):	INA
Description:		CAPABILITIES	SPECIFICATIONS
Crew:	2	Operating (scan) Speed (km/h):	10
Troop Capacity:	INA	Mounting/dismounting Time (min):	Up to 7
Chassis:	Used on UAZ-469/69 or other light 4x4 vehicles	Detection Ability:	Can detect metallic mines in roadways, airfields, and other flat terrain.
Combat Weight (Mt):	INA	Max Detection Depth (cm):	25
Length Overall (M):	INA	Max Detection Depth While Fording (cm):	70
Height Overall (M):	INA	VARIANTS	None
Width Overall (M)	INA		
Ground Pressure (Kg/Cm2):	INA		
Automotive Performance:	INA		
Engine Type:	INA		
HP:	INA		
Cruising Range (Km):	INA		
Speed (Km/H):			
Max Road:	INA		
Max Off-Road:	INA		

NOTES

COMPONENTS: DETECTION SYSTEM, PNEUMATIC SYSTEM, ELECTRONIC SYSTEM. THE DIM IS A LARGE PULSE-INDUCTION MINE-DETECTION DEVICE MOUNTED TO A LIGHT 4X4 TRUCK. THE DETECTION ELEMENT FASTENS TO A FRAME ON THE FRONT OF THE VEHICLE. WHEN A MINE IS DETECTED, THE VEHICLE BREAKING SYSTEM IS ENGAGED AND THE CLUTCH IS DISENGAGED. THE FULL-WIDTH DETECTION HEAD, LOCATED 2.6 METERS FROM THE VEHICLE'S

FRONT WHEELS TO PROVIDE STOPPING DISTANCE, IS DIVIDED INTO SIX COMPONENTS TO PINPOINT MINE LOCATION. THE ELECTRONIC SYSTEM ALSO DISPLAYS WHICH COMPONENT OF THE MINE-DETECTOR HEAD THE MINE IS UNDER. IT ALSO HAS ATTACHED ROLLERS SO THAT THE HEAD DOES NOT COME IN CONTACT WITH GROUND OBJECTS. CROSS-COUNTRY CAPABILITY IS VERY LIMITED; THEREFORE THE DIM IS GENERALLY USED FOR CLEARING PREPARED SURFACES. THE DETECTION EQUIPMENT SWINGS UPWARD TO RIDE ON THE TOP OF THE VEHICLE CAB FOR TRAVELING. WHEN NEEDED IT IS SWUNG FORWARD TO REST ON TWO WHEELS.

RUSSIAN TANK-MOUNTED MINECLEARING ROLLER-PLOW KMT-5



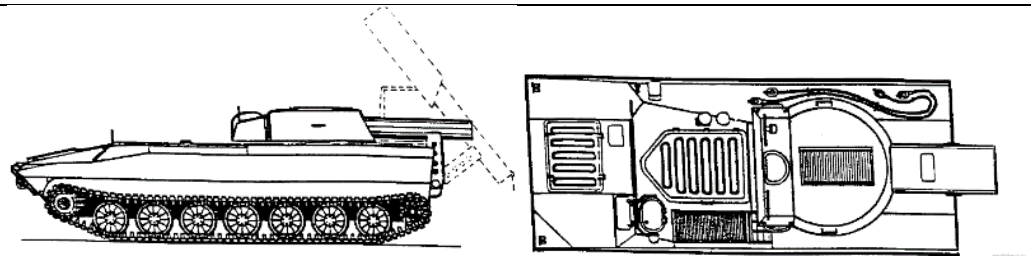
SYSTEM	SPECIFICATIONS	FEATURES (CONT.)	SPECIFICATIONS
System		Max Swim:	None
Alternative Designations:	INA	Fording Depths (M):	None
Date Of Introduction:	1960s	Radios, Frequency, And Range:	None
Proliferation:	At least 20 countries	Vertical Step (m):	INA
Description:		CAPABILITIES	SPECIFICATIONS
Crew:	2	Type:	Roller and plow
Troop Capacity:	INA	Form:	3 rollers x 2
Chassis:	Mounted on T-54, T-55, T-62, other medium tanks	Number of Rollers Per Set:	2
Combat Weight (Mt):	7.5	Total Number of Rollers:	6
Length Overall (M):	3.2	Mine Removal Speed (km/h):	8-12
Height Overall (M):	INA	Cleared Lane Width, each (mm):	810 x 2
Width Overall (M)	4	Mineclearing Track Width (mm):	810
Ground Pressure (Kg/Cm2):	INA	Installation Time (min):	30 to 45
Automotive Performance:	None		
Engine Type:	None		
HP:	None		
Cruising Range (Km):	None		
Speed (Km/H):			
Max Road:	None		
Max Off-Road:	INA		

NOTES

THE KMT-5M MINE ROLLER-PLOW IS VERY FLEXIBLE, SINCE IT ALLOWS FOR EITHER THE PLOWS OR THE ROLLERS TO BE USED. THE ROLLERS FUNCTION SATISFACTORILY AGAINST MINES EQUIPPED WITH SIMPLE PRESSURE FUZES, BUT OTHER MINES WILL DEFEAT THIS EQUIPMENT. HOWEVER, THE ROLLER-PLOW COMBINATION ALSO ALLOWS THE TANK TO COUNTER MORE SOPHISTICATED FUZES WITH PLOWS DESIGNED TO UNCOVER OR PUSH MINES ASIDE. THE PLOWS AND ROLLERS CANNOT WORK SIMULTANEOUSLY. THE KMT-5M ALSO INCLUDES A LUMINOUS LANE-MARKING DEVICE FOR NIGHT OPERATIONS. BECAUSE PLOWS AND ROLLERS DO NOT CLEAR THE AREA BETWEEN THEM A "DOG BONE" OR LIGHT CHAIN WITH ROLLERS IS STRETCHED BETWEEN THE ROLLER SECTIONS TO DEFEAT TILT-ROD MINES.

QUICK DISCONNECTS ALLOW THE OPERATOR TO DROP EITHER PLOWS OR ROLLERS OR BOTH; OTHERWISE, THE CREW CAN REMOVE THE SYSTEM IN 8 TO 13 MINUTES. ALL CURRENT MEDIUM TANKS HAVE FITTINGS FOR ATTACHING MINE CLEARING EQUIPMENT. THERE IS ONE PLOW PER TANK PLATOON AND ONE ROLLER PER COMPANY. FOR TANKS NEWER THAN THE T-55/62 THE PLOWS ARE NO LONGER CARRIED IN THE ENGINEER COMPANY, BUT ARE PERMANENTLY MOUNTED ON THE TANK. THEREFORE THE ENGINEERS NEED ONLY TO TRANSPORT THE ROLLERS. ONE KRAZ-255B TRUCK (WITH KM-61 CRANE) OR TWO ZIL-131 TRUCKS CAN CARRY ONE KMT-5M.

RUSSIAN TRACKED MINE CLEARING VEHICLE MTK-2



SYSTEM	SPECIFICATIONS	FEATURES (CONT.)	SPECIFICATIONS
System		Max Swim:	INA
Alternative Designations:	UR-77 mine clearing vehicle, M1979	Fording Depths (M):	INA
Date Of Introduction:	1981	Radios, Frequency, And Range:	INA
Proliferation:	FSU and former Warsaw Pact armies	Vertical Step (m):	INA
Description:		MINE CLEARING EQUIPMENT	
Crew:	2	Type:	Explosive line
Troop Capacity:	INA	Charges Used:	UZP-77, UZ-67
Chassis:	Based on the 2S1	Length of Charge (m):	93
Combat Weight (Mt):	15.5	Length of Charge Feed (m):	See Notes
Length Overall (M):	8.4	Size of Lane in AT Minefield (m):	See Notes
Height Overall (M):	3.1	Breaching Time (min):	3 to 5
Width Overall (M)	2.8	Variants	INA
Ground Pressure (Kg/Cm2):	INA		
Automotive Performance:			
Engine Type:	INA		
HP:	INA		
Cruising Range (Km):	500		
Speed (Km/H):			
Max Road:	60		
Max Off-Road:	30		

NOTES

THE MTK-2 CLEARS LANES IN MINEFIELDS BY USING ROCKET-PROPELLED CHARGES. THE CHARGES ARE LAUNCHED ONTO THE MINEFIELD AND THEN DETONATED BY THE VEHICLE COMMANDER-OPERATOR FROM WITHIN THE VEHICLE. THE CHARGE CAN BE FIRED ON LAND OR IN THE WATER. LENGTH OF CHARGE FEED (M): UZP-77: 200 AND 500. UZ-67: 200 AND 350 SIZE OF LANE IN AT MINEFIELD (M): WIDTH: UP TO 6 LENGTH (USP-77): 80-90 LENGTH (UZ-67): 75-80

RUSSIAN ARMORED ROUTE-CLEARING VEHICLE BAT-2



SYSTEM	SPECIFICATIONS	FEATURES (CONT.)	SPECIFICATIONS
System		Max Swim:	INA
Alternative Designations:	None	Fording Depths (M):	1.3
Date Of Introduction:	1981	Radios, Frequency, And Range:	INA
Proliferation:	At least 2 countries.	Vertical Step (m):	.8
Description:		Trench Crossing (m): 2.7	2.7
Crew:	2+8	Automotive Performance:	
Troop Capacity:	8	Engine Type:	V-64-4 multi-fuel diesel
Chassis:	MT-T	HP:	700
Combat Weight (Mt):	39.7	Cruising Range (Km):	500
Length Overall (M):	9.64	Speed (Km/H):	
Height Overall (M):	3.69	Max Road:	INA
Width Overall (M)	4.2	Max Off-Road:	INA
Clearance (mm):	430		
Automotive Performance:			
Engine Type:	V-64-4 multi-fuel diesel		
HP:	700		
Cruising Range (Km):	500		
Speed (Km/H):			
Max Road:	INA		
Max Off-Road:	INA		

NOTES

BLADE WIDTH (M): VARIABLE. MOUNTED VERTICALLY IN FRONT AND OVER THE CREW CAB WHEN NOT IN USE. BULLDOZER POSITION: 4.5. ROAD CLEARING/BUILDING: 4.2. GRADING: 4.1-4.35. OPERATING DEPTH (SOLID AND FROZEN SOIL) (M): .5. OPERATING SPEED (KM/H): ROAD BUILDING: GROUND UNOBSTRUCTED: 6-8. GROUND WITH TREES < 30 CM: 2-3. SNOW: 8-15 HOURLY CAPACITY (M3/HR): DITCH DIGGING: 200-250. FILLING IN DITCHES, CRATERS, ETC: 350-450. CRANE CAPACITY (MT): 2. BOOM LENGTH (M): 7.3. WINCH CAPACITY (MT): 25 CABLE

LENGTH (M): 100 THE BAT-2 IS A FOLLOW-ON TO THE BAT AND BAT-M DOZERS, BUT BETTER FITS THE CLASSIFICATION OF ARMORED ROUTE-CLEARING VEHICLE RATHER THAN THAT OF A HIGH-SPEED ARMORED DOZER. ITS CAB IS FULLY ARMORED AND IT IS DESIGNED TO OPERATE IN THE FORWARD AREAS OF THE BATTLEFIELD. THE WINDOWS IN THE FRONT, SIDES, AND REAR ARE BULLET-PROOF FURTHER ENHANCING BATTLEFIELD SURVIVABILITY.

THE ABILITY TO CARRY AN EIGHT-MAN ENGINEER SQUAD FACILITATES ITS ROLE IN THE MOVEMENT SUPPORT DETACHMENT. OTHER BAT-2 MISSIONS INCLUDE ROAD BUILDING, OBSTACLE, (STONE AND WOOD) REMOVAL, AND SNOW REMOVAL OPERATIONS. THE VEHICLE IS ALSO DESIGNED TO OPERATE IN URBAN TERRAIN AND AS AN NBC VEHICLE. STORAGE AREAS FOR ENGINEER SUPPLIES HAVE BEEN DESIGNED INTO THE VEHICLE. THE BAT-2 HAS A CRANE, A RIPPER, AND A WINCH.

RUSSIAN TRACKED ROUTE-CLEARING VEHICLE BAT-M

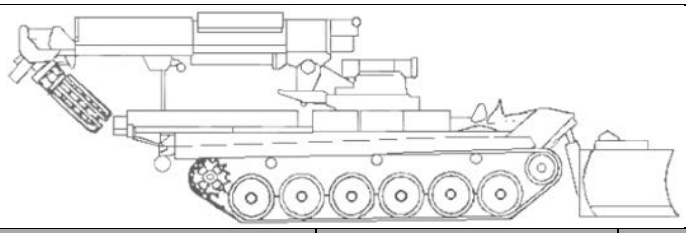


SYSTEM	SPECIFICATIONS	FEATURES (CONT.)	SPECIFICATIONS
System		Max Swim:	INA
Alternative Designations:	Dozer	Fording Depths (M):	.7
Date Of Introduction:	1967	Radios, Frequency, And Range:	INA
Proliferation:	Widespread	Vertical Step (m):	1
Description:		Trench Crossing (m): 2.7	1.57
Crew:	2	Time from Travel to Operating Position (min):	5 to 7
Troop Capacity:	INA	Variants	BAT. BAT-2: Based on MT-T artillery tractor
Chassis:	AT-T heavy tracked artillery tractor	Automotive Performance:	
Combat Weight (Mt):	26	Engine Type:	V-12 diesel
Length Overall (M):	10	HP:	
Height Overall (M):	3.5	Cruising Range (Km):	500
Width Overall (M)	4.7	Speed (Km/H):	35
Clearance (mm):	425	Max Road:	INA
		Max Off-Road:	INA

NOTES

BLADE WIDTH (M): 4.8 BLADE RATE (M3/HR): 250. OPERATING SPEED (KM/H): 10. ROTARY CRANE CAPACITY (MT): 2. THE BAT TRACTOR DOZER IS AN AT-T HEAVY TRACTOR WITH A LARGE DOZER BLADE MOUNTED AT THE FRONT OF THE HULL. IT IS DESIGNED FOR GENERAL ENGINEER USE, ROAD AND TRAIL CLEARING AND CONSTRUCTION. THE BAT-M IS AN IMPROVED MODEL (OVER THE BAT) AND IS ELECTRO-HYDRAULIC, WHEREAS THE BAT IS ELECTRO-PNEUMATIC. THE BAT-M ALSO HAS A HYDRAULIC CRANE, AND THE DOZER BLADE CAN BE SWUNG TO THE REAR IMPROVING THE VEHICLE'S LOAD DISTRIBUTION WHEN IN TRAVELING MODE.

RUSSIAN OBSTACLE CLEARING VEHICLE IMR-2M



SYSTEM	SPECIFICATIONS	FEATURES (CONT.)	SPECIFICATIONS
System		Max Swim:	INA
Alternative Designations:	INA	Fording Depths (M):	1.2
Date Of Introduction:	1982	Radios, Frequency, And Range:	R-173 radio, R-174 intercom
Proliferation:	FSU and former Warsaw Pact armies	Vertical Step (m):	INA
Description:		Trench Crossing (m): 2.7	1.57
Crew:	2	Time from Travel to Operating Position (min):	5 to 7
Troop Capacity:	INA	Variants	yes
Chassis:	T-72A	Automotive Performance:	
Combat Weight (Mt):	44.3	Engine Type:	12 cyl, diesel
Length Overall (M):	9.55	HP:	840
Height Overall (M):	3.68	Cruising Range (Km):	500
Width Overall (M)	3.73	Speed (Km/H):	60
Clearance (mm):	INA	Max Road:	INA
Gradient	25	Max Off-Road:	INA

NOTES

SYSTEM COMPONENTS: MULTIPURPOSE DOZER EQUIPMENT, BOOM, TREADWAY MINE EXPLODER. NIGHT DRIVING EQUIPMENT: YES. NBC PROTECTION SYSTEM: YES. BLADE: CAN BE USED AS A DOZER, GRADER AND V-BLADE, VERTICAL PLANE SKEW ABILITY. OPERATING SPEED (BULLDOZER) (KM/H): 8-12. EARTH DISPLACEMENT (M3/HR): 300. LANE CLEARING RATE (KM): .35. ALL-PURPOSE TOOL TRENCH DIGGING (1.1 TO 1.3M DEEP)(M3/HR): 8-10. PIT DIGGING (UP TO 2.5M DEEP) (M3/HR): 12-16. BOOM CAPACITY (MT): 2. REACH (M): 8.4. MINE SWEEPING SPEED (KM): AT PRESSURE MINES: 6-15. TILT ROD MINES: 7 VARIANTS: IMR: THE IMR IS A NBC-PROTECTED, COMBAT ENGINEER VEHICLE BASED ON THE T-54/55 TANK CHASSIS. IT IS FITTED WITH AN ARTICULATING DOZER BLADE AND A TELESCOPING CRANE THAT FITS A NUMBER OF ATTACHMENTS. IMR-2: EQUIPPED WITH MINE SWEEPERS AND MINE-CLEARING EXTENDED CHARGES. LINE DRAWING IS OF IMR-2. THE IMR-2M DIFFERS FROM THE IMR-2 IN THAT THE IMR-2M HAS NO LINE-LAUNCHED MINE CLEARING CHARGE. THE IMR-2M HAS MORE ARMOR, HYDRAULIC EQUIPMENT AND A SCRAPER-RIPPER.

RUSSIAN ENGINEER RECONNAISSANCE VEHICLE IRM



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative designations:	Zhuk (Beetle)	Name:	Machinegun PKT
Date of introduction:	1976	Caliber/length:	7.62-mm (7.62x 54R)
Proliferation:	Former Soviet Union	Type:	Lt Ball, Ball-T, API, API-T
Description:	Based on the BMP-1 chassis (7 road wheels instead of 6 on BMP-1)	Ammo:	7.62-mm PKT MG (Typical Combat Load 2,000)
Crew:	6 (commander, driver, 4x dismountable engineers)	Maximum Effective Range:	Max Effective Range (m): Day: 1,000 / 400-500 on the move. Night: 800
Combat weight (mt):	17	Armor penetration:	INA
Chassis length overall (m):	8.2 (detector arms in travel mode)	Muzzle velocity (m/s):	INA
Height overall (m):	2.4	Name:	INA
Width overall (m):	3.1	Caliber/length:	INA
Ground pressure (kg/cm2):	0.69	Type:	INA
Automotive performance:	UTD20	Ammo:	INA
Engine type:	Diesel	Maximum Effective Range:	INA
Cruising range (km):	500 HP 300	Armor penetration:	INA
Speed (km/h):	Max road: 52 Max off-road: INA Average cross-country: INA Max Swim: 12	Muzzle velocity (m/s):	INA
Fording depths (m):	3		
Radio:	Onboard and 2 x R-147 (dismt)	VARIANTS	SPECIFICATIONS
Protection:	INA	IPR:	Very similar to the IRM except it has a folding snorkel on the rear deck.
Armor, turret front (mm):	INA		
Applique armor (mm):	INA		
Explosive reactive armor(mm):	INA		
Active Protection System:	INA		
Self-entrenching blade:	No		
NBC protection system:	Yes, collective protection system		
Smoke equipment:	Vehicle engine exhaust smoke system (VEESS)		

Survivability equipment:	**INA**		

NOTES:

THE IRM ENGINEER RECONNAISSANCE VEHICLE CONDUCTS RECONNAISSANCE OF ROUTES, FORDS, WATER BARRIERS (VELOCITY, DEPTH, UNDERWATER OBSTACLES, AND BOTTOM PROFILE AND DENSITY), ICE, MAPPING, AND OVERALL TERRAIN TRAFFICABILITY. ITS CHASSIS EMPLOYS COMPONENTS OF THE BMP-1 IFV. IT HAS TWO PROPELLERS ON THE REAR OF THE HULL FOR PROPULSION IN THE WATER. A WAVE DEFLECTOR COVERS THE FRONT OF THE HULL. THE IRM HAS AN EMERGENCY EXTRACTION/SELF-RECOVERY SYSTEM AVAILABLE WHICH ALLOWS THE VEHICLE TO QUICKLY EXTRACT ITSELF WHEN STUCK IN MUD, ETC WITHOUT HAVING THE CREW EXIT THE VEHICLE. THE SYSTEM CONSISTS OF TWO RACKS OF 12 ROCKETS EACH MOUNTED ON THE REAR DECK BETWEEN THE PROPELLERS. THIS ROCKET PROPULSION SYSTEM IS ESPECIALLY VALUABLE IF THE VEHICLE IS STUCK WHEN UNDER ENEMY FIRE. WEAPONS & AMMUNITION TYPES. GRADIENT: 36.SIDE SLOPE: 17. MINE DETECTING CAPABILITY: TWO EXTENDABLE ARMS FOR MINE DETECTING. THE MINE DETECTOR ARMS ARE HYDRAULICALLY ARTICULATED TO THEIR OPERATING POSITION IN THREE MINUTES. THE DETECTOR WILL BRING THE VEHICLE TO A HALT UPON ENCOUNTERING AN OBSTACLE OR DETECTING A METALLIC OBJECT. HANDHELD MINE DETECTORS (2) AT MINE DETECTION ZONE (M) WIDTH: 3.6 DEPTH: .3. RIVER-TYPE WIDE-SPAN MINE DETECTOR: RSHM-2 (DETECTS MINES PLANTED DEPTH OF .3M WITH CURRENT VELOCITY OF 3-5 KM/H). MECHANICAL PENETROMETER (TO ANALYZE SOIL FOR TRAFFICABILITY). SONAR (ECHO SOUNDER WITH AN AUTO RECORDER AND THREE HYDRO-ACOUSTIC TRANSDUCERS) .5 TO 20 M (FOR WATER BOTTOM PROFILES, MINE AND OBSTACLE DETECTION). GYROCOMPASS AND GYRO-STABILIZED ARTIFICIAL HORIZON: AGI-1S SURVEILLANCE AND NIGHT OBSERVATION EQUIPMENT: TNPO-160, TNP-370, TVN-2BM. NAVIGATION: INERTIAL WITH CONSTANT COORDINATE AND DIRECTION READOUT: TNA-3. IR SEARCHLIGHT IS MOUNTED TO THE RIGHT OF THE PKT MG. EQUIPMENT FOR DISMOUNTED ENGINEER: DIGITAL CAMERA PORTABLE PERISCOPE: PIR-T. THE 15X PERISCOPE IS USED PRIMARILY FOR DETAILED STUDIES OF ENEMY STRUCTURES AND OBSTACLE SOIL PENETROMETER, PORTABLE ICE DRILL LASER RANGEFINDER, THERMAL VIEWER, HANDHELD GPS RECEIVER, HANDHELD MINE DETECTORS, PORTABLE: RVM-2M AND IMP-2. RADIOS, HANDHELD: R-147 (X2)

CZECHOSLOVAK ARMORED VEHICLE-LAUNCHED BRIDGE MT-55A



SYSTEM	SPECIFICATIONS	FEATURES (CONT.)	SPECIFICATIONS
System		Max Swim:	INA
Alternative Designations:	None	Fording Depths (M):	1.4
Date Of Introduction:	1970	Radios, Frequency, And Range:	R-123
Proliferation:	At least 20 countries	Vertical Step (m):	.7
Description:		BRIDGE	SPECIFICATIONS
Crew:	2	Type:	Scissors
Troop Capacity:	INA	Capacity (mt):	50
Chassis:	T-55A Tank (modified)	Width of Obstacle (m):	17
Combat Weight (Mt):	36	Width (m):	3.3
Length Overall (M):	9.90	Length Opened (m):	18
Height Overall (M):	3.35	Weight (kg): 6.5	6.5
Width Overall (M)	3.30	Emplacement Time (min):	2
Ground Pressure (Kg/Cm2):	INA	Displacement Time (min):	5-6
Automotive Performance:		Variants	None
Engine Type:	V-12 Diesel,		
HP:	580 hp		
Cruising Range (Km):	690		
Speed (Km/H):			
Max Road:	32-35		
Max Off-Road:	16-20		

NOTES

THE MT-55A HAS A GAP MEASURING DEVICE AND INFRARED EQUIPMENT FOR BRIDGE-LAYING AT NIGHT. IT CAN ALSO LAUNCH THE MT-72 BRIDGE. SELF-ENTRENCHING BLADE: NO. NBC PROTECTION SYSTEM: YES. SMOKE EQUIPMENT: VEHICLE ENGINE EXHAUST SMOKE SYSTEM. VERTICAL STEP (M): .7. TRENCH (M): 2.7. GROUND CLEARANCE (MM): 425. GRADIENT: 30

RUSSIAN ARMORED VEHICLE-LAUNCHED BRIDGE MTU-72



SYSTEM	SPECIFICATIONS	FEATURES (CONT.)	SPECIFICATIONS
System		Max Swim:	INA
Alternative Designations:	None	Fording Depths (M):	1.2
Date Of Introduction:	1974	Radios, Frequency, And Range:	R-173 and R-134
Proliferation:	At least one country.	Vertical Step (m):	2.8
Description:		BRIDGE	SPECIFICATIONS
Crew:	2	Type:	Cantilever
Troop Capacity:	INA	Capacity (mt):	50
Chassis:	T-72S	Width of Obstacle (m):	18
Combat Weight (Mt):	40	Width (m):	3.55
Length Overall (M):	11.64	Length Opened (m):	20
Height Overall (M):	3.38	Weight (kg):	6,400
Width Overall (M)	3.46	Emplacement Time (min):	3
Ground Pressure (Kg/Cm2):	INA	Displacement Time (min):	8
Automotive Performance:		Variants	None
Engine Type:	Diesel		
HP:	840		
Cruising Range (Km):	500		
Speed (Km/H):			
Max Road:	60		
Max Off-Road:	45		

NOTES

SELF-ENTRENCHING BLADE: YES. NBC PROTECTION SYSTEM: YES. SMOKE EQUIPMENT: VEHICLE ENGINE EXHAUST SMOKE SYSTEM. AVERAGE CROSS-COUNTRY: 35. FORDING WIDTH (M): 1000. TRENCH (M): 2.8. GROUND CLEARANCE (MM): 49. GRADIENT: 31. SIDE SLOPE: 22

RUSSIAN SELF-PROPELLED AMPHIBIOUS FERRY PMM-2



SYSTEM	SPECIFICATIONS	FEATURES (CONT.)	SPECIFICATIONS
System		Max Swim:	INA
Alternative Designations:	None	Fording Depths (M):	1.2
Date Of Introduction:	1983	Radios, Frequency, And Range:	R-173 and R-134
Proliferation:	At least four countries.	Vertical Step (m):	2.8
Description:		BRIDGE	SPECIFICATIONS
Crew:	3	Type:	SP Ferry
Troop Capacity:	INA	Capacity (mt):	42.5
Chassis:	Based on amphibious version of the Kharkov T-64 (same as MT-T transporter, PTS-2 tracked amphibian)	Obstacle Gap (m):	20
Combat Weight (Mt):	36	Deck Length Opened One (m):	10
Length Overall (M):	13.5	Loading Ramps (2) width ea (m):	5
Height Overall (M):	3.85	Deck Width Opened (m):	4.2
Width Overall (M)	3.5/10.5	Emplacement Time Approx (min):	5
Ground Pressure (Kg/Cm2):	INA	Variants	Amphibious Bridging System-Wheeled (ABS-W)
Automotive Performance:	V-64-4 V-12		
Engine Type:	Diesel		
HP:	710		
Cruising Range (Km):	500		
Speed (Km/H):			
Max Road:	55		
Max Off-Road:	INA		

NOTES

THE PMM-2 REPLACES THE GSP AND HAS ONE MAIN ADVANTAGE AS A FERRY OVER THE GSP: WHEREAS TWO GSP HALF-FERRIES MUST BE JOINED TOGETHER TO PRODUCE ONE FERRY WITH A CAPACITY OF 50 METRIC TONS, ONE PMM-2 CAN HANDLE APPROXIMATELY THE SAME CAPACITY–EIGHT PMM-2 VEHICLES CAN FORM EIGHT SEPARATE FERRIES OR FOUR LARGE FERRIES (85-

TON CAPACITY). THE PMM-2 BEARS GREAT SIMILARITY TO THE PTS-2 TRACKED AMPHIBIAN, WITH ITS CAB AND BOAT-LIKE BOW. THE CHASSIS IS SIMILAR TO THAT OF THE MT-T ARTILLERY PRIME MOVER, WITH SEVEN ROAD WHEELS AND FOUR RETURN ROLLERS. WHEN UNFOLDED THE PMM-2 CREATES A RAFT THAT CAN CARRY A MAIN BATTLE TANK WITHOUT FURTHER ASSISTANCE OR CONSTRUCTION. WHILE TWO SYSTEMS CAN BE COMBINED TO FORM AN 85-TON CAPABLE FERRY, THE PMM-2 DOES NOT FORM FLOAT BRIDGES. ON TOP OF THE HULL, THE SYSTEM HAS TWO LARGE BOX PONTOONS CARRIED ONE ATOP THE OTHER. THEY ARE HINGED TO HYDRAULICALLY UNFOLD TO EITHER SIDE OF THE HULL FOR WATER OPERATIONS. SMALL TREAD WAY RAMPS ARE FOLDED ON THE PONTOONS. THE UNFOLDED PONTOONS HAVE WAVE DEFLECTORS, AS WELL AS RAMPS TO EXPEDITE THE LOADING AND UNLOADING OF VEHICLES. AIRDROP/AIR TRANSPORTABLE: NO MINIMUM OPERATING DEPTH (M): 1.3. GROUND CLEARANCE (M): .4. APPROACH ANGLE: 25. DEPARTURE ANGLE: 25

RUSSIAN HEAVY FOLDING PONTOON BRIDGE PMP



SYSTEM	SPECIFICATIONS	FEATURES (CONT.)	SPECIFICATIONS
System		Max Swim:	INA
Alternative Designations:	Ribbon bridge	Fording Depths (M):	1.2
Date Of Introduction:	1961	Radios, Frequency, And Range:	R-173 and R-134
Proliferation:	Over 20 countries.	Vertical Step (m):	2.8
Description:		BRIDGE	SPECIFICATIONS
Crew:	3	Type:	Pontoon
Troop Capacity:	INA	Total Length of Bridge (m):	227
Chassis:	KraZ-255B	Capacity/Load Class (mt):	60
Combat Weight (Mt):	36	Roadway Width (m):	6.5
Length Overall (M):	13.5	Working Party:	Varies - approx. 65 for full bridge set. See RAFT ASSEMBLY DATA
Height Overall (M):	3.85	Material:	SKhL-4 steel
Width Overall (M)	3.5/10.5	Bridge/center:	32
Ground Pressure (Kg/Cm2):	INA	Ramp/shore:	4
Automotive Performance:	V-64-4 V-12		
Engine Type:	Diesel		
HP:	710		
Cruising Range (Km):	500		
Speed (Km/H):			
Max Road:	55		
Max Off-Road:	INA		

NOTES

THE COMPLETE PMP RIBBON BRIDGE SET CONSISTS OF 32 CENTER PONTOONS AND 4 RAMP PONTOONS, THE NORMAL BRIDGE UNIT CONSISTS OF A HALF-SET (ONE COMPLETE BRIDGE) MADE UP OF 16 CENTER AND 2 RAMP PONTOONS. EACH 4-SECTION IS LAUNCHED FROM THE KRAZ-255B. IT AUTOMATICALLY UNFOLDS UPON ENTERING THE WATER. THE SECTIONS THEN LOCK IN PLACE TO FORM A BRIDGE UNIT 6.75 METERS LONG AND 8 METERS WIDE. NORMALLY, ALL THE UNITS ARE LAUNCHED SIMULTANEOUSLY. THEY JOIN TOGETHER PARALLEL TO THE NEAR SHORE TO FORM A CONTINUOUS ROADWAY. THE ROADWAY THEN SWINGS ACROSS THE WATER OBSTACLE; POWERBOATS (6 PER HALF-SET) HOLD IT IN PLACE ON THE DESIGNATED CENTERLINE. ENGINEERS CAN USE THE FULL 36-PONTOON SET TO CONSTRUCT 227 METERS OF BRIDGE. THEY MAY ALSO CONFIGURE IT AS 40- TO 170-TON RAFTS. A HALF-SET GIVES THE CAPABILITY TO CONSTRUCT 119 METERS OF 60-TON BRIDGE, 191 METERS OF 20-TON BRIDGE, OR RAFTS. UNDER IDEAL CONDITIONS ASSEMBLY SPEEDS OF 7 METERS OF BRIDGE PER MINUTE CAN RESULT. THIS BRIDGE CAN BE BUILT IN

STREAMS WITH A VELOCITY OF UP TO 2 METERS A SECOND (APPROX. 7 KM/H). AUTOMATICALLY UNFOLDS UPON ENTERING THE WATER. THE SECTIONS THEN LOCK IN PLACE TO FORM A BRIDGE UNIT 6.75 METERS LONG AND 8 METERS WIDE. NORMALLY, ALL THE UNITS ARE LAUNCHED SIMULTANEOUSLY. THEY JOIN TOGETHER PARALLEL TO THE NEAR SHORE TO FORM A CONTINUOUS ROADWAY. THE ROADWAY THEN SWINGS ACROSS THE WATER OBSTACLE; POWERBOATS (6 PER HALF-SET) HOLD IT IN PLACE ON THE DESIGNATED CENTERLINE. ENGINEERS CAN USE THE FULL 36-PONTOON SET TO CONSTRUCT 227 METERS OF BRIDGE. THEY MAY ALSO CONFIGURE IT AS 40- TO 170-TON RAFTS. A HALF-SET GIVES THE CAPABILITY TO CONSTRUCT 119 METERS OF 60-TON BRIDGE, 191 METERS OF 20-TON BRIDGE, OR RAFTS. UNDER IDEAL CONDITIONS ASSEMBLY SPEEDS OF 7 METERS OF BRIDGE PER MINUTE CAN RESULT. THIS BRIDGE CAN BE BUILT IN STREAMS WITH A VELOCITY OF UP TO 2 METERS A SECOND (APPROX. 7 KM/H). BRIDGE PONTOONS: WEIGHT (KG): 6,790. LENGTH (M): UNFOLDED: 6.75. FOLDED: 6.75. WIDTH (M): UNFOLDED: 8. FOLDED: 5. DEPTH UNFOLDED (M): BOW SECTION: .9. CENTER SECTION: .7. FOLDED: 2. RAMP PONTOONS. WEIGHT (KG): 7,252. LENGTH (M): UNFOLDED: 5.6. FOLDED: 5.6. WIDTH UNFOLDED (M): RIVER END: 7.3. SHORE END: 7. FOLDED: 3.1. RAFT ASSEMBLY DATA. 40-TON RAFT-BRIDGE PONTOONS: 2 OVERALL DECK LENGTH (M): 13.5. ASSEMBLY TIME (MIN): 8 WORKING PARTY (EST.): 6. 60-TON RAFT-BRIDGE PONTOONS: 3 OVERALL DECK LENGTH (M): 20.3. ASSEMBLY TIME (MIN): 10. WORKING PARTY (EST.): 9. 80-TON RAFT-BRIDGE PONTOONS: 4. OVERALL DECK LENGTH (M): 27. ASSEMBLY TIME (MIN): 12. WORKING PARTY (EST): 12. 110-TON RAFT-BRIDGE RAMP PONTOON: 1 BRIDGE PONTOONS: 5 OVERALL DECK LENGTH (M): 39.3. ASSEMBLY TIME (MIN): 15. WORKING PARTY (EST.): 18. 170-TON RAFT-BRIDGE RAMP PONTOON: 1.BRIDGE PONTOONS: 8. OVERALL DECK LENGTH (M): 59.6. ASSEMBLY TIME (MIN): 15. WORKING PARTY (EST.): INA. AUXILIARY EQUIPMENT POWERBOATS OR TRACKED AMPHIBIANS: 12. LAUNCH SEQUENCE. 1. THE TRAVEL LOCKS ARE DISENGAGED, THE PONTOON CARRIER BACKS TO THE EDGE OF THE WATER, BRAKES SHARPLY, AND THEN THE PONTOON SLIDES OVER THE CARRIER ROLLER SYSTEM INTO THE WATER WHERE IT UNFOLDS ALMOST IMMEDIATELY. 2. THE PONTOON IS THEN STIFFENED BY ACTIVATING SIX LOCKING DEVICES. 3. ONCE THE PONTOONS HAVE BEEN LAUNCHED AND STIFFENED THEY ARE INTERCONNECTED PARALLEL TO THE NEAR SHORE TO FORM A CONTINUOUS STRIP OF ROADWAY. 4. THIS ROADWAY IS THEN SWUNG ACROSS THE WATER OBSTACLE AND HELD IN PLACE BY POWERBOATS. WHENEVER POSSIBLE THE LAUNCHING OPERATIONS ARE DONE ALONG A CONTINUOUS SHORELINE PERMITTING ALL PONTOONS TO BE LAUNCHED AT THE SAME TIME. IF NECESSARY, THE BRIDGE CAN BE BUILT ON A SMALL FRONTAGE USING THE SUCCESSIVE RAFT SYSTEM. THIS SLOWS CONSTRUCTION TIME. RETRIEVAL FOR RETRIEVAL THE LAUNCH OPERATION IS REVERSED. THE PONTOON CARRIER BACKS TO THE WATER'S EDGE, AN INTEGRAL JIB IS UNFOLDED FROM THE TRUCK BED, AND TWO CABLES ARE STRUNG FROM THE WINCH (LOCATED BEHIND THE DRIVER'S CAB) THROUGH THE JIB PULLEYS, AROUND THE PONTOON RETRIEVING GUIDES, AND SECURED TO THE PONTOON RETRIEVAL STUDS. THE WINCH SIMULTANEOUSLY FOLDS AND LIFTS THE PONTOON TO THE TRUCK BED. THE JIB IS THEN FOLDED BACK INTO THE TRUCK BED, AND THE PONTOON IS WINCHED OVER THE ROLLER SYSTEM AND SECURED. THE WHOLE PROCEDURE TAKES BUT A VERY FEW MINUTES.

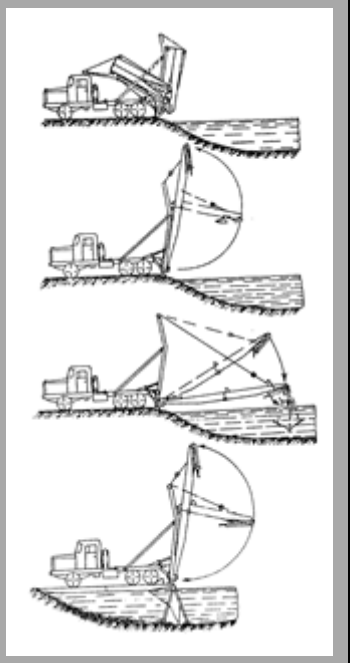
RUSSIAN TRUCK-MOUNTED SCISSORS BRIDGE TMM



SYSTEM	SPECIFICATIONS	FEATURES (CONT.)	SPECIFICATIONS
System		Max Swim:	INA
Alternative Designations:	Mechanized Bridge, Scissors Bridge	Fording Depths (M):	1
Date Of Introduction:	1964	Radios, Frequency, And Range:	INA
Proliferation:	At least20 countries.	Vertical Step (m):	INA
Description:		BRIDGE	SPECIFICATIONS
Crew:	See Notes	Type:	Truck-mounted scissors
Troop Capacity:	INA	Total Length of Bridge (m):	227
Chassis:	Modified KrAZ-214 (6 × 6), 7,000 kg, or KrAZ-255B (6 × 6), 7,500 kg, and KrAZ-260 trucks.	Capacity/Load Class (mt):	60
Combat Weight (Mt):	19	Roadway Width (m):	3.2-3.8
Length Overall (M):	9.3	Working Party:	See Notes
Height Overall (M):	3.15	Material:	Low alloy steel
Width Overall (M)	3.2	Bridge/center:	INA
Ground Pressure (Kg/Cm2):	INA	Ramp/shore:	INA
Automotive Performance:	INA	Variants	TMM-3: KrAZ-255B 6 x 6 improved bridgelaying mechanism. TMM-6: MAZ-543 8 × 8 truck with 17 m bridge spans (unfolded).
Engine Type:	INA		
HP:	INA		
Cruising Range (Km):	INA		
Speed (Km/H):			
Max Road:	INA		
Max Off-Road:	INA		

NOTES

THE TMM IS A MULTIPLE-SPAN, TRESTLE-SUPPORTED, SCISSORS-TYPE, TREADWAY BRIDGE. ONE BRIDGE SET COMPRISES FOUR 10.5 METER, SPANS CARRIED ON, AND LAUNCHED FROM SPECIALLY MODIFIED TRUCKS. SPANS FOLD IN HALF FOR TRANSPORT. THREE OF THE SPANS HAVE INTEGRAL-MOUNTED ADJUSTED (1.7 TO 3.2 METERS) TRESTLE LEGS, WHILE THE FOURTH (FAR-SHORE) SPAN HAS NONE. DURING TRAVEL, THE TRESTLES CAN FOLD BENEATH THE SCISSORS PLAN. A LAUNCHING GIRDER MOUNTED ON THE TRUCK BED LAUNCHES THE TMM HYDRAULICALLY OVER THE TAILGATE. ASSISTED BY WINCH CABLES AND PULLEYS, THE GIRDER RAISES, UNFOLDS, AND EMPLACES THE SPAN WITH THE FOLDING TRESTLE LEGS. IF NECESSARY THE TMM CAN BE LAID UNDERWATER. THIS REQUIRES ABOUT 50% MORE EMPLACEMENT TIME. WEIGHT (KG): 4.24. PIER: (TMM ON KRAZ-255). HEIGHT (M): MIN: 1.7 MAX: 3.21. GROUND AREA (M2/PIER): 2.4. WEIGHT (M): 1.15. LOWERING METHOD: CABLE RELEASE. RAISING METHOD: HAND WINCH. LOCKING METHOD: MANUAL. ASSEMBLY DATA SPANS IN SET: 4. LENGTH OF 1 SPAN (M): UNFOLDED: 10.5. FOLDED: 5.2. TOTAL LENGTH OF BRIDGE (M): 42. OBSTACLE SPAN (M): SPAN: 9.4. DEPTH: 3. ROADWAY WIDTH (M): CLOSED: 3.2. EXTENDED: 5.2. ASSEMBLY TIME (MIN): 20-40. 1 SPAN: 8-15. 4 SPANS: 30-60. RECOVERY TIME (MIN): SAME AS ASSEMBLY. WORKING PARTY: 3 PER SPAN/12 TOTAL.



LAUNCH SEQUENCE

1. TRUCK BACKS INTO POSITION.

2. A HYDRAULIC LAUNCHING GIRDER RAISES THE FOLDED SPAN TO THE VERTICAL POSITION.

3. THE SPAN IS STRAIGHTENED BY A CABLE/WINCH SYSTEM, AND THEN IS LOWERED WITH THE INTEGRAL TRESTLE LEGS SWINGING INTO POSITION.

4. ONCE THE LOWERING OPERATION IS COMPLETED, THE CABLES ARE DISCONNECTED, THE LAUNCHING GIRDER IS BROUGHT TO TRAVEL POSITION, AND THE TRUCK MOVES OFF.

RUSSIAN EXCAVATING VEHICLE BTM-4 / MDK-3



SYSTEM	SPECIFICATIONS	FEATURES (CONT.)	SPECIFICATIONS
System		Max Swim:	N/A
Alternative Designations:		Fording Depths (M):	N/A
Date Of Introduction:	1982	Radios, Frequency, And Range:	
Proliferation:	Russia	R-124	intercom
Descrption:		R-123	
Crew:	2	Command Level:	Battalion
Troop Capacity:	N/A	Operating Equipment:	
Chassis:	MT-T	Dozer Blade (front mounted):	Yes
Combat Weight (Mt):	39.5	Ripper:	Yes
Length Overall (M):	10.2	Road harrow:	Yes
Height Overall (M):	4	Trenching machine:	Yes
Width Overall (M)	3.7	Productivity M3/hr:	< 800
Ground Pressure (Kg/Cm2):	UNK	Ditch Size:	
Automotive Performance:		Width (M):	1.1
Engine Type:	Diesel	Depth (M):	1.5
HP:	710	Excavation Rate (Km/hr):	1
Cruising Range (Km):	500	Ditch Size (frozen):	
Speed (Km/H):		Width (M):	.6
Max Road:	70	Depth (M):	1.1
Max Off-Road:	UNK	Excavation Rate (Km/hr):	.3
NBC Protection:	Yes	Machine prep time (min.):	5

NOTES

FITTED WITH A ROTARY BLADE ON THE REAR AND A DOZER BLADE ON THE FRONT. THE MDK-3 CAN DIG AT DITCHES, VEHICLE POSITIONS, AND FIGHTING POSITIONS.

Dec
2016

Worldwide Equipment Guide

Chapter 8: Logistics



TRADOC G-2 ACE–Threats Integration
Ft. Leavenworth, KS

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Chapter 8: Logistics

This chapter provides the basic characteristics of selected logistics vehicle and trailers. This chapter provides the basic characteristics of selected trucks, maintenance vehicles, and other logistic equipment readily available to the OPFOR. It includes a representative vehicle from the light, utility, medium, and heavy truck categories. Later updates of this guide will include data on a wider selection of trucks, trailers, vans and other logistical equipment.

Questions and comments on data listed in this chapter should be addressed to:

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RUSSIAN 2 MT 4X4 CARGO TRUCK GAZ-66



Photo courtesy of the Khabarovsk Military Museum, by Andshel

SYSTEM	SPECIFICATIONS	AUTOMOTIVE	SPECIFICATIONS
Alternative Designation		Engine	V8, 115 hp, Gasoline
Date of Introduction	1964	Cooling	Water
Proliferation	Widespread	Cruising Range (road) (km)	875
Troop Capacity	3 in cab, 18 in read	Speed (km/h)	95
Weight (mt)		Fuel capacity (liters)	
Gross Vehicle Weight	5.8	Right Tank	105
Curb	3.6	Left Tank	105
Length Overall (m)	5.65	Towing Capability (kg)	
Height Overall (m)	2.44	Off Highway	2000
Width Overall (m)	2.32	On Highway	2000
Payload on/off Highway (kg)	2000	Gradient (loaded) (°)	39
Number of Axles	2	Fording Depths (m)	8
Ground Clearance (mm)	315	CARGO SPACE	SPECIFICATIONS
Turning Radius (m)	10	Height (m)	.89
Side Slope (°)		Width (m)	2.05
Vertical Step (mm)		Length (m)	3.33
Wheels		Cargo Bed Area (m^2)	6.8
Size (in)	12X18	VARIANTS	SPECIFICATIONS
Central Tire Pressure Regulation System	Yes	GAZ-66B	Canvas-top cab for air transport or airdrop
Run Flat		GAZ-66A	Steel cab
Armament	None	Numerous other variants for various duties	

NOTES

BESIDES FUNCTIONING AS A GENERAL CARGO CARRIER, THE GAZ-66 IS USED AS A PRIME MOVER FOR 120-MM MORTARS. THE DDA-66 VARIANT IS AN NBC DECONTAMINATION TRUCK.

RUSSIAN 4.5 MT 6X6 CARGO TRUCK URAL-375D



Photo from Wikimedia Commons

SYSTEM	SPECIFICATIONS	AUTOMOTIVE	SPECIFICATIONS
Alternative Designation		Engine	V8, 180 hp, Gasoline
Date of Introduction	1965	Cooling	Liquid
Proliferation	Widespread	Cruising Range (road) (km)	650
Troop Capacity	3 in cab, 24 in read	Speed (km/h)	75
Weight (mt)		Fuel capacity (liters)	
Gross Vehicle Weight	13.2	Main Tank	300
Curb	8.4	Aux Tank	60
Length Overall (m)	7.36	Towing Capability (kg)	
Height Overall (m)	2.68	Off Highway	5,000
Width Overall (m)	2.67	On Highway	10,000
Payload on/off Highway (kg)	4,500	Gradient (loaded) (°)	65
Number of Axles	3	Fording Depths (m)	1.49
Ground Clearance (mm)	410	CARGO SPACE	SPECIFICATIONS
Turning Radius (m)	10.8	Height (m)	.872
Side Slope (°)	32	Width (m)	2.43
Vertical Step (mm)	800	Length (m)	3.9
Wheels		Cargo Bed Area (m^2)	9.5
Size (in)	14x20	VARIANTS	SPECIFICATIONS
Central Tire Pressure Regulation System	Yes	URAL-375	Observation hatch and unimproved power train
Run Flat		URAL-375E	Decontamination vehicle
Armament	None	URAL-375N	2,000 kg additional payload
		URAL-375S	Truck-tractor
		URAL-375T	Equipped with winch

NOTES

BESIDES FUNCTIONING AS A GENERAL CARGO CARRIER, THE URAL-375D IS USED AS A PRIME MOVER FOR LIGHT AND MEDIUM ARTILLERY. THE URAL-375 CHASSIS ALSO SERVES AS A BASE FOR THE BM-21 MRL, POL TANKERS, VANS, AND CRANES. THE URAL-4320 BEGAN TO REPLACE THE URAL-375D AROUND 1978.

RUSSIAN 7.5 MT 6X6 CARGO TRUCK KRAZ-255B



"790th Fighter Order of Kutuzov 3rd class Aviation Regiment, Khotilovo airbase (356-27)" by Vitaly V. Kuzmin - http://vitalykuzmin.net/?q=node/356. Licensed under CC BY-SA 3.0 via Commons -

SYSTEM	SPECIFICATIONS	AUTOMOTIVE	SPECIFICATIONS
Alternative Designation		Engine	V8, 265 hp, Diesel
Date of Introduction	1967	Cooling	Water
Proliferation	Widespread	Cruising Range (road) (km)	850
Troop Capacity	3 in cab, 16 in rear	Speed (km/h)	70
Weight (mt)		Fuel capacity (liters)	
Gross Vehicle Weight	19.7	Right Tank	165
Curb	12	Left Tank	165
Length Overall (m)	8.64	Towing Capability (kg)	
Height Overall (m)	2.94	Off Highway	10,000
Width Overall (m)	2.75	On Highway	10,000
Payload on/off Highway (kg)	7,500	Gradient (loaded) (°)	30
Number of Axles	3	Fording Depths (m)	1
Ground Clearance (mm)	360	CARGO SPACE	SPECIFICATIONS
Turning Radius (m)	14	Height (m)	.92
Side Slope (°)		Width (m)	2.5
Vertical Step (mm)		Length (m)	4.56
Wheels		Cargo Bed Area (m^2)	
Size (in)	20X21	VARIANTS	SPECIFICATIONS
Central Tire Pressure Regulation System	Yes	KrAZ-258	Tractor-truck
Run Flat		Numerous other variants for various duties.	
Armament	None		

NOTES

PRIMARILY DESIGNED AS A CARGO TRUCK, THE KRAZ-255B IS ALSO USED AS A PRIME MOVER FOR VARIOUS EQUIPMENT INCLUDING A TANK-TRANSPORTER TRAILER AND PMP PONTOON BRIDGE.

RUSSIAN 6 MT 6X6 GENERAL UTILITY TRUCK KAMAZ 4310



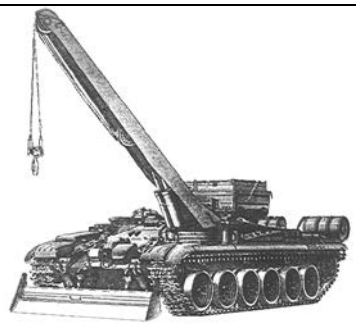
Photo by: Vitaly Kuzmin

SYSTEM	SPECIFICATIONS	AUTOMOTIVE	SPECIFICATIONS
Alternative Designation		Engine	V8, 165 hp, Diesel turbocharged
Date of Introduction	1980	Cooling	Water
Proliferation	Russia, Bulgaria, Lithuania, Serbia, Poland, Hungary, Romania, Latvia, Cuba, Venezuela, Panama, Vietnam, Afghanistan, Turkey, Algeria, Kuwait, Sudan, Senegal, Burkina Faso, Botswana, Guinea, Iran, India, Pakistan	Cruising Range (road) (km)	1000
Troop Capacity	3 in cab, 18 in rear	Speed (km/h)	85
Weight (mt)		Fuel capacity (liters)	
Gross Vehicle Weight	7	Right Tank	120
Curb	3.6	Left Tank	120
Length Overall (m)	7.73	Towing Capability (kg)	
Height Overall (m)	3.375	Off Highway	2,000
Width Overall (m)	3.34	On Highway	7,000
Payload on/off Highway (kg)	6,000	Gradient (loaded) (°)	31
Number of Axles	3	Fording Depths (m)	.5
Ground Clearance (mm)	550	CARGO SPACE	SPECIFICATIONS
Turning Radius (m)	10	Height (m)	.89
Side Slope (°)		Width (m)	2.47
Vertical Step (mm)		Length (m)	4.89
Wheels		Cargo Bed Area (m^2)	~ 12
Size (in)	21X24	VARIANTS	SPECIFICATIONS
Central Tire Pressure Regulation System	Yes	KamAZ-43101	More powerful 220 hp engine
Run Flat		Numerous other variants for various duties.	
Armament	None		

NOTES

BESIDES FUNCTIONING AS A GENERAL CARGO CARRIER, THE KAMAZ-4310 IS USED AS A COMMAND AND CONTROL VEHICLE.

RUSSIAN ARMORED RECOVERY VEHICLE BREM-1

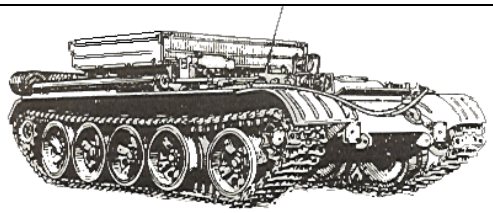


SYSTEM	SPECIFICATIONS	AUTOMOTIVE	SPECIFICATIONS
Alternative Designation	None	Engine	V12, 840 hp, Multi-fuel Diesel
Date of Introduction	1984	Cruising Range w/external tanks (km)	
Proliferation	At least 5 countries	Dirt Road w/o Towed Vehicle	650
Crew	3-TC, driver, mechanic	Dirt Road Towing Vehicle	220-430
Chassis	T-72 tank	Highway w/o Towed Vehicle	700
Weight (mt)	41	Speed (km/h)	
Length Overall (m)	7.98	Max Highway	60
Height Travel (m)	2.45	Dirt Road	45
Width Overall (m)	3.46	Highway w/o Towed Vehicle	12
Ground Clearance (mm)	457	Radio	R-123
Gradient (°)	30	RECOVERY	SPECIFICATIONS
Fording Depth (m)	1.2	Towing Capacity (mt)	50
Trench Crossing (m)	2.8	Towing Rods (m)	Two-1.68; Two-5.5
Vertical Step (m)	.85	Hydraulic Jack Capacity (mt)	30
ARMAMENT	SPECIFICATIONS	Crane Capacity (mt)	
Machine gun	12.7-mm, AD MG NSV-T	2.4 m Extension	19
Mount Type	Cupola	4.4 m Extension	3
Fire on Move	Yes	Winch Capacity (mt)	
Smoke Equipment	VEESS; Four smoke grenade launchers	Line Pull	25
NBC protection	Yes	With Blocks	100
BLADE	SPECIFICATIONS	Cable length (m)	200
Width (m	3.1	Auxiliary Winch	
		Capacity (line pull) (kg)	530
		Cable Length (m)	400
		VARIANTS	SPECIFICATIONS
		None	

NOTES

THE BREM-1 IS DESIGNED TO TOW DAMAGED TANKS FROM THE BATTLEFIELD TO DAMAGED VEHICLE COLLECTION POINTS. INSTEAD OF A TURRET IT HAS A RECTANGULAR PLATFORM ON TOP OF THE HULL FOR WORK AND LOADING.

RUSSIAN ARMORED RECOVERY VEHICLE T-54 T



SYSTEM	SPECIFICATIONS	AUTOMOTIVE	SPECIFICATIONS
Alternative Designation	BTS-2 (Medium Tank Towing Vehicle-2)	Engine	V12, 520 hp, Diesel
Date of Introduction	1965	Cruising Range (km)	400
Proliferation	At least 50 countries	Speed (km/h)	
Crew	3 to 5	Max Highway	48
Chassis	T-54 tank	Dirt Road	
Weight (mt)	36	Highway w/o Towed Vehicle	
Length Overall (m)	7.5	Radio	
Height Travel (m)	1.9		
Width Overall (m)	3.27	RECOVERY	SPECIFICATIONS
Ground Clearance (mm)	264	Towing Capacity (mt)	40
Gradient (°)	31	Crane Capacity (mt)	1
Fording Depth (m)			
Unprepared	1.4		
With Snorkel	5.5	VARIANTS	SPECIFICATIONS
Trench Crossing (m)	2.7	There are numerous variants based on T-54 and T-55 chassis each with differing equipment modifications.	
Vertical Step (m)	.8	T-54 (A)	Push/pull bar at front, 1 mt crane, NBC equipment, no winches or spades
ARMAMENT	SPECIFICATIONS	T-54 (B)	Similar to T-54 (A). Tow cable brackets at hull rear, hull front protective plate, snorkel. No winch or spade.
Smoke Equipment	VEESS	T-54 (C)	Heavy-duty crane, snorkel
NBC protection	No (See Variants)		

NOTES

THE T-54-T ARMORED RECOVERY VEHICLES ARE BASED ON MODIFIED CHASSIS OF THE T-54 MEDIUM TANK. THE RECOVERY VEHICLE VARIANTS HAVE A CRANE ABLE TO LIFT UP TO 3 MT, A LOADING PLATFORM, AND A SPADE ON THE REAR OF THE VEHICLE. THEY CAN MOUNT A SNORKEL FOR DEEP FORDING. PERFORMANCE FIGURES ARE THE SAME FOR THE T-54 (AND T-55) TANKS. THEY REPLACED OLDER TANK RECOVERY VEHICLES BASED ON THE T-34 CHASSIS.

FRENCH 2.5 T TRAILER SOFRAME RP









SYSTEM	SPECIFICATIONS	PAYLOAD WEIGHT DATA	SPECIFICATIONS
Alternative Designation	BTS-2 (Medium Tank Towing Vehicle-2)	Tanker Payload on-road (Liter)	1500
Date of Introduction	2012	Cargo payload on-road (kg)	1540
Proliferation	Widespread	Generator Payload on-road (kg)	1640
Nominal Payload (t)	2.5	Tanker Curb Weight (kg)	800
Trailer Type	Full	Cargo Curb Weight (kg)	760
Tanker Height (mm)	1500	Generator Curb Weight (kg)	660
Cargo Height (mm)	2300	Gross Vehicle Weight on-road (kg)	2300
Generator Height (mm)	2070		
Length (mm)	3880	MOBILITY	SPECIFICATIONS
Width (mm)	2050	Air Lift	Including helicopter
Ground Clearance (mm)	320	Crane Lift	
Number of axles	1	Fork Lift	
Number of tires	2		
Brake system (rear)	Drum, full air	VARIANTS	SPECIFICATIONS
		Tanker designed to carry fuel or water	
UTILITY	SPECIFICATIONS	Generator designed to carry generators	
Transport	Water, fuel, tents, generators, barbed wire, refrigerated containers, space heaters, ammunition, and field supplies	Cargo designed to carry field equipment	

NOTES
MULTIPURPOSE CROSS-COUNTRY TRAILER CAN CARRY A SERIES OF MODULAR BODIES INCLUDING STANDARD CARGO BODIES, FUEL, WATER, AND GENERATORS. DESIGNED TO BE TRANSPORTABLE BY FIXED WING OR ROTARY WING AIRCRAFT.

GREEK MULTIPURPOSE 2-WHEEL TRAILER NK P-126

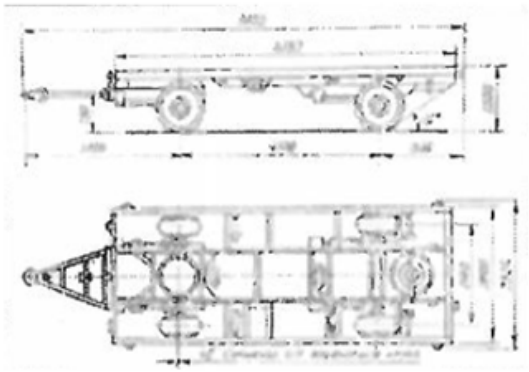


SYSTEM	SPECIFICATIONS	PAYLOAD WEIGHT DATA	SPECIFICATIONS
Alternative Designation	None	Trailer Payload on-road (kg)	2000
Date of Introduction	2009	Cargo payload on-road (kg)	
Proliferation	Europe and Africa	Generator Payload on-road (kg)	
Nominal Payload (t)	2.0	Curb Weight (kg)	1800
Trailer Type	Full	Cargo Curb Weight (kg)	
Height (mm)	2780	Generator Curb Weight (kg)	
Length (mm)	4000	Gross Vehicle Weight on-road (kg)	3800
Width (mm)	2400		
Ground Clearance (mm)		MOBILITY	SPECIFICATIONS
Number of axles	1	Towing Vehicle	MAN-Steyr or Mercedes Benz Unimog
Number of tires	2 plus spare		
Brake system (rear)	Full dual air line		
UTILITY	SPECIFICATIONS	VARIANTS	SPECIFICATIONS
Transport	Tents, generators, barbed wire, refrigerated containers, space heaters, ammunition, and field supplies	None	

NOTES

MULTIPURPOSE TRAILER SUITED FOR TWIN MOUNTED GENERATOR SETS. WELDED STEEL CARGO BODY WITH STEEL SHEET ROOF. HINGED REAR TAILGATE AND SIDE COVERS PROVIDE EASY ACCESS TO SERVICING AND COOLING AIR CIRCULATION FOR TWO LIQUID COOLED GENERATOR SETS. TRAILER IS EQUIPPED WITH NATO TOWING EYE, JOCKEY WHEEL AS THE FRONT AND RETRACTABLE LEG AT THE REAR.

RUSSIAN TRAILER MAZ-8950





SYSTEM	SPECIFICATIONS	PAYLOAD WEIGHT DATA	SPECIFICATIONS
Alternative Designation	None	Trailer Payload on-road (kg)	10,500
Date of Introduction	1996	Cargo payload on-road (kg)	
Proliferation	Eastern Europe	Curb Weight (kg)	4,500
Nominal Payload (t)	10.0	Cargo Curb Weight (kg)	
Trailer Type	Full	Gross Vehicle Weight on-road (kg)	15,000
Height (mm)	1200		
Length (mm)	8920		
Width (mm)	2820		
Ground Clearance (mm)		MOBILITY	SPECIFICATIONS
Number of axles	2	Towing Vehicle	Kraz-255B
Number of tires	4		
Brake system (rear)	Mechanical and rear wheels		
Brake system (front)	Pneumatic, all-wheel		
UTILITY	SPECIFICATIONS	VARIANTS	SPECIFICATIONS
Transport	Various types of equipment up to 10 tons	None	

NOTES

DOUBLE AXLE LOW-FRAME CHASSIS HAS SPECIFICALLY CONSTRUCTED FRAME INTENDED FOR MOUNTING VARIOUS TYPES OF EQUIPMENT. TRAILER HAS FOUR STABILIZING JACKS WHICH CAN BE SWITCHED TO TRAVELING POSITION WHEN THE VEHICLE IS IN MOTION.

General Utility Truck Table (4x4)

TRUCK NAME/TYPE	KamAZ-4326, 4x4	Ural-43206 4x4	Ural-43206 -0651 4x4	Mercedes-Benz Zetros 1833A 4x4
BASE DESCRIPTION	Russian Army Multipurpose Cargo Truck	Russian Army Multipurpose Cargo Truck	Russian Army Multipurpose Cargo Truck	German Army Multipurpose Cargo Truck
Nominal Payload	4.0 tonnes	4.0 tonnes	3.0 tonnes	
Drive Formula	4x4	4x4	4x4	4x4
Cab Configuration	Cab over engine	Cab behind engine	Cab behind engine (4 door metal cab, six seat, equipped with a roof hatch)	Cab behind engine
Personnel in Cab	3	3	6	3
Personnel in Cargo Area	30	24	INA	INA
AUTOMOTIVE				
Engine	KaMz-740.11-240 (updated turbo-Diesel engine)	YaMz-236M2 Diesel (standard engine)	YaMz-236M2 Diesel (standard engine)	Mercedes Benz OM 926 LA Diesel
Power	240 hp @ 2200 rpm	180hp @ 2100 rpm	180hp @ 2100 rpm	326 hp @ 2200 rpm
Engine	N/A	N/A	YaMz-236BE2 Diesel (optional engine)	N/A
Power	N/A	N/A	250hp @ 2100 rpm	N/A
Max % Grade	69%	58%	58%	60%
Max % Side Slope	44 %	40%	40%	40%

Max Speed (on road)	90 km/h	90 km/h	90 km/h	88 km/h
Cruise Speed (on road)				
Fuel Consumption (on road)	25 L/100 km (@ 60 km/h)	24 L/100 km (@ 60 km/h)	24 L/100 km (@ 60 km/h)	INA
Fuel Capacity	240 L	270 L	210 L	300 L
Cruising Range (on road)	960 km	1080 km (@ 60 km/h)	860 km	INA
Electrical	24 volt	24 volt	24 volt	24 volt
Transmission and Transfer Case				
Transmission Type	Manual with hydraulically-operated dual plate clutch, with pneumatic assist	Manual	Manual	Manual (automatic is optional)
Number of Forward Gears	5 (within a three range gearbox)	5	5	9
Number of Reverse Gears	1	1	1	1
Number of Speeds in Transfer Case	2	2 (with locking inter-axle differential)	2	2
Axles and Suspension				
Number of Axles	2	2	2	2

Number of Powered Axles	2 (rear axle has a lockable differential)	2 (rear axle has a lockable differential)	2 (with lockable differentials)	2
Suspension, front	Live axles	Longitudinal leaf	Longitudinal leaf	Solid axle, hub reduction (HL7 planetary axles)
Springs front	INA	Conventional leaf	Conventional leaf	Conventional leaf
Suspension, rear	Longitudinal leaf (with hydraulic shock absorbers)	Longitudinal leaf	Longitudinal leaf	Solid axle, hub reduction (HL7 planetary axles)
Springs, rear	Conventional leaf	Conventional leaf	Conventional leaf	Conventional leaf
Steering				
Number of Steered Axles	1	1	1	1
Turning Radius	10, 500 mm	11,400 mm	11,400 mm	10,300 mm
Tires				
Number of Tires	4	4	4	4
Central Tire Inflation System	Yes	Yes	Optional	Optional
Fording				
Type	Fording	Fording	Fording	Fording
Fording Depth	INA	1750 mm	1750 mm	800 mm (up to 1500 mm with preparation)

Dimensional Data				
Length	7935 mm	7746 mm	7776 mm	7780 mm
Width	2500 mm	2550 mm	2550 mm	2530 mm
Height	2875 mm	3065 mm	3065 mm	2828 mm
Ground Clearance	385 mm	400 mm	400 mm	INA
Cargo Bed Length	4800 mm	3890 mm	3500 mm	5100 mm
Cargo Bed Width	2320 mm	2330 mm	2462 mm	2450 mm
Cargo Bed Height	500 mm	1000 mm	600 mm	500 mm
Vehicle Weight				
Payload (on road)	4000 kg	4200 kg	3200 kg	5000 kg
Payload (off road)	INA	3600 kg		
Gross Vehicle Weight (on road)	11,600 kg	12,100 kg	12,000 kg	18,000 kg
Gross Vehicle Weight (off road)	INA	11,500 kg	INA	INA
Towed load maximum (on road)	5000 kg	7000 kg	7000 kg	INA
Towed load maximum (off road)	5000 kg	7000 kg	INA	INA
Winch Crane				

Winch Type	Mechanical	Mechanical, front or rear mounted (optional)	Mechanical, front mounted (optional)	Optional
Winch Capacity	82 m cable length	10,000 kg (60 m cable length)	10,000 kg (60 m cable length)	Optional
PROLIFERATION	Afghanistan, Iraq, Russia, and the United Arab Emirates	Angola, Egypt, Georgia, Russia, and Ukraine	Russia and Venezuela	Bulgaria and Germany

Selected Russian Fuel Service Trucks Basic Characteristics

Characteristics	Model Designator				
	TZ-2-66D	**ATZ-7-43101**	**ATZ-10-4320**	**ATMZ-5-4320**[i]	**ATMZ-5.5-4310**[ii]
Main Chassis	GAZ 66-14	KamAZ 43101	Ural 4320	Ural 4320	KamAZ 4310
Crew	1	1	1	1	1
Setup Time, min	4	5	5 est.	3	5
Fuel Capacity (L)	2000	7000	10,000	5000	5500
Pump Type (Fuel)	SVN-80	SVN-80A	STsN 75/70	STsL-20-24A	STsL-20-24A
Capacity, L/min	500	580	1,000[iii]	750	750
Fineness of Fuel Filtration µ	INA	20-25	5	15-20	15-20
Oil Capacity (L)	N/A	N/A	N/A	250 (Heated Oil)	250 (Heated Oil)
Pump Type (Oil)	N/A	N/A	N/A	Sh8-25	Sh8-25
Capacity, L/min				40	40
Fineness of Oil Filtration µ	N/A	N/A	N/A	60	60
Suction Hoses:					
Length, m	3	3	INA	3	3
Diameter, mm	65	75	INA	38	38
Quantity	3	3	2	4	4
Dispensing Hoses:					
Length, m	9	9	INA	10	10
Diameter, mm	25	38	INA	25	25
Quantity	2	2	2	4	4
Flow Rate, L/min					
1 Hose	120	200	1,000	220	220
2 Hoses	240	350		440	440

3 Hoses 4 Hoses				650 750	650 750
Unique Features	Air Transportable and Air Droppable	Not Air Transportable	Air Transportable Primary use to refuel aircraft but may be used to refuel ground vehicles	Air Transportable	Air Transportable

NOTES: The first digit in the model designator indicates the fuel tank capacity. The final digits indicate the base chassis used for the fuel transporter. For example, the ATZ-7-43101 first digit of 7 equates to a 7,000 liter fuel tank capacity. The final digits, 43101 indicates the model number of the KamAZ chassis.

[i] The ATMZ designator signifies that this is a fuel and oil service truck.

[ii] The ATMZ designator signifies that this is a fuel and oil service truck.

[iii] 1,000 l/min when pressure fueling and 500 l/min using a conventional nozzle.

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Worldwide Equipment Guide

Chapter 9: C2 and INFOWAR



TRADOC G-2 ACE–Threats Integration
Ft. Leavenworth, KS

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Chapter 9: C2 and INFOWAR

Command and Communications C2

This chapter provides basic characteristics of selected tactical command and control (C2) systems either in use or readily available to the OPFOR. Critical C2 equipment

Many foreign militaries are leveraging advances in automated technologies in order to use increasing amounts of data across all warfighting capabilities. Increases in processing power and broadband technologies through commercial research and development make real time situational awareness and communications on the move a tangible objective for many foreign forces. The emergence of rudimentary Integrated Battlefield Management Systems (IBMS) in tier three forces represents this global trend. Net Centric operations are viewed worldwide as a key element of modern military operations, an IBMS is a system that integrates multiple command and control formats as well as sensor data into one display that improves situational awareness through multiple sources.

There are a variety of technologies available to achieve improved situational awareness through network enabled battlefield systems. Foreign forces will incorporate various modern systems into the C2 structure and will rely on manual operators to fuse them to legacy systems.

Incorporating commercial telecommunications and internet service to meet strategic, operational and tactical objectives represents one of the most important aspects of the foreign forces information warfare (INFOWAR) campaign. In tier one and tier two forces, the level of automated interoperability can be integrated across many levels of command through domestically produced systems designed for military use. These systems are equivalent to friendly system capabilities. This selection of systems is not intended to be complete; rather, it is representative of the types and capabilities that are currently fielded or available.

Command systems in the WEG are initially limited to command vehicles, such as the listed BMP-1KSh.

While the focus of the communications equipment for this chapter is primarily tactical communications systems and the more recently fielded IBMS systems, this chapter does include limited information on satellite communication systems (SATCOMs), navigation (NAV) systems, and weather systems. Satellites have added a new dimension to the battle space in the past few decades especially in terms of SATCOM and NAV capabilities.

There are currently over a thousand operating satellites orbiting the earth, with more than half having a primary mission of supporting communication and navigation efforts both commercially and militarily world-wide. See the Tables 2-4 for specific information on examples of these satellites, their owners/operators, and users.

Questions and comments on data listed in this chapter should be addressed to:

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Table 1: Tactical Communications Systems

System	Country of Origin	Description	Frequency Range (MHz)	Digital ?	FH?	Range (km)	Power Output
Panther-V	UK	Vehicle/Manpack VHF/UHF	30-108	Yes	Yes	50	50W
Jaguar-V	UK	Vehicle/Manpack VHF	30-88	Yes	Yes	50	50W
R163-50U	Russia	Vehicle VHF	30-80	Yes	No	40	30W
R173M	Russia	Vehicle VHF	30-80	No	No	30	20W
M3TR	GE	Vehicle/Manpack	1.5-512	Yes	Yes	50	50W
RF5000	US	Vehicle HF	1.6-30	Yes	Yes	75	400W
XK2000	GE	Vehicle HF	1.5-30	Yes	No	75	150W
R123M	Russia	Vehicle HF/VHF	20-52	No	No	30	22W
Panther-P	UK	Hand-held Squad/Platoon	30-88	Yes	Yes	10	5W
TRC5102	France	Hand-held Squad/Platoon	30-88	Yes	No	7	2W
ACH42	S. Afr.	Hand-held Squad/Platoon	45-68	No	No	7	2W
R31K	Bulgaria	Hand-held Squad/Platoon	44-54	No	No	5	1W
RL402	Swe/Nor	MMW Radio Relay	225-1850	Yes	Yes	Network	N/A
R423-1	Russia	Troposcatter Relay System	4400-4700	No	N/A	Network	N/A
KSR8	Hungary	Microwave Relay System	8000	Yes	N/A	Network	N/A
R161-5	Russia	HF Radio Station	1.5-30	No	No	3000	5kW
Scimitar-H	UK	HF SPF Radio	1.6-30	Yes	Yes	500	20W
PRC138	US	HF SPF Radio	1.6-80	Yes	Yes	500	20W
PVS5300	UK	HF SPF Radio	2-30	Yes	No	500	20W
PRC104	US	HF SPF Radio	2-30	No	No	500	20W

Table 2: Communication Satellites

Name of Satellite System	Country of Operator/Owner	Users	Class of Orbit	Comments
Amos	Israel	Military/ Commercial	GEO	C-band, Ku-band, and Ka-band transponders.
Apstar	China	Commercial	GEO	C-band and Ku-band transponders.
AsiaSat	China	Commercial	GEO	C-band and Ku-band transponders.
Chuangxin	China	Government	LEO	Prototype of advanced telecommunications satellite for LEO.
Express	Russia	Commercial	GEO	C-band, Ku-band, and L-band transponders.
Gonets	Russia	Commercial/Government	LEO	UHF.
Meridian	Russia	Military	Elliptical	C-band transponders.
Raduga	Russia	Military	GEO	C-band transponders.
Rodnik	Russia	Military	LEO	UHF.
Thuraya	United Arab Emirates	Commercial	GEO	C-band and L-band transponders.
Yahsat (Y1A)	United Arab Emirates	Military/ Commercial	GEO	C-band, Ku-band, and Ka-band transponders.
Zhongxing	China (PR)	Military/Government	GEO	Ku-band transponders.

Table 3: Navigation Satellites

Name of Satellite System	Country of Operator/Owner	Users	Comments	Class of Orbit
Beidou	China	Military	Navigation/Global Positioning	GEO
Compass	China	Military	Navigation/Global Positioning	GEO
Glonass	Russia	Military/ Commercial	Navigation/Global Positioning	MEO
Parus	Russia	Military	Navigation	LEO

Table 4: Weather Satellites

Name of Satellite System	Country of Operator/Owner	Users	Comments	Class of Orbit
Electro	Russia	Government	Meteorology	GEO
Haiyang	China	Government	Meteorology	LEO
Meteor	Russia	Government	Meteorology	LEO

Note: Additional information exists for all these satellites to include perigee, apogee, eccentricity, inclination, period, mass, power, launch site, and launch vehicle and is available on request.

NORWEGIAN TACTICAL COMMUNICATIONS SYSTEM ERITAC



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations:	Eritac	Components Backbone:	
Date of Introduction:	1999	Eritac Network to IP and TDM Network:	IPX600
Proliferation:	Oman, Kuwait, Egypt, Saudi Arabia, Croatia, Romania	Radio transmitter link for Eritac network:	RL532
Description:	KONGSBERG's tactical communications system	Components Tactical Local Area Network:	
Performance: Data Rates:		Tactical Gateway and Router between local and remote Combat net Radios:	TR600
Combat Net radio HF (kbps):	2	IP Based Radios:	WM600
Combat Net Radio VHF (kbps) :	16 - 64	Frequency Range (MHz):	225 - 400
Broadband IP radio UHF (Mbps):	2	Communications:	Automatic selection of link for every Data Rate and service (HF-UHF-VHF-Sat), based on required Quality of Service
Features:	Broadband and fiber optic ethernet backbone for transport to higher echelons: 100 Mbps Supported by both wireless and wired gateways	Frequency band Types:	HF/VHF/UHF/SHF
Security:	Encrypted, Frequency Hopping Spread Spectrum Transmission capable, Electro Magnetic Pulse (EMP) hardened.	Communications Transmission Platforms:	CNR/HCLOS/WLAN/SATCOM/ Fiber Optics

NOTES

ERITAC IS A HIGH-CAPACITY, AUTONOMOUS, DISTRIBUTED SWITCHING SYSTEM. VOICE AND DATA CAPABILITY INTEGRATED FROM THE STRATEGIC TO THE TACTICAL LEVEL.

PAKISTANI INTEGRATED BATTLEFIELD MANAGEMENT SYSTEM (IBMS)



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designations:	Horus	Command and Control	Adds and deletes vehicles for specific tasks Associates vehicle echelon with assigned domains Provides situational alerts
Date of Introduction:	UNK	Geographical Information System:	
Proliferation:	UNK		Static and mobile management centers include routers and radio access points (RAP) to backbone
Description:	IBMS provides near real time battlefield situational awareness (SA) data through an integrated network of both mobile and fixed nodes.		Tracking devices are installed in weapons platforms (including MBTs).
VHF	Digital signal multiband interoperability	Communications:	
UHF:	Fiber optic backbone for transport to higher echelons	Frequency band Types:	HF/VHF/UHF/SHF
Features:	Displays vehicles includes real time status and decision point warnings	Communications Transmission Platforms:	CNR/HCLOS/WLAN/SATCOM/ Fiber Optics
Vehicle Management:	Records routes of registered vehicles		

NOTES
GNSS BASED UPDATES DISPLAYS ALL VEHICLES IN NETWORK. INCLUDES REAL TIME STATUS AND DECISION POINT WARNINGS.

RUSSIAN COMMAND AND STAFF VEHICLE BMP-1KSHM



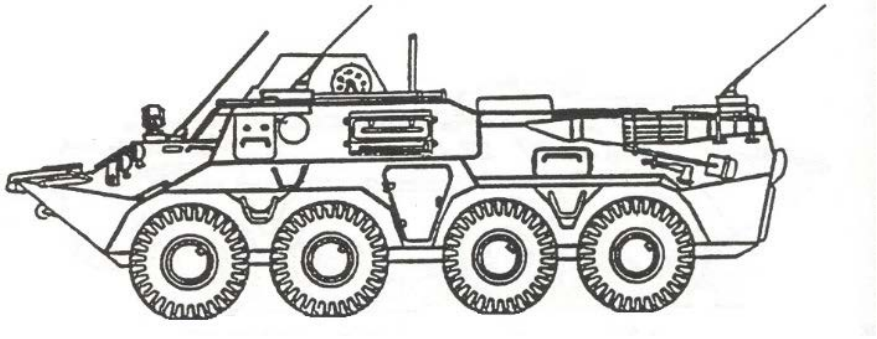
SYSTEM	SPECIFICATIONS	FEATURES (CONT.)	SPECIFICATIONS
System		Encryption:	
Alternative Designations:	"Potok"- 2	Masking Devises:	R-168mve
Date Of Introduction:	1976	Transmission Equipment:	E-9u Secure
Proliferation:	Bulgaria, China, Czech Republic, Poland, And Sweden	Digital Navigation Monitor:	
Descrption:		Glonass:	Yes
Crew:	1 Plus Vehicle/Staff Commander (Included Below)	1g11n Gyrocompass:	Yeas
Troop Capacity:	Staff 4-6 (Total Vehicle Capacity 5-7)	Graphic Display:	Yes
Chassis:	BMP-1	Automated Networks:	Yes
Combat Weight (Mt):	13.3	Emplace Time (Min):	2-3
Length Overall (M):	6.74	4 X AT-3031Telephones	
Height Overall (M):	2.15	Rear Mounted Onboard Generator(kw):	5
Ground Pressure (Kg/Cm2):	0.57	Whip Antennae For Mobile Comms:	1 HF Whip, 3 Vhfwhips
Automotive Performance:		Other Antennae:	VHF Discones Masted, HF Dipoles And 11-M Mast
Engine Type:	Diesel	Options:	Spall Liners, Air Conditioning, And A More Powerful Engine
Cruising Range (Km):	600	ARMAMENT	SPECIFICATIONS
Speed (Km/H):		Main Armament:	(Caliber, Type, Name:
Max Road:	65	Loader Type:	Belt-feed (100-rd belts)
Max Off-Road:	40-45	Ready/Stowed Rounds:	Ina
Average Cross-Country:	Ina	Elevation (°):	Ina
Max Swim:	7	Fire On Move:	No
Fording Depths (M):	Amphibious	ATGM Launcher:	N/A
		Firing Ports:	None

Command:	Normal Configuration For Rear Compartment Has 2 Officer Workstations And Two Radio Operator Consoles.	Sights	
Radios, Frequency, And Range:		Type:	Ina
R-168-5kve	1.5-30 Mhz (Hf), Voice/Digital, 10-300 Km	Sighting Range (M):	1,500
R-168-25ue	30-108 Mhz (Vhf),Voice/Digital, 20-40 Km	Magnification:	INA
R-168-100ue	30-80 Mhz (Vhf), Voice/Digital, 30-60 Km	Night Sights Available:	Yes
2 X R-168-5UN(1)E	30-108 Mhz (VHF), Man Pack, 10-25 Km	Caliber, Type, Name:	7.62-Mm API, API-T
R-168-5kne	1.5-30 Mhz (Hf), Voice/Digital, 10, 40, 300 Km	Maximum Aimed Range (M):	1,500
R-438 Satellite Comms System,	Data Exchange Up To 5,000 Km	Max Effective Range (M):	
Command Level:	Division, Regiment, Brigade And Battalion	Day:	1,000/400-500 On The Move
Intercoms:	2	Night:	Ina
Communications Links:	1-12	Tactical AA Range:	INA
Security:	Encrypted, Frequency Hopping Spread Spectrum Transmission Capable, Electro Magnetic Pulse (EMP) Hardened.	Armor Penetration (Mm):	8 (Rha) At 500 M
		Other Ammunition Types:	Light Ball/Ball-T, Heavy Ball
		VARIANTS	
		BMP-1ksh:	Tier 2 System Rradios Include R-130 HF, R-107, R-111 VHF, R-123/173 VHF.
		Communications Transmission Platforms:	CNR/HCLOS/WLAN/SATCOM/ Fiber Optics

NOTES

FOR STATIONARY LONG-RANGE TRANSMISSIONS, HAWK EYE 10-METER FOLDING DISCONES MASTED ANTENNA IS REMOVED FROM CARRYING CASE ON RIGHT SIDE OF VEHICLE AND INSERTED INTO ANTENNA BASE, WHICH EXTENDS FORWARD FROM THE TURRET.

RUSSIAN COMMAND AND STAFF VEHICLE KUSHETKA-B



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designations:	R-149BMR	Explosive Reactive Armor (mm):	N/A
Date of Introduction:	1990s	Active Protective System:	N/A
Proliferation:	At least 1country	Mineclearing Equipment:	N/A
Description:		Self-Entrenching Blade:	N/A
Crew:	1 plus vehicle/staff commander (included below)	NBC Protection System:	Collective
Troop Capacity:	Staff 4-6 (total vehicle capacity 5-7)	Smoke Equipment:	VEESS, 6 x 81-mm smoke grenade launchers
Chassis:	K1Sh1 version UnSh wheeled 8 X 8 derived from BTR-80	ARMAMENT	
Combat Weight est. (mt):	13	Main Armament:	(turret mount)
Chassis Length Overall (m):	7.65	Caliber, Type, Name:	7.62-mm (7.62x 54R) MG, PKM
Height Overall (m):	2.63	Rate of Fire (rd/min):	250 practical / 650 cyclic, 2-10 round bursts
Width Overall (m):	2.9	Loader Type:	Belt-feed (100-rd belts)
		Ready/Stowed Rounds:	INA
Automotive Performance:		Elevation (°):	INA
Engine Type Diesel (hp):	260	Fire on Move:	Yes
Cruising Range (km):	600	Firing Ports:	Yes
Speed (km/h):			
Max Road:	UNK	SIGHTS	
Max Off-Road:	UNK	Type:	INA
Average Cross-Country:	UNK	Sighting range (m):	1,500
Max Swim:	UNK	Magnification:	INA
Fording Depth (m):	Amphibious	Night Sights Available:	Yes
Command:	Normal configuration for rear compartment has 2 officer workstations and two radio operator consoles.	VARIANTS	
Communications:		MAIN ARMAMENT AMMUNITION	

Radios, frequency, and range:		Caliber, Type, Name:	
R-173M 30-80 MHz (VHF), standard vehicle type(km)	20	7.62-mm API, API-T	
R-171M 30-76 MHz (VHF), duplex, voice/digital (km):	35 - 80	Maximum Aimed Range (m):	1,500
R-163-50, R-163 UP 30-80 MHz (HF), voice/digital (km):	20 - 60	Max Effective Range (m):	
R-163-10V 2-30 MHz (HF'/VHF), voice/telegraph(km):	10 - 30	Day:	1,000/400-500 on the move
HF/ VHF portable short-range units	2 x R-163-1V	Night:	INA
Protection:		Tactical AA Range:	INA
Armor, Turret Front (mm):	Against 12.7-mm rounds	Armor Penetration (mm):	8 (RHA) at 500 m
Applique Armor (mm):	N/A		

NOTES

THE VEHICLE SHARES THE SAME CONFIGURATION AS BMM MEDICAL VEHICLES AND THE 1V152/KAPUSTNIK-B ACRV. OTHER LESS SIMILAR USERS OF THE UNSH/1KSH1CHASSIS INCLUDE THE BREM-K RECOVERY VEHICLE AND SEVERAL RADIO AND IW VEHICLES.

RUSSIAN COMMAND AND CONTROL VEHICLE R-142 NSA



Photo by: Vitaly Kuzmin

SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
SYSTEM		Curb:	3.6
Alternative Designations:	INA	Length Overall (m):	7.73
Date of Introduction:	1980	Height Overall (m):	3.375
Proliferation:	Russia	Width Overall (m):	3.34
Communications:		Payload on/off Highway (kg):	6,000
Radios, frequency, and range:		Ground Clearance (mm):	550
R-173M 0-80 MHz (VHF), standard vehicle type (km):	32	Turning Radius (m):	10
R-171M 30-76 MHz (VHF), duplex, voice/digital (km):	35 - 80	Wheels:	6
R-163-50, R-163 UP 30-80 MHz (HF), voice/digital (km):	20-60	Size (mm):	533 X 610
R-163-10V 2-30 MHz (HF'/VHF), voice/telegraph (km):	10-30	Central Tire Pressure Regulation System:	Yes
R-438 satellite comms system, data exchange up to (km):	5,000	AUTOMOTIVE	
Command level:	Division, brigade, and battalion	Engine V8, diesel turbocharged (hp):	165
Intercoms:	2	Cooling:	Water
Communications links:	1-12	Cruising Range (road) (km):	1000

Encryption E-24D:	Yes	Speed (km/h):	85
Digital navigation monitor GLONASS:	Yes	Fuel Capacity (liters):	
Graphic display:	Yes	Left Tank:	120
Automated networks:	Yes	Right Tank:	120
Emplace Time (min):	2-3	Towing Capability (kg):	
Vehicle can communicate on the move:	Yes	Off Highway:	2,000
CP can operate autonomously/in network:	Yes/Yes	On Highway:	7,000
Onboard generator:	Yes	Gradient (loaded) (°):	31
Whip antennae for mobile comms:	2 HF whips, 3 VHF	Fording Depths (m):	0.5
Other antennae:	VHF discones masted, HF dipoles and 11-m mast	CARGO SPACE	
Vehicle can communicate on the move:	Yes	Height (mm):	890
Description:		Width (mm):	2,470
Troop Capacity:	7	Length (mm):	4,890
Weight (mt):	7	Cargo Bed Area (m2):	~12

NOTES
BESIDES FUNCTIONING AS A COMMAND AND CONTROL VEHICLE, THE R-142 CAN PERFORM VARIOUS EW FUNCTIONS.

INFOWAR

INFOWAR is defined as specifically planned and integrated actions taken to achieve an information advantage at critical points and times. The goal is to influence an enemy's decision-making through his collected and available information, information systems, and information-based processes, while retaining the ability to employ friendly information, information-based processes, and systems to control the use of the electromagnetic spectrum at critical locations and times in the battle space or to attack the enemy.

All INFOWAR elements are mutually supporting. INFOWAR occurs through the combinations of seven elements:

- Electronic warfare (EW).
- Deception.
- Physical destruction.
- Protection and security measures.
- Perception management.
- Information attack (IA).
- Computer warfare.

EW capabilities allow foreign forces to exploit, deceive, degrade, disrupt, damage, or destroy sensors, processors, communications, and command and control (C^2) nodes. Information supremacy, delay, and denial, or distortions of the adversary's use of the electromagnetic spectrum and information infrastructure are the objectives. Electronic warfare (EW) is a perfect example of the integrated nature of foreign forces INFOWAR elements. The EW section in this chapter provides basic characteristics of selected systems either in use or readily available to the foreign forces.

Computer warfare includes capabilities that allow the foreign forces to conduct network warfare (NETWAR) to attack and exploit information systems by attacking key information technology systems within cyberspace, and to conduct network operations (NETOPS) to establish and protect C4ISR networks and information. In NETWAR the foreign forces obtains access through social engineering processes such as phishing schemes but can also employ complex technologies to intercept communications through man in the middle (MITM) attacks and hack into a system remotely. Once access is obtained, foreign forces will attempt to degrade the system or to exploit the system to collect intelligence. Some forms of attack can be launched unexpectedly through a data driven attack known as a "drive-by- download" that is embedded into a website or uploaded to a commonly used system, the victim in these cases releases malware by attempting to access what is believed to be a legitimate site or program. There are various methods used to accomplish this for the purpose of releasing viruses and other malware designed to give the attacker control over the victim's computer. The methods used to gain access involve highly developed social engineering techniques and or network attacks such as a spoofed email account or a false website.

Because these types of attacks are launched by the end user they are a concern since the attack is able to legitimately pass through various electronic defense systems such as firewalls. If access is obtained an electronic beachhead is established on the infected computer exposing the rest of the network to further attacks such as distributed denial of service attacks that overwhelm internet servers. Attacks can include vandalizing or



sabotaging a website, downloading sensitive information or degrading a key war fighting function through the release of malware.

Cyber espionage describes those INFOWAR actions that involve collecting sensitive and proprietary information such as plans, capabilities or personal data. The threat will exploit poor information technology security that exposes sensitive data to risk of exploitation or manipulation.

Information attack is a type of action that focuses on the intentional disruption or distortion of information in a manner that supports accomplishment of the mission. Unlike computer warfare attacks that target the information systems, information attacks target the information itself. Attacks on the commercial Internet by civilian hackers have demonstrated the vulnerability of cyber and information systems to innovative and flexible penetration, disruption, or distortion techniques.

Computer warfare consists of attacks that focus specifically on the computer systems, networks, and/or nodes. This includes a wide variety of activities, ranging from unauthorized access (hacking) of information systems for intelligence-collection purposes, to the insertion of malicious software (viruses, worms, logic bombs, or Trojan horses). Such attacks concentrate on the denial, disruption, or manipulation of the infrastructure's integrity. Terrorist organizations use a variety of encryption techniques such as embedding communications into innocuous computer applications in order to transmit data in a surreptitious manner. Other methods are the use of code words to conceal the meaning of topics and swapping Subscriber Identity Module (SIM) cards or cell phones to prevent electronic surveillance systems from identifying the user of a particular phone.

Evolving mobile technology has increased the portability of battlefield automated systems improving the integration and capabilities of many military functions. The proliferation of these capabilities increases the military's dependence on mobile devices and the networks that support them. Referred to as the "edge of the network," mobile systems provide improved situational awareness. However, the complexity associated with these enhancements in functionality, has introduced additional vulnerabilities. Vulnerabilities associated with wireless networking, and the need to support an expanding list of military applications, make mobile technology an important, feasible and valuable target for INFOWAR operations. Mobile devices share many of the vulnerabilities of personal computers. However, the attributes that make mobile phones easy to carry, use, and modify as well as comparatively low security standards open them to a range of attacks.

This selection of systems is not intended to be complete; rather, it is representative of the types and capabilities that are currently fielded or available. Later WEG updates will include equipment for other elements of INFOWAR operations. For more information on the INFOWAR tactics techniques and procedures see chapter 7 of TC 7-100.2 OPFOR Tactics.

Table 5: Tactical Electronic Warfare Systems

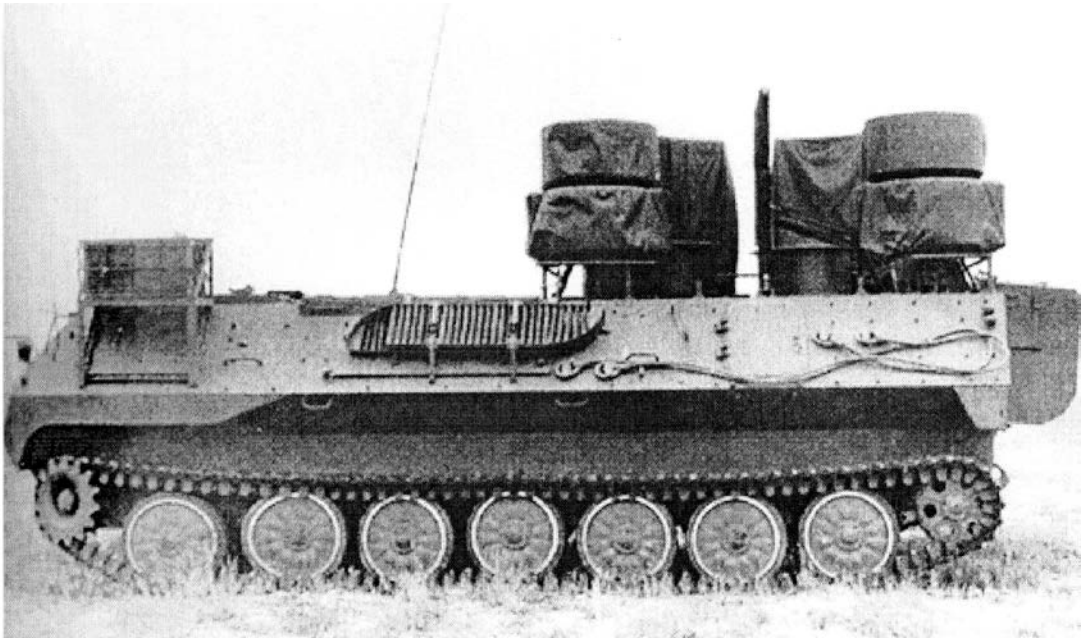
System	Country of Origin	Description	Frequency Range (MHz)	Vs. GPS?	Vs. FH?	Range (km)	Power Output
MEERKAT-S	UK	ESM/ELINT	2-40,000	No	Yes	500km	Passive
WEASEL 2000	UK	ESM/ELINT	.5-10,000	-	Yes	500km	Passive
EULe	Germany	ESM/ELINT	.9-3,000	-	Yes	450km	Passive
MCS90 TAMARA	Czech Rep	ESM/ELINT	820-3,000	-	No	450km	Passive
R-703 /709	Russia	ESM/ELINT	1.5-2,000	Yes	n/a	Unk	Unk
CICADA-C	Germany	Mounted ESM/ECM HF/VHF/UHF	.525-3,000	Yes	Yes	100km	10kw
TRC274	France	Mounted ESM/ECM HF/VHF/UHF	20-3,000	Yes	Yes	150km	4kW 1.2kW on the move
GSY1800	S. Africa	Mounted ESM/ECM HF/VHF/UHF	1-3000	Yes	Yes	100km	(ECM: 1kW)
PELENA-6	Russia	Mounted ECM HF/VHF/UHF	20-1,000	No	No	60 km	60W
R-330 ZH	Russia	Mounted ECM HF/VHF	100-2000	Yes	No	60km	1kW
CICADA-R	Germany	Mounted ESM/ECM HF/VHF/UHF	6,000-18,000	No	Yes	100km	1kW
LIMAN P2	Ukraine	Mounted ECM VHF/UHF	225-1,215*	Yes	Yes	100km	Unk
R-934B	Russia	Mounted ECM VHF/UHF	100-400	No	No	50km	500W
BOQ-X300	Sweden	Mounted ECM S/C/X/Ku/K	2-40,000	Yes	n/a	Unk	Unk
CBJ-40 BOME	France	Mounted ECM S/C/X/Ku	2-20,000	Yes	n/a	Unk	Unk
PELENA-1	Russia	Mounted ECM S/C	1,000-4,000	Yes	n/a	250 km	Unk
SPN-2/4	Russia	Mounted ECM X/K	6,000-17,500	No	No	130km	(ECM: 1kW)

SGS2000	Germany	Mounted ESM/ECM HF/VHF/UHF	1.5-1000	No**	Yes	100km	(ECM: 1kW)
System	**Country of Origin**	**Description**	**Frequency Range (MHz)**	**Vs. GPS?**	**Vs. FH?**	**Range (km)**	**Power Output**
JN-1102	China	Mounted ECM VHF (UAV Mounted)	20-500	No	Unk	Unk	Unk
BARRAGE	France	Mounted ECM VHF (UAV Mounted)	1-3000	Yes	No	Unk	Unk
AJ-045A	Bulgaria	Mounted ECM VHF (UAV Mounted)	20-100	No	No	10km	Unk
HUMMEL	Germany	Mounted ESM/ECM VHF	20-80	No	Yes	100km	(ECM: 1kW)
STORM-H	France	Manpack ECM HF/VHF/UHF/ SHF	20-470	No	No	5km	1kW (est.)
EL/K 7029/A/B	Israel	Mounted ESM /VHF /UHF/ESM	116-400	-	Yes	100km	Passive
ORION	Russia	ELINT	200-18,000	-	No	400km	Passive
AVTOBAZA-M	Russia	ELINT	200-18,000	-	No	400km	Passive

*Liman does not DF in the 960 to 1,215 MHz range

**SGS 2000 frequency range can be extended up to 3000MHz

RUSSIAN AIRBORNE EA RADAR JAMMER 1L245



SYSTEM	SPECIFICATIONS	PERFORMANCE	SPECIFICATIONS
Alternative Designations:	Vstrecha,Ground-Based Weapons Control Radar Suppression System	Fording Depths (m):	Amphibious
Date of Introduction:	1979	Communications:	Combat Net Radios Sets
Proliferation:	At least 2 countries	Protection:	Against 5.56 ball 5.56, all-around
Description:		Transmitter:	
Crew:	3	Frequency Range (GHz):	8 - 18
Platform (chassis):	MT-LBu	Output Power (W):	1,000
Combat Weight (mt):	15.7	Simple pulse signals received and analyzed 0.25 – 10 khz (μs):	1 - 5
Chassis Length Overall (m):	7.26	Pulse linear-frequency modulated signals 1 – 20 MHz (μs):	1 - 25
		Polarization of signals received:	vertical and horizontal
		Vertical:	YES
Height Overall (m):	3	Horizontal:	YES
Width Overall (m):	2.85	Sector, deg:	Combat operation (azimuth x elevation) 120 x 15 ECM with respect to the main radar 2 x 2 directional lobe of the reconnaissance strike system
Automotive Performance:		Radar detection and suppression range:	

Engine Type:	YaMZ-238, 240hp diesel	Reconnaissance strike system (km):	80 - 200
Cruising Range (km):	500 km	Tactical aircraft (km):	30 - 100
Speed (km/h):		Polarization of signals transmitted:	chaotic
Max Road:	60	Types of jamming:	
Max Off-Road:	26	Noise:	Yes
Cross-Country:	INA	Spot Programmed:	Yes
Max Swim:	4.5	Range Programmed:	Yes
		Interval Programmed:	Yes

NOTES
THE 1L245 IS MAINLY USED TO DEFEAT AIRBORNE RADAR SYSTEMS AND JSTARS. HOWEVER, IT HAS THE CAPABILITY TO AND JAM GROUND SYSTEMS AS WELL

RUSSIAN AIRBORNE EA JAMMER INFAUNA



SYSTEM	SPECIFICATIONS	PERFORMANCE	SPECIFICATIONS
Alternative Designations:	None	Engine Type:	INA
Date of Introduction:	2012	Cruising Range (km):	600
Proliferation:	Russian Airborne Forces (VDV)	Speed (km/h):	
Description:	Modified BTR 80 chassis identified as the K1Sh1.	Max Road:	85
Height (m):	2.21	Max Off-Road:	60
Weight (kg):	12,000	Average Cross-Country:	40
Length (m):	7.65	Max Swim:	10
Crew:	2	Fording Depths (m):	Amphibious
Troop Capacity:	8	EW/JAMMING SYSTEM:	
Combat Weight (mt):	14	Frequency Jamming Range (MHz):	20 - 2020
Chassis Length Overall (m):	7.55	Output Power (W):	60
Height Overall (m):	2.41	Voltage Supply (V):	12.6
Width Overall (m):	2.95	Weight of System (Separated from vehicle) (kg):	14
Ground Pressure (kg/cm2):	INA	Deployment:	Protects combat vehicles and troops against radio controlled mines and explosives (IEDs).
Drive Formula:	8 x 8	APS Capability	Softkill aerosol interference against high-precision

			weapons with laser and video-management systems.

NOTES
FIELDED TO: EW BATTALIONS IN AIRBORNE FORCES OF THE RUSSIAN ARMY. AS PART OF THE AIRBORNE FORCES, THIS SYSTEM WILL BE USED TO ACCOMPANY INITIAL ENTRY TROOPS AND ASSIST WITH SECURING KEY TERRAIN TO ENABLE FOLLOW-ON FORCES (MOTORIZED, MECHANIZED, AND ARMOR) TO DEPLOY INTO COMBAT AREAS.

RUSSIA MOBILE EW SYSTEM LEER-2



SYSTEM	SPECIFICATIONS	PERFORMANCE	SPECIFICATIONS
Alternative Designations:	Tigr-M REI PP	Crew:	6
Date of Introduction:	2012	Engine MZ-5347-10 multi-fuel diesel engine (hp):	215
Proliferation:	Russia	Max Speed (kph):	125
Jamming Range (MHz):	20-1000	Protection:	7.62
Automotive Range (km):	400		

NOTES

E TIGR-M MKTK REI PP MOBILE TECHNICAL CONTROL, ELECTRONIC EMULATION AND ELECTRONIC COUNTERMEASURES SYSTEM IS DESIGNED FOR DEVELOPING RADIO EMITTERS, JAMMING AND SUPPRESSING RADIO-ELECTRONIC MEANS INCLUDING CELLULAR PHONE SYSTEMS.

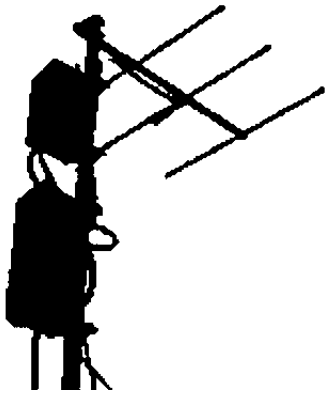
RUSSIAN GNSS JAMMING TRANSMITTER AVIACONVERSIA



SYSTEM	SPECIFICATIONS	PERFORMANCE	SPECIFICATIONS
Alternative Designations:	GPS / GLONASS Jammer	Fixed:	Yes
Date of Introduction:	1990s	Manportable:	Yes
Proliferation:	Iran, Iraq, North Korea	Vehicle:	Yes
Description:	Aviaconversia portable GPS and GLONASS jammer	Airborne:	Yes
SPECIFICATIONS		Antenna and Transmitter:	
Jamming Range (km):	150 - 200	Antenna Type:	Omni directional or directional yagi
Power Supply DC (V):	15	Transmitter:	Continuous-wave with cable link to antenna
Configuration Weight (kg):	8 – 12	Signal:	Coherent pulse Doppler, J-band
Frequency range:		Power (kw):	
Civilian Channel (MHz):	1,577	Consumed (W):	25
Military Channel (MHz):	1,230	Emitted (W):	4
Target Systems:		Width of radiation pattern lobe (°):	360
Glonass:	Yes	Operation:	Designed to affect C2, maneuver and fire support activities. May affect high precision munitions.
GPS:	Yes		
Mount:			

NOTES
CONTINUOUSLY JAMS GPS SIGNALS. 6 MHZ FREQUENCY DEVIATION TO COUNTER EP MEASURES. ADJUSTABLE MODULATION FROM 44 TO 270 HZ TO COUNTER VARIOUS GNSS SYSTEMS.

BELARUSIAN GNSS DISTRIBUTED JAMMING COMPLEX OPTIMA-3



SYSTEM	SPECIFICATIONS	PERFORMANCE	SPECIFICATIONS
Alternative Designations:	GPS / GLONASS Jammer	Width of radiation pattern lobe (°):	
Date of Introduction:	2003	Horzontal (°):	60 - -10
Proliferation:	Fielded in one country and marketed for sale in at least 2 others	Vertical (°):	40 - -10
Jammer Range (km):	100	Components:	The main components are the operator's automated workstation and a control unit for each transmitter. .
Power Supply AC/DC:	220/24	Number of Transmitters:	9
Weight Transmitter (kg):	10	Control System:	ASU-PP automated control system. System status and situational awareness is monitored by the operator at the remote workstation
Frequency range:		Command Links:	
Civilian (MHz):	1,575.42	Command VHF:	Yes
Military (MHz):	1,227.6	Command GSM:	Yes
Antenna and Transmitter:		Control Link Range (km):	30-50
Mount:		Response time:	
Fixed:	Yes	Command VHF (seconds):	5
Vehicle:	Yes	Command GSM (seconds):	≤ 60
Antenna Type:	Omni directional	Operation:	Designed to affect C2, maneuver and fire support activities. May affect high precision munitions.
Transmitter:	Continuous-wave with cable link to antenna		
Signal:	Complex frequency and interval waveform degrade the GNSS code.		
Output Power (W):	20		

NOTES
OPTIMA-3 GNSS JAMMING COMPLEX IS A NETWORK OF JAMMING TRANSMITTERS THAT CAN BE CONTROLLED BY A CENTRAL COMMAND STATION BY EITHER GSM CELL PHONE OR ULTRA SHORT WAVE RADIO.

GERMANY ELECTRONIC SUPPORT / ATTACK JAMMING TRANSMITTER
CICADA-C AND R



SYSTEM	SPECIFICATIONS	PERFORMANCE	SPECIFICATIONS
Alternative Designations:	Hummel	FM Morse Code:	YES
Date of Introduction:	1990s	AM Telegraph	YES
Proliferation:	Holland, Spain, Australia	AM Voice:	YES
Description:	Threat multi-range jammer.	AM Morse Code:	YES
Vehicle Range (KM):	150-200	AM Facsimile:	YES
Power Supply (AC/DC):	6 / 15	Fast scan speed (MHz/s):	250 / 1000 (upgraded variant)
Weight (Mt.):	8 – 12	Passive Antennas:	
Frequency Range (MHz):	0.525 - 3,000		dipole or monopole antennas
JAMMING TRANSMITTER:			vertical or horizontal polarized omnidirectional antennas
Transmit modulation:	deception and burn through		antennas for operation on the move
FM Voice:	YES	AMPLIFIER:	
FM Telegraph / Teletype :	YES	Amplifier types:	broadband, solid-state, liquid cooled
FMFacsimile:	YES	Max output power kW into 50 Ω	10
AM Telegraph:	YES	Transmitter:	Continuous-wave with cable link to antenna
AM Voice:	YES	Amplifier Power Consumption(kW):	25.4
Jamming operation modes:		Width of radiation pattern lobe (°):	360
PRESET FREQ:	YES	OPERATION:	
BROAD JAM:	YES	Frequency Range (MHz):	1.5 - 3,000
ATTACK JAM:	YES	Automatic computer controlled jamming sequences	YES

MANUAL JAM:	YES	High power Amplifier MAX (Kw):	YES
DECEPTION:	YES	"Look Through" Capability ensures jammer is only active when target signal is on the air	YES
Broadjam bandwidth:	up to 240 MHz, in 0.1 MHz steps, simultaneous generation of up to 16 separate broadband segments	Deception jamming	YES
Jamming efficiency:	up to 16 simultaneously active radio nets	Broadband TDM (barrage) jamming against simultaneous spread spectrum transmitters	YES
ANTENNA AND TRANSMITTER:		Programming protected frequencies:	YES
Mount:	Fixed site, vehicle and airborne platforms available.	Local or remote control	YES
Antenna Type:	Omni directional or directional yagi	Environmental conditions:	
RECEIVER:		Operation (°C):	-25 - + 55
Receive modes:		Storage (°C):	-40 - +70
FM Voice:	YES	VARIANTS:	
FM Telegraph / Teletype:	YES	Cicada-R Radar Jammer	
FM Facsimile:	YES	Frequency range (GHz):	6-18

NOTES

CAN BE MOUNTED ON AN ARMORED SIX-WHEEL APC, TRACKED VEHICLE, OR IN A FIXED SITE. ABLE TO REMOTELY OPERATE WITH EITHER RADIO OR WIRED LINKS. ADDITIONAL JAMMING MODES AGAINST NEW THREATS (E.G. FREQUENCY HOPPERS, MOBILE TELEPHONES, SATELLITE NAVIGATION). COMPACT DESIGN FOR HIGHLY MOBILE APPLICATIONS.

GERMANY GROUND BASED SIGINT LIGHT ELECTRONIC SUPPORT SYSTEM (EULE)



Source: Panzerbaer

SYSTEM	SPECIFICATIONS	PERFORMANCE	SPECIFICATIONS
Alternative Designations:	Owl (English), (TMS) 210	Fast scan speed (GHz/s):	1.3
Date of Introduction:	2000's	Scan Mode:	Frequency, memory and radio frequency panorama
Proliferation:	Germany.	Target Data:	Identifies and locates,LPI, LPD emissions Frequency Hop, and Spread Spectrum
Description:	Transportable Monitoring System	Frequency identification accuracy:	± 30MHz
Vehicle Range (km) est.:	150-200	Accuracy of DF,degrees:	2
Engine:	Mercedes Benz 306 hp	ANTENNAS:	
Drive:	4x4	Passive Antennas Frequency Range:	
Length (m):	6.6	ADD 195(MHz):	20-1300
Width (m):	2.39	ADD 170 UHF DF antenna for GSM (MHz):	800-2,000
Crew:	2	HE 500 (MHz):	20-3,000
Weight:	14 t	antennas for operation on the move	
Max Speed (km/h):	80	STORAGE and C2 INTERFACE:	
RECEIVER:		Storage (Tbyte):	1
Designation:	ESMB	Remote Data Rates:	
Power Supply AC/DC:	11/ 32	LAN 500 m, (copper pair) (kbps)	128
Power Supply Weight (kg):	36.8	Serial 300m, (kbps)	20
Operational Frequency Ranges (MHz):	.9 – 3,000	GSM Link, (kbps)	10
DF and Intercept (MHz):	20 - 1300	OPERATION:	
Intercept only (MHz):	≥1300		
Receive modes:		Software Defined (RAMON) Receiver	

FM Voice:	YES	Uses two or more station for DF	
FM Telegraph / Teletype:	YES	Local or remote control	
FM Facsimile:	YES	Operations Time (hours):	12
FM Morse Code:	YES	Environmental conditions:	
AM Telegraph	YES	Operation:	40 °C to +65 °C
AM Voice:	YES	Storage:	-40 °C to +65 °C
AM Morse Code:	YES	VARIANTS:	
AM Facsimile:	YES	ESMD	
GSM:	YES	Receiver Frequency Range (MHz):	.9 – 26,500

RUSSIAN GROUND BASED ES, ELINT SYSTEM AVTOBAZA



SYSTEM	SPECIFICATIONS	PERFORMANCE	SPECIFICATIONS
Alternative Designations:	1L222	Fast scan speed Targets Per Second:	15
Date of Introduction:	1980s	Frequency identification accuracy:	
Proliferation:	At least 4 countries	Accuracy of DF:	
Description:	Passive ELINT signals intercept system designed to intercept and locate pulsed airborne radars including fire control radars, terrain following radars and ground mapping radars as well as weapon (missile) data links.	Azimuth (degrees):	.3 - .5
Vehicle Range:	INA	Elevation (degrees):	3
Engine:	INA	ANTENNAS:	
Drive:	INA	Rotating Parabolic:	Yes
Length:	INA	Azimuth:	360
Width:	INA	Rotation Orbits per per minute:	6 - 12
Crew:	4	Local or remote control	Yes
Weight (mt):	13.3	Range of Remote Operations (m):	100
Max Speed:	INA	LAN copper twisted pair:	INA
		Serial 300m (kbps):	INA
RECEIVER:		Radio Link (kbps):	INA
Designation:	INA	OPERATION:	
Power Supply:	6V or 15V DC	Prioritization Targets:	Yes
Operational Frequency Range (GHz):	8 – 17.5	Number of Targets Monitored:	60
DF and Intercept:	Yes	Local or remote control	Yes
Receive modes:		Set Up Time (minutes):	25
SLAR:	Yes	Environmental conditions:	

PGM Targeting Radar:	Yes	Operation Temperature:	-45 - 40
Nap of the Earth (NOE) Radar:	Yes	Humidity (%):	98
Early Warning Radar:	Yes	VARIANTS:	Avtobaza-M
SAT Phones:	Yes	Receiver Range (km):	400
		Frequency range (GHz):	2 - 18

NOTES
MAY HAVE BEEN MODIFIED TO RECEIVE AND LOCATE EMISSIONS ASSOCIATED WITH SATELLITE TELEPHONES. REPORTEDLY OPERATED IN SYRIA IN 2011 -2012.

UNITED KINGDOM GROUND BASED ES, ELINT SYSTEM WEASEL 2000



SYSTEM	SPECIFICATIONS	PERFORMANCE	SPECIFICATIONS
Alternative Designations:	None	Operation:	
Date of Introduction:	2005	Coverage sector deg.:	0 - 180
Proliferation:	At least 2 countries	Travel mode:	
Description:	Passive ELINT System	Fixed:	Yes
Crew:	2	Mobile:	No
Platform:	Mercedes Ax or 4 ton	Remote operation:	
		Number of Sensors:	≥ 1
Combat Weight (Tons):	12.6	Remote Range wired(m):	85
Antenna and Receiver:		Direction Finding::	
Mount:	Motor-driven	Library::	Yes
Antenna Type:	Omni directional	Other links:	
	Rotating Dish	PERFORMANCE	
Azimuth coverage º:	360	Surveillance range (km):	Passive system
Direction Finding assembly:	Dual 8 port switched amplitude comparison system	Variants:	
Frequency Range (GHz):	0.4 - 10		TAC Weasel
Bearing Accuracy (DF) 1 Deg. RMS (GHz):	3 - 10		Weasel II
Polarization Range (GHz):	2 - 18		Weasel III
Receiver sensitivity (dBmi):	-62		
Range (dB):	60		

NOTES
AT THE NETWORK CONTROL CENTER NCC. SENSORS OPERATE AUTOMATICALLY AFTER SETUP. SEARCH RECEIVER AUTOMATICALLY TUNES TO CORRECT FREQUENCY ONCE THE EMISSION IS IDENTIFIED. ANALYSIS AND THREAT DATA CAN BE TRANSMITTED TO REMOTE USERS. THE DATA CAN ALSO BE FUSED WITH OTHER SENSOR SYSTEMS FOR TARGET LOCATION BY AZIMUTH INTERSECTION. WEASEL SYSTEMS CAN BE USED IN CONJUNCTION WITH THE SCORPION JAMMING SYSTEM.

FINLAND ESM WIDEBAND COMINT SENSOR ELEKTROBIT



SYSTEM	SPECIFICATIONS	PERFORMANCE	SPECIFICATIONS
Alternative Designations:	N/A	Antennas for operation on the move:	Yes
Date of Introduction:	2010s	AMPLIFIER:	
Proliferation:	Finland.	Amplifier types:	broadband, solid-state, liquid cooled
Description:	Wideband COMINT Sensor.	Output power (kW): into 50 Ω	10
SPECIFICATIONS:		frequency change time at the power output < 100 µs	
Range est. (km):	5 - 10	Transmitter:	Continuous-wave with cable link to antenna
		Amplifier Power (kW):	
		Consumption:	25
Power Supply (AC/DC):	6 / 15	Emitted:	4
Weight (kg):	2	Width of radiation pattern lobe:	360
Frequency Range (MHz):	30 - 40	OPERATION:	
RECEIVER:		Storage:	High capacity raw data recording of predetermined area
Receive modes:	VHF/UHF/SHF		Reconfigurable waveforms broadband wireless signals
Fast scan speed (MHz / s):	250 - 1000 (upgrade)	LPI:	Yes
Passive Antennas:		Remote Operations:	Yes
Dipole or monopole antennas:	Yes	Environmental conditions:	
Vertical or horizontal polarized omnidirectional antennas:	Yes	VARIANTS:	INA
		Frequency range (GHz):	INA

CHINA UNMANNED AERIAL VEHICLE EW, ECM ASN-207



SYSTEM	SPECIFICATIONS	PERFORMANCE	SPECIFICATIONS
Alternative Designations:	D-4	Dimensions (m):	
Date of Introduction:	2002	Wing Span:	6
Proliferation:	At least 1 country	Length (fuselage):	3.8
Description:		Height:	1.4 (excluding skids)
Engines (HP):	51	Launch Method:	Solid rocket booster on a zero length launcher.
HS-700 four-cylinder, two-stroke gasoline air-cooled piston		Recovery Method:	Parachute (nonsteerable)
Propulsion:	propeller	Landing Method:	2 spring loaded skids
Weight (kg):		Maximum Flights Per Aircraft:	INA
Takeoff:	222		
Fuel and Payload (combined):	50	Survivability/Countermeasures:	INA
Speed (km/h):		Pre-programmable waypoints for self correcting:	Yes
Maximum (level):	210	EW/ECM	
Cruise:	150	Payload Type:	JN-1102 EW/ECM suite
Ceiling (m):		Frequency Range (MHz):	20 -.500
Maximum:	5,000 - 6,000	Intercept:	Yes
Minimum:	100	VARIANTS:	
Fuel (liters):	INA	ASN-206:	
Endurance (hr.):	8 - 16	Date of Introduction:	1990's
Range (km):			

RPV Mode:	**600**		
Pre-programmed Mode:	**600**		

NOTES
***THE UAV IS LAUNCHED FROM A ZERO-LENGTH LAUNCHER USING A SOLID ROCKET BOOSTER THAT IS JETTISONED AFTER TAKE-OFF.**

SWEDEN AIRBORNE ECM/EW POD, SAAB BOQ X-300 (ON JAS39/GRIPEN)



SYSTEM	SPECIFICATIONS	PERFORMANCE	SPECIFICATIONS
Alternative Designations:	None	Intern Range (km):	
Date of Introduction:	1997	Combat Radius:	800
Proliferation:	Sweden (Hungary and South Africa – planned)	Ferry:	3,000
Description:		Takeoff Run/Landing Roll (m):	800/800al:
Crew:	1 (pilot) (JAS 39A/C), 2 pilots (JAS 39B/D)	External:	3,300.
Appearance:		Dimensions (m):	
Wings:	Multi-sparred delta.	Length:	14.1 (A/C), 14.8 (B/D)
Engines:	Turbofan with intake boxes on both	Wingspan (m):	8.4
sides of fuselage.		Height:	4.5
Tail:	Leading edge swept fin with upright inset rudder.	BOQ-X300 ECM/EW POD.	
Engines:	1 x 12,140 lbs thrust Volvo Aero RM12, 18,200 lbs thrust with afterburner	Alternative Designations:	None
Weight (kg):		DATE OF INTRODUCTION:	2012
Takeoff:	12,500 (A/C), 14,000 (B/D)	PROLIFERATION:	Sweden
Empty:	6.500 (A/C), 7,100 (B/D)	COUNTRY OF ORIGIN:	Sweden
Speed (km/h):		FREQ. BANDS:	S/C/X/Ku/K
Maximum (at altitude):	2,150, Mach 1.8+	FREQ. RANGE (MHz):	2-40,000
Max “G” Force (g):	+9/-3 g	RANGE:	INA
Ceiling (m):	16,000	POWER OUTPUT:	INA
Fuel (liters):		TYPE:	Airborne Electronic Countermeasures (ECM), radar jamming system.

NOTES
THE BOQ-X300 HIGH-PERFORMANCE JAMMING POD IS THE LATEST POD BEING DEVELOPED BY SAAB FOR THE GRIPEN FIGHTER. THE POD IS A MODULAR SYSTEM THAT INTEGRATES A SOPHISTICATED JAMMER, SUPPORTED BY A RWR AND ESM SYSTEM. AS AN OPTION, THE POD CAN BE CONFIGURED WITH A DUAL FIBER OPTIC TOWED DECOY TO PROVIDE EFFECTIVE COUNTERMEASURES AGAINST MONOPULSE THREAT. THE BOQ-X300 PROVIDES SELF-PROTECTION FOR HIGH VALUE ASSETS SUCH AS FIGHTER, ATTACK AND RECONNAISSANCE AIRCRAFT. THE POD IS DESIGNED TO SUPPRESS LEGACY THREATS, SURFACE BASED AS WELL AS AIRBORNE. A SECONDARY ROLE FOR THE BOQ-X300 IS TO PROVIDE JAMMING FOR TRAINING OF RADAR OPERATORS IN AIRBORNE AS WELL AS GROUND- OR SEA-BASED ENVIRONMENTS.

Dec
2016

Worldwide Equipment Guide

Chapter 10: Countermeasures, Upgrades, and Emerging Technology



TRADOC G-2 ACE–Threats Integration
Ft. Leavenworth, KS

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Chapter 10: Countermeasures, Upgrades, and Emerging Technology

Chapter 10 provides information on countermeasure techniques, weapon system upgrades, and emerging technology. The section on countermeasures will detail how the OPFOR can employ a variety of countermeasures in order to secure the advantage over the enemy. The section on weapon system upgrades provides an overview of the types of upgrades common OPFOR weapons systems have. The section on emerging technology highlights advancements of weapon system technology for near- and mid-term time periods.

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Countermeasures

Countermeasures (CMs) are survivability measures that preserve the integrity of assets and personnel by degrading enemy sensors and weapons effectiveness. These measures often fit within the US Army term CCD (camouflage, concealment and deception) or within the OPFOR term C3D (camouflage, cover, concealment and deception). Decoys used by tactical units within branch operations are designed to aid survivability, and are considered to be countermeasures. Countermeasures can take the form of tactical CMs (or reactive measures), or they can be technical CMs. The variety of tactical CMs changes with new unit tactics, techniques, and procedures (TTP) to adapt to a given situation within rules of engagement. This document focuses on technical CM. In specialized branches, new technical CMs continue to appear.

Modern forces will upgrade systems with selected countermeasures. Many CMs noted are intended to protect combat vehicles from anti-armor sensors and weapons. Although the below CMs can be used to counter precision weapons, many were developed for use against conventional weapons. Priorities for countermeasures are dictated by the goals of survival, mission success, and maintaining effectiveness. The first CM priority is to avoid detection until you can control the events. Among goals for using countermeasures, the highest is mission success.

Survival ("don't be killed") is defined holistically, including the following requirements in order of priority: operating system or network survival, vehicle survival, avoidance of major vehicle damage, crew survival, and avoidance of minor vehicle repair. A compatible suite of countermeasures may be limited to a more modest goal, to preserve a measure of effectiveness, even at the risk of system survival. Effectiveness in this context could be defined as the ability to effectively execute the immediate and subsequent missions until system or subsystem failure interrupts this process. Effectiveness includes: crew effectiveness, mission success, operating system effectiveness, and vehicle/soldier readiness for employment.

Several factors must be considered when selecting countermeasures:

- Countermeasures should be fielded and mounted on systems with a holistic and rational approach to assure survivability. The rational developer will focus countermeasures with the highest priority given to assure protection against the most likely and most lethal threats. However, with changing threat capabilities over time, and conflicting priorities, the current CMs mix may not be successful. Most CMs are responses to specific perceived threats, and are limited by cost and weight budget concerns. With the modern reliance on precision weapons, military forces may develop complex and expensive countermeasure "suites" to degrade their effects.
- Some countermeasures can degrade a variety of sensors and weapons capabilities. They can be grouped by threat to be countered, such as artillery or ATGM CMs. Others are more adversary and technology specific, and may not be fielded until that technology is fielded. Driven by threatening technologies, designers may launch a short-response program to produce or purchase countermeasures for rapid mounting.
- The R&D process has led to the development of counter-countermeasures, intended to negate the effects of CMs. However, at some level, these are also CMs. To avoid confusion on labeling, these will also be called countermeasures.

- When countermeasures are added to a vehicle or within close proximity, they must be mutually compatible and compatible with other subsystems. Thus issues such as electromagnetic interference and self-blinding with smokes must be considered.
- Although a variety of countermeasures are now marketed, many technical and financial factors can negate their advantages. Countermeasure development may be restricted due to resource, technology, and fabrication limitations, which vary by country and timeframe. Budget limitations may limit fielding of feasible and valuable CM, or compel selection of less capable countermeasures. For instance, active protection systems can counter some weapons; but they are expensive, hazardous to soldiers, and ineffective against many weapons. Thus they may be unsuitable and unlikely for application to many systems. OPFOR users should consult the POC below for assistance in selecting CMs for a specific system.
- Countermeasures will not replace the need for armor protection and sound tactics.

Lethality Component versus Countermeasure Responses

This table is intended to assist in selection of CM and understanding the categorization for use in upgrade schemes. Many of the more widely-fielded countermeasures are designed to degrade a variety of sensors and munitions, for minimal upgrade cost. Thus, countermeasure types may be repeated under several functions. Because new technologies are emerging rapidly, and systems are finding applications which can place them in several CM types, the placement of CMs can be somewhat arbitrary. Use against artillery vs ATGMs vs ground vehicle weapons will vary. The following list of CM can be used for artillery, air defense, antitank, armor, aircraft, theater missile, and other systems, depending on the platform, gun, sensor, and munition configuration of the system.

Capability to Be Degraded	Type of Countermeasure
Detection and location	Camouflage: nets, paints, fasteners for added natural materials Cover: entrenching blades, hole-blast device, underground facilities Concealment: screens, skirts, thermal engine covers, scrim, other signature reduction Deformers, engine exhaust diversion, other signature alteration measures Aerosols: smoke and flares, water spray systems Decoys, clutter, and acoustic countermeasures Counter-location measures: GPS jammers, laser and radar warning systems
C2/sensor-shooter links	See Information Warfare (IW) Chapter
Platform or weapon	Counterfire: directional warning systems, laser radars, for rapid response Directed energy weapons (DEW), such as high-energy lasers System prioritization for hard-kill, e.g., anti-helicopter mines (See Ch 7)
Weapon sensors and fire control	CCD as noted above. Directed energy weapons, such as low-energy lasers (LEL) Electro-optical countermeasures (EOCMs)
Submunition dispensing/activation	Global positioning system (GPS) jammer Fuze (laser/IR/RF), RF barrage jammers, acoustic jammers
Precision munition and submunition sensors	CCD as noted above. False-target generator (visual, IR, RF/acoustic) Electromagnetic mine countermeasure system, to pre-detonate or confuse Fuze jammers (laser/IR/RF), RF barrage jammers, acoustic jammers

Munition/submunition in-flight, and its effects	Sensors to detect munitions: MMW radars, RF/IR/UV passive sensors Air watch and air defense/NBC warning net, to trigger alarm signal Active protection systems, for munition/submunition hard kill Cover, additional armor to reduce warhead effects
Other system effects	Miscellaneous CM (See below)

Countermeasures against Sensors

Type Countermeasure	Countermeasure	Example	Application
Camouflage	Camouflage nets Camouflage paints, IR/radar/and laser-absorptive materials/paints Fasteners, belts for attaching natural materials	Russian MKS and MKT Salisbury screen rubber epoxy Chinese "grass mat" set	Variety of vehicles Variety systems Uniforms and vehicles
Cover	Natural and manmade cover, civilian buildings Entrenching blade to dig in vehicles Hole-blast devices for troop positions, spider holes Underground facilities, bunkers, firing positions	Tree cover, garages, underpasses T-80U tank, BMP-3 IFV, 2S3 arty Hardened artillery sites, bunkers	TELs, vehicles, troops IFVs, tanks, SP arty Infantry, SOF Iraqi and NK sites
Concealment	Screens, overhead cover for infantry (conceal IR/visible signature) Canvas vehicle cover, to conceal weapons Thermal covers, vehicle screens Scrim, side skirts and skirting around turret	Colebrand netting Cover on Chinese Type 90 MRL Kintex thermal blanket over engine French "Ecrim" track cover scrim	Infantry, weapon, sensor Truck-based weapons For combat vehicles Combat vehicles
Deformers/ signature modification	"Wummels" (erectable umbrellas to change/conceal shape/edges) Exhaust deformers (redirect exhaust under/behind vehicle) Engine and running gear signature modification (change sound) IR/radar deformers (in combination with RAM and RAP, etc)	Barracuda RAPCAM/TOPCAM Russian exhaust deflectors Track pads, road wheel/exhaust change Cat-eyes, Luneburg lens	Vehicles, sites, weapons Combat vehicles Tracked, other vehicles Tracked, other vehicles
Aerosols	Visual suppression measures, smokes, WP rounds Multi-spectral smokes for IR and or MMW bands, Flares, chaff, WP, to create false targets, disrupt FLIR Toxic smokes (irritants to disrupt infantry and weapons crews) Water spray systems (to reduce thermal contrast)	Smoke generators, fog oil, S-4, RPO-D ZD-6 Smoke grenades (visual/IR) WP rounds, Galix 6 flare system, Adamsite and CN in smoke mix Add-on kits for vehicles	Blinding, screening Vehicle protection Combat vehicles, arty Smoke generators Recon, C2, AD, arty
Decoys	Clutter (civilian/military vehicles, structures, burning equipment) Low to high-fidelity (multi-spectral) decoys Radar/IR decoy supplements (to add to visual/fabricated decoys) Acoustic countermeasures (to deceive reconnaissance, sensors)	Log site, truck park, tank farm, derricks IMT-72 “dummy tank”, Shape Intl Corner reflectors, KFP-1-180 IR heater Acoustic tape/speaker systems	Artillery, combat vehicles TBM, vehicle decoys Vehicle/site radar decoys Vehicles, sites

Counter-location measures	Degrade GPS by jamming to reduce precision location capability Jam radars/IR sensors Laser, IR, and radar warning systems (to trigger move/CM)	Aviaconversia GPS jammer SPN-2 truck-borne jammer set Slovenian LIRD laser warner	Infantry and others tactical/operational area Combat vehicles

Countermeasures against Weapons and Weapon Sensors

Type Countermeasure	Countermeasure	Example	Application
Added protection (supplements to armor in reaction to specific capability)	Armor supplements (ERA, screens, bar or box armor, sand bags) Armor skirts over road wheels Mine rollers, plows and flails Vehicle belly armor, raised or redesigned belly design, skirt Vertical smoke grenade launchers (to counter PGM top attack)	Barracuda, SNPE ERA KMT-5, KMT-6	
EOCM	Use EOCMs such as IR jammer/IR searchlights to redirect ATGM	KBCM infrared CM system	Combat vehicles
False-target Generators	Acoustic jammers and directed acoustic countermeasure Laser false-target generator (against semi-active laser homing) Electromagnetic mine countermeasure system, counters fuzes	In development, can be improvised In development	To distract acoustic seekers Combat vehicles
Jammers	Altimeter jammer (counters submunition dispersion altimeter) Fuze jammers (to spoof RF proximity fuzes on munitions) Incoherent infrared jamming (to jam IR fuzes on munitions) GPS jammers to confuse navigation and course correction systems	SPR-1 armored ECM vehicle	High priority sites, CPs etc.
Active countermeasures	Active protection systems, for munition hard kill. High energy laser weapons to destroy munitions or sensors Low energy lasers to blind or dazzle. Radio-frequency weapons to burn electronics and detonate munitions Directed MGs	Arena hard-kill system ZM-87 laser weapon VEMASID counter-mine system	Tanks, recon vehicle, IFVs AT, AD systems
Counterfire/ Threat response warners	Directional warning system (locate laser/radar, to direct weapons) Employ sensors (RF/IR/UV - to detect munitions) Acoustic directional systems (to detect munitions) Laser radars (laser scanner to locate optics and direct weapons) Directed energy weapons (against optics) Anti-helicopter mines (against aircraft) Employ air watch/security, AD, NBC, nets to trigger alarm signal Dazzle grenades (temporarily blind personnel)	Pilar acoustic detection system Star-burst grenades	Infantry

Miscellaneous CM	Optical filters to degrade effect of battlefield lasers. Pulse code/thermal CCM beacons on SACLOS ATGMs (to counter EOCM)	HOT-3 ATGM	

Countermeasures by Functional Area and Type System

Functional Area	System	Type Countermeasure	Countermeasure
Infantry, Special Forces, Reconnaissance, Military Police/Security	Dismounted soldier, Utility vehicle troops	Camouflage	Camouflage nets Fasteners, belts for attaching natural materials
		Cover	Natural and manmade cover, civilian buildings Hole-blast devices for troop positions, spider holes Underground facilities, bunkers, firing positions
		Concealment Aerosols	Screens, overhead cover for infantry (conceal IR/visible signature) Visual suppression measures, smoke grenades, WP rounds Multi-spectral smokes for IR and or MMW bands, Flares, chaff, WP, to create false targets, disrupt FLIR
		CM Operational Technologies	Vertical smoke grenade launchers (to counter PGM top attack) Toxic smokes (irritants to disrupt infantry and weapons crews) Acoustic directed counterfire system Dazzle grenades (temporarily blind personnel)
Mechanized Infantry, Reconnaissance, Military Police/Security, Antitank	Armored personnel carrier Armored scout cars (Less costly LAVs) Light tanks Self-propelled AT Guns (HACVs)	Camouflage	Camouflage paints, IR/radar/and laser-absorptive materials/paints Fasteners, belts for attaching natural materials
		Cover	Natural and manmade cover, civilian buildings Underground facilities, bunkers, firing positions Armor supplements (stand-off screens, bar armor, sand bags) Thermal covers, vehicle screens
		Concealment	Scrim, side skirts and skirting around turret Exhaust deformers (redirect exhaust under/behind vehicle)
		Deformers/signature modification	Engine and running gear signature modification (change sound) IR/radar deformers (in combination with RAM and RAP, etc)
		Aerosols	Visual suppression measures, smokes, WP rounds Multi-spectral smoke grenades for IR and or MMW bands, Flares, chaff, WP, to create false targets, disrupt FLIR Toxic smokes (irritants to disrupt infantry and weapons crews) Clutter (civilian/military vehicles, structures, burning equipment)
		Counter-location measures	Laser, IR, and radar warning systems (to trigger move/CM) Beyond line-of-sight modes Remote-controlled missiles and guns Mine rollers, plows and flails

Functional Area	System	Type Countermeasure	Countermeasure
		CM Operational Technologies	Air watch/security, AD, NBC, nets to trigger alarm signal Optical filters to degrade effect of battlefield lasers. Encoded SACLOS ATGMs (to counter EOCM)
Air Defense , Artillery, Radar units, Theater Missile Units , Aviation, Headquarters,	Command and communications vehicles, Radars, missile launchers, Aircraft (High value targets)	Camouflage Cover Concealment Deformers/signature modification Aerosols Counter-location measures Decoys CM Operational Technologies	Camouflage paints, IR/radar/and laser-absorptive materials/paints Natural and manmade cover, civilian buildings Entrenching blade to dig in vehicles Underground facilities, bunkers, firing positions Canvas vehicle cover, to conceal weapons when not in use Thermal covers, vehicle screens Scrim, side skirts and skirting around turret "Wummels" (erectable umbrellas to change/conceal shape/edges) Exhaust deformers (redirect exhaust under/behind vehicle) Engine and running gear signature modification (change sound) IR/radar deformers (in combination with RAM and RAP, etc) Visual suppression measures, smokes, WP rounds Multi-spectral smoke grenades for IR and or MMW bands, Flares, chaff, WP, to create false targets, disrupt FLIR Degrade GPS by jamming to reduce precision location capability Jam radars/IR sensors Laser, IR, and radar warning systems (to trigger move/CM) Clutter (civilian/military vehicles, structures, burning equipment) Low to high-fidelity (multi-spectral) decoys Radar/IR decoy supplements (to add to visual/fabricated decoys) Acoustic countermeasures (to deceive reconnaissance, sensors) Anti-helicopter mines (against aircraft) Beyond line-of-sight modes Non-ballistic launch modes Anti-radiation missiles Low energy lasers to blind/dazzle optics on designators/aircraft Encoded laser target designators to foil false target generators Radio-frequency weapons - burn electronics/detonate munitions High energy laser weapons to destroy munitions or sensors Laser false-target generator (against semi-active laser homing) Altimeter jammer (counters submunition dispersion altimeter)

Functional Area	System	Type Countermeasure	Countermeasure
			Fuze jammers (to spoof RF proximity fuzes on munitions) Incoherent infrared jamming (to jam IR fuzes on munitions) GPS jammers to confuse navigation and course correction systems Optical filters to degrade effect of battlefield lasers
Information Warfare/ Deception Units	IW vehicles	Camouflage Cover Deformers/signature modification Aerosols Counter-location measures Decoys	Camouflage paints, IR/radar/and laser-absorptive materials/paints Natural and manmade cover, civilian buildings Underground facilities, bunkers, firing positions "Wummels" (erectable umbrellas to change/conceal shape/edges) IR/radar deformers (in combination with RAM and RAP, etc) Visual suppression measures, smokes, WP rounds Multi-spectral smoke grenades for IR and or MMW bands, Flares, chaff, WP, to create false targets, disrupt FLIR Degrade GPS by jamming to reduce precision location capability Jam radars/IR sensors Laser, IR, and radar warning systems (to trigger move/CM) Clutter (civilian/military vehicles, structures, burning equipment) Low to high-fidelity (multi-spectral) decoys Radar/IR decoy supplements (to add to visual/fabricated decoys) Acoustic countermeasures (to deceive reconnaissance, sensors)
All Units	Combat support vehicles (Light strike vehicles, Tactical utility vehicles, Motorcycles, ATVs, Armored CSVs, etc), Trucks	Camouflage Cover Concealment Deformers/signature modification Aerosols Decoys CM Operational Technologies	Camouflage paints, IR/radar/and laser-absorptive materials/paints Fasteners, belts for attaching natural materials Natural and manmade cover, civilian buildings Underground facilities, bunkers, firing positions Armor supplements (ERA, screens, bar or box armor, sand bags) Thermal covers, vehicle screens Engine and running gear signature modification (change sound) IR/radar deformers (in combination with RAM and RAP, etc) Multi-spectral smoke grenades for IR and or MMW bands, Flares, chaff, WP, to create false targets, disrupt FLIR Clutter (civilian/military vehicles, structures, burning equipment) Air watch/security, AD, NBC, nets to trigger alarm signal Acoustic directed counter-fire system

Trophy "Family" HV (Heavy Vehicle) Armor Countermeasure











SYSTEM	SPECIFICATIONS
Alternative Designations:	"Wind Breaker" systems ELM-2133 (WindGuard) Radar
Date of Introduction:	Declared operational by Israeli Defense Force (IDF) in 2009; Started full scale development in 2005.
Proliferation:	Fielded and successfully combat tested in one country (Israel). Tested by US in 2006. In 2013, Canada was conducting tests.
Description:	Active Protection Systems (APS)/Anti-armor countermeasures. System can engage anti-tank guided missiles (ATGM), rocket propelled grenades (RPG) and tank launched high explosive anti-tank projectiles.
Automated Hard-Kill System:	Usually 2 platforms per tank. One mounted on each side of the turret. When traveling the system normally face inwards to the turret. Each platform has Multiple Explosive Formed Penetrators (MEFP) that fire a multiple "spray" of projectiles that engages and neutralizes the warhead (at a certain point on the projectile) before detonation. System can engage on the move or at a standstill. System can engage multiple targets and auto reloads. Minimum collateral damage (estimated at less than 1 percent) to dismounted infantry and non-combatants in area of engagement.
Antenna and Transmitter:	Four (bullet/fragment resistance) flat-panel phased array antennas; pulse Doppler active electronically scanned array (AESA) radar. One (each) radar provides a 90° coverage area. Radars are located on front, rear and sides of turret providing 360^0 coverage including defense from "top down" threats.
Operation:	ELM-2133 radar actively scans for threats. If a threat is located the radar provides identification, tracks the vector of incoming threat, and delivers the point of origin to the battle management system (BMS). The computer for the BMS determines if the threat will engage the tank and if that is the case, begins the automated countermeasure process. The ballistic automated hard-kill system uncovers and aims launchers. The computer through advanced algorithms and logics continues to track the threat and determines the best intercept point. The countermeasure is then launched and neutralizes the threat. The system takes no action if the threat is going to miss the tank.
Performance:	The Trophy (HV) system is currently fielded as an APS for the Israeli Merkava Mk 4 main battle tank (MBT). Trophy has an extensive history of successful tests. The system has been challenged by different anti-tank platforms including: RPG-7, RPG-29, AT-3, among

	others. The first successful combat engagement took place on March 2011 in Gaza. An Israeli tank was on patrol near the border and an anti-tank weapon was fired at the tank but the Trophy system neutralized the threat. The system had a number of successful engagements (reporting indicates 5 or more) during the conflict between Hamas and Israeli in August 2014.	
Range (m):	10-60	
Power Supply:	UNK	VARIANTS
Weight (kg):	850	Trophy Medium Vehicle (MV)
Frequency Range (radar):	S Band	Trophy Light Vehicle (LV)

Equipment Upgrades

Armed forces worldwide employ a mix of legacy systems and selected modern systems. In the current era characterized by constrained military budgets, the single most significant modernization trend impacting armed forces worldwide is upgrades to legacy systems. Other factors impacting this trend are:

- A need for armed forces to reduce force size, yet maintain overall force readiness for flexibility and adaptability.
- Soaring costs for modern technologies, and major combat systems.
- Personnel shortages and training challenges.
- Availability of a wide variety of upgrade packages and programs for older as well as newer systems.
- New subsystem component technologies (lasers, GPS, imaging sensors, microcircuits, and propellants), which permit application to platforms, weapons, fire control systems, integrated C2, and munitions old and new.
- An explosion of consortia and local upgrade industries, which have expanded worldwide and into countries only recently introduced to capitalism.

The upgrade trend is particularly notable concerning aerial and ground vehicles, weapons, sensors, and support equipment. From prototype, to low-rate initial production (LRIP), to adoption for serial production, minor and major improvements may be incorporated. Few major combat systems retain the original model configuration five or more years after the first run. Often improvements in competing systems will force previously unplanned modifications.

Upgrades enable military forces to employ technological niches to tailor their force against a specific enemy, or to integrate niche upgrades in a comprehensive and well-planned modernization program. Because of the competitive export market and varying requirements from country to country, a vehicle may be in production simultaneously in many different configurations, as well as a dozen or more support vehicle variants fulfilling other roles. In light of this trend, OPFOR equipment selected for portrayal in simulations and training should not be limited to the original production model of a system, rather a version of the system that reflects the armed forces strategic and modernization plans and likely constraints that would apply.

The adaptive OPFOR will introduce new combat systems and employ upgrades on existing systems to attain a force structure that supports its plans and doctrine. Because the legacy force mix and equipment were selected in accordance with earlier plans and options, use of upgrades versus costly new acquisitions will always be an attractive option. A key consideration is the planned fielding date. For this document, the most widely portrayed OPFOR timeframe is the current Contemporary Operational Environment. Only upgrades currently available (or marketed with production and fielding expected in the near term) are considered in COE Tiers 1-4. Also, system costs and training and fielding constraints must be considered. However, in the Emerging Technology Trends section of this chapter, we anticipate a wide variety of upgrades that could be currently applied to fielded systems.

The selection of equipment upgrades is not a simple matter. Most forces have limited budgets, competing upgrade priorities, and a substantial inventory of outdated equipment. A specific subsystem upgrade (gun, fire control system, etc.) may only slightly improve a generally obsolete system. Another option is an upgrade package, with compatible subsystem upgrades. The surest approach is to refurbish a system into



a new model with all application problems resolved. A critical factor is assurance that the modernized equipment is tested and successful. The best test remains performance in combat.

The following tables describe selected upgrades available for system modernization. The lists are not intended to be comprehensive. Rather, they are intended to highlight major trends in their respective areas. For instance, for armored combat vehicles, the focus is on upgrades in mobility, survivability, and lethality.

The category of survivability upgrades includes countermeasures (CM). The CM upgrades can apply not only to branch-specific systems (tanks, IFV, and artillery), but to general use systems subject to similar threats. An example of this is the proliferation of smoke grenade launchers on artillery and reconnaissance vehicles.

Implementation of all upgrade options for any system is generally not likely. Because of the complexity of major combat systems and need for equipment subsystem integration and maintenance, most force developers will chose a mix of selected upgrades to older systems, as well as limited purchases of new and modern systems. Please note that systems featured in this document may be the original production system or a variant of that system. On data sheets, the variants section describes other systems available for portrayal in training and simulations. Also, equipment upgrade options (such as night sights) and different munitions may be listed, which allow a user to consider superior or inferior variants. Within the document chapters, multiple systems are listed to provide other substitution options. Of course there are thousands of systems and upgrade options worldwide, which could be considered by an adaptive OPFOR.

An OPFOR trainer has the option to portray systems or upgrade packages not included in the OPFOR Worldwide Equipment Guide, to reflect an adaptive thinking OPFOR. In future WEG updates, the authors will expand on the upgrade tables with names and descriptions of upgrade options and specific systems applications which have been noted in the current document. Chapter authors are available to assist users in selecting reasonable upgrade options for system configuration in specific force portrayals.

OPFOR Antitank Weapon Upgrades

GRENADE LAUNCHER	TOWED AT GUN	GROUND ATGM LAUNCHER
Improved AT and dual-purpose rifle grenades permit riflemen to supplement shoulder-mount grenade launchers. Accurate low trajectory longer range grenades for shoulder launchers Parachute-drop overhead camera grenades for shoulder/ground launch Tripod, bipod, pintle mounts convert launchers for vehicle/ground use Take-apart AT grenade launchers or disposable launch tubes Larger, more lethal disposable AT grenade launchers supplement grenadier reusable launchers at critical times. Reduced noise, smoke, and flash signature grenades for AT launchers Improved reusable sights for disposable launchers, including ballistic computer/laser rangefinder sights Image intensifier/thermal night sights Counter -charge AT grenades for firing from inside of buildings Dual-purpose (HE/AT) longer range rounds HE longer range rounds Multi-purpose (HE/AT/anti-bunker) rounds Tandem shaped-charge (HEAT) warhead Thermobaric Frag-HE warhead Guided (SAL-H) grenades for shoulder/ground/vehicle launchers UPGRADE PRIORITY Computer/LRF FCS II night sights Tandem AT grenades, HE/DP grenades, thermobaric grenades	Auxiliary propulsion unit for local movement Take-apart capability for lighter guns Improved gun and recoil system Ballistic computer/laser rangefinder sights MMW radar target auto-tracker day/night FCS Image intensifier/thermal night sights Automated battle management system with graphic flat panel display Indirect fire rounds/FCS for fire support role Increased DF range, new tank/AT gun rounds Improved, heavier , more lethal , and longer range APFSDS-T round Tandem or triple-charge HEAT round Improve Frag-HE round and DPICM submunition Canister/flechette round New type lethalities (DPICM submunition, etc.) Gun-launched ATGM (100 mm+) , including tandem HEAT UPGRADE PRIORITY APU and take-apart for lighter guns Improved gun and recoil system Improved sights, 1st gen thermal night sights	Man-portable/ground launch and shoulder launch Take-apart launcher and sub-systems Pintle mount/dismount for variety of vehicles/platforms 1st or 2nd generation thermal night sights Extended range missiles Soft-launch for use from bunkers and buildings Launcher countermeasures (CM), such as reduced noise, smoke, flash SACLOS Guidance CCM, e.g., pulsed codes Increased ATGM velocity/reduced flight time New guidance modes: Semi-active laser beam rider and laser-homing, Fiber-optic guided missile (FOG-M) guidance, Fire and forget imaging infrared seeker, Radar homing, Multi-mode (FOG/IR homing, etc.) Helicopter stand-off launch using ground guidance High velocity MANPADS missiles used for AT Larger warhead/tandem warhead HEAT ATGM Sensor-fuzed EFP/HEAT top-attack Thermobaric HE warhead, for new applications UPGRADE PRIORITY

GRENADE LAUNCHER	TOWED AT GUN	GROUND ATGM LAUNCHER
	Automated battle management system Improved ammunition, inc ATGM.	Take-apart launcher, with pintle mount Improved 1st gen thermal night sights SACLOS CCM Reduced signature Improved ATGMs (tandem HEAT, etc.)

OPFOR Light Armored Vehicle Upgrades

COMBAT SUPPORT VEHICLE	APC/IFV, INFANTRY FIRE SUPPORT VEHICLE	ATGM LAUNCHER VEHICLE
Used/adapted for various roles, e.g., infantry (less than squad), combat support, and support vehicles. Most are light, 4x4 wheeled, van or light utility vehicle; but auxiliary wheel, 6x6 or tracked versions exist. Many of these are being converted to or replaced by mine-resistant vehicles. Included are motorcycles, ATVs, and light strike vehicles (e.g., jeep-type 4x4 vehicles or recreational dune buggies). Gun trucks, riot control vehicles, and amphibious/over-snow all terrain vehicles are used. Add encrypted voice and digital data capability. Graphic display battle management system Central tire inflation system and/or run-flat tires GPS hand-held or bracket mount Ford capability, swim capability desired Hybrid (diesel/electric) drive kits Add-on light armor, mine protection desired CM, such as multi-spectral smoke grenades Laser warning receiver desired 7.62-14.5-mm MG or 20-40-mm automatic grenade launcher main weapon Remote or overhead weapon station (RWS/OWS) Individual weapons, RPG, MANPADS, or ATGM launcher for secondary weapons Day sight and II or thermal night sight UPGRADE PRIORITY	Must be able to carry a squad Higher horsepower diesel engine GPS and inertial land navigation, graphic display battle management system, IFF Swim or deep ford (due to armor increases). Amphibious conversion with compartments for high sea state capability. Add-on armor, ERA, and improved mine protection. Fire and blast suppression CM, e.g., multi-spectral smoke grenades, LWR Firing ports (or forego due to armor increases, use periscopes or side and rear view cameras) IFV/IFSV: 20-100 mm stabilized gun, and 2-man turret. Active protection system (APS) or defensive aids suite (DAS). Upgraded FCS: Cdr's independent viewer, 2-plane stabilized TV sights, 1 - 2 gen FLIR. Upgraded secondary MG or grenade launcher with superior sights (integrated, high-angle, night). Additional remote MGs/AGLs for high-angle fires security. Improved KE, HEAT, Frag-HE rounds, ATGMs APC/IFSV: Includes truck/light vehicle conversions Remote weapon station or 1-man turret with high-angle-of fires 7.62-	Use APC/IFV wheeled/tracked chassis or tank chassis, with mobility and protection upgrades, Side and rear-view cameras Graphic display battle management system CM, e.g., multi-spectral smoke grenades, LWR Active protection system or other DAS. 1-2 man turret, or turretless design. Alternative design: 1-5 pedestal/turret or mast-elevated ATGM launchers on remote or overhead weapon station (RWS/OWS) Autoloader or manual loader under armor Multiple ATGM launch and targeting capability Improved ATGMs, as noted in above table, or RF, laser-beam rider, SAL-H/IIR ATGMs 7.62-12.7-mm MG secondary arms FCS with commander's independent viewer, 2-plane stabilized sights, TV, and target tracking. Use 1st or 2nd gen FLIR Most common ATGM vehicles are combat support vehicles with pintle-mount ATGM launcher (see above table for ground launcher). Recent development: motorcycle with sidecar and pintle-mount ATGM launcher

COMBAT SUPPORT VEHICLE	APC/IFV, INFANTRY FIRE SUPPORT VEHICLE	ATGM LAUNCHER VEHICLE
Light armor and smoke grenade launchers Remote MG or auto grenade launcher Day/night (thermal sights), RPG GPS, secure comms	23 mm MG, grenade launcher (some with 20-30-mm auto-cannon and ATGM launcher) UPGRADE PRIORITY Add-on armor, ERA, LWR, new grenades Add auto grenade launcher, upgrade ATGM, and KE round to APFSDS. FCS, stabilized sights, Imp 1st gen FLIR	UPGRADE PRIORITY RWS multiple ATGM launchers (APC/IFV/tank conversion), pintle-mount for light combat support vehicles (motorcycle, ATV, LSV, TUV, truck, etc.) Stabilized sights and 1st gen thermal sights Improved ATGMs

OPFOR Reconnaissance and Assault Vehicle Upgrades

RECONNAISSANCE VEHICLE	HEAVY ARMORED COMBAT VEHICLES	MAIN BATTLE TANK
Light recon vehicle: Combat support vehicle with light armor and TV, thermal sights, Add encrypted voice and digital data capability Combat recon vehicle: See IFV upgrades, e.g.: GPS and inertial land navigation. Digital real-time link to subscriber map overlay display, IFF, force tracker battle management system, Swim capability, winch, central tire inflation for wheeled Upgraded FCS: Cdr's independent viewer, 2-plane stabilized TV camera sights, 1 - 2 gen FLIR Elevated battlefield surveillance radar/TV/FLIR sensor suite with TV, encrypted voice, and digital data transmission capability Launch UAVs and/or robots (unmanned ground vehicles) CM, e.g., multi-spectral smoke grenades, LWR, IR/radar skirts Active protection system (APS) or other defensive aids suite (DAS). 20-100 mm gun with 2-plane stabilization, and 2-man turret. Improved secondary MG or automatic grenade launcher and sights. Man-portable SAMs (MANPADS) for self-protection Named and targeted areas of interest link to indirect fire and missile units for real-time targeting. Laser target designator guides munitions. Sensor vehicle: APC/IFV or combat support vehicle and mast- mounted sensor pod: radar, thermal and TV Encrypted voice SATCOM/digital data systems	Distinction among heavy recon, infantry fire support, assault gun, light tank has blurred APC/IFV chassis with increased armor and higher horsepower diesel engine. GPS and inertial land navigation, graphic display battle management system, IFF Swim or deep ford capability Add-on armor, ERA, improved mine protection, fire and blast suppression. CM, e.g., multi-spectral smoke grenades, LWR Side and rear-view cameras for security Active protection system (APS) or other defensive aides suite (DAS). 76-125 mm tank gun with 2-plane stabilization, Improved MG or auto grenade launcher, sights FCS with commander's independent viewer, 2-plane stabilized sights, TV, and target tracking. Use of 1st or 2nd generation FLIR. Side and rear-view cameras Improved KE, electronic fuzed Frag-HE, and tandem HEAT rounds Gun-launched ATGMs (100+ mm) UPGRADE PRIORITY Add higher HP diesel engine Add-on armor, ERA, LWR, new grenades Imp 1st gen FLIR, gunner and commander Larger stabilized gun, gun-launch ATGM, and KE round to APFSDS.	Higher horsepower diesel engine power packs and add-on reserve fuel tanks GPS and inertial land navigation, graphic display battle management system, IFF Deep ford snorkel capability Welded turret, blow-out panels, ERA, improved mine and turret protection, fire and blast suppression. CM suite, including multi-spectral and vertical smoke grenade mix, LWR, VEESS capability Active protection system (APS) or other defensive aides suite (DAS), self-entrenching blade Side/rear-view security cameras Tank gun with 2-plane stabilization FCS with commander's independent viewer, 2-plane stabilized sights, TV, and target tracking. 2nd or 3rd generation FLIR. Auto-tracker. Hunter-tracker FCS. Heavier and longer range APFSDS-T rounds, electronic fuzed Frag-HE, and tandem HEAT rounds Gun-launched ATGMs and IR homing rounds (100+ mm). Semi-active laser homing munitions permit ATGMs to deliver indirect fire precision strikes. Improved remote-firing MG, high-angle AD sights

RECONNAISSANCE VEHICLE	HEAVY ARMORED COMBAT VEHICLES	MAIN BATTLE TANK
UPGRADE PRIORITY Add higher HP diesel engine Add-on armor, ERA, LWR, new grenades Imp 1st gen FLIR, gunner and commander, Add auto grenade launcher, upgrade ATGM, and KE round to APFSDS. Elevated sensor suite and transmission capability.		UPGRADE PRIORITY Add higher HP diesel engine Land navigation and deep ford snorkel Add-on armor, ERA, CM suite Imp stabilization and FCS, 1st gen FLIR, Remote MG, Imp ammo (sabot, Frag-HE, and HEAT) Gun-launch ATGM.

OPFOR Artillery Upgrades

ARTILLERY RSTA/C2 SUPPORT	TOWED AND SELF-PROPELLED CANNON	MULTIPLE ROCKET LAUNCHER
Automated secure digital joint C2 network with SATCOM, linking artillery, air, EW, and reconnaissance units Integrated artillery recon vehicle with sensor mast Reconnaissance strike and fire complexes Forward air controllers linked to artillery units Artillery surveillance vehicles with ground surveillance radars, sensor suite and networked Observation teams with goniometers, thermal sights, digital comms, and laser target designators Artillery links to selected special purpose forces Acoustic vehicle detection and location Phased array counter-battery radars, networked to automated artillery net, with increased range, lower probability of error, windows-based man-machine interface Target-acquisition UAVs, networked to artillery net Automated battle management equipment use for towed and SP guns, mortars and MRLs Navigation system with GPS/inertial update, linked to automated net UPGRADE PRIORITY Integrated artillery recon vehicle, sensor mast Reconnaissance strike and fire complexes Target-acquisition UAVs, networked Observation teams, radars, acoustic sensors	Conventional munitions, e.g., controlled fragmentation, proximity and multi-option fuzes, special munitions, and propellant s (modular propellants) Artillery delivered high precision munitions e.g., SAL-H, sensor-fuzed, course corrected, terminal-homing IR Self-Propelled: Automated fire control with barrel cooling and thermal warning systems Auxiliary power unit Mobility and weight improvements, Muzzle velocity analyzer CM, such as smoke grenade launcher and LWR Upgrade to 52-caliber cannon for longer range Truck-mounted high-mobility systems with long-range cannons Towed: Addition of auxiliary propulsion unit On board technical fire control computer Reduced weight and emplace/displace times Muzzle velocity analyzer Onboard or portable digital linked fire control computer Upgrade to 52-caliber cannon for longer range UPGRADE PRIORITY Mobility and weight improvements On-board navigation and fire direction systems	Mobility and weight improvements, truck-based launchers which conceal the MRL signature Rapid emplace-displace and response capabilities CM, such as smoke grenade launcher and LWR On-board computer-based fire direction and land navigation systems, which permit autonomous launcher, platoon, and battery operations Tube-launched UAVs linked to the launchers and to the fire control network for real-time acquisition Improved lethality improved conventional munitions and special purpose (mines, jam, etc,) munitions Extended-range and course-corrected rockets, as well as addition of artillery/cruise missiles Computer-based fire control system for electronically-fuzed rockets Artillery delivered high precision munitions (ADHPM), e.g., sensor fuzed, laser-homing rockets Special munitions, such as FASCAM, chemical warhead, RF jammer rockets Mine clearer and fuel-air explosive rocket MRLs UPGRADE PRIORITY Autonomous/ semi-autonomous launcher

ARTILLERY RSTA/C2 SUPPORT	TOWED AND SELF-PROPELLED CANNON	MULTIPLE ROCKET LAUNCHER
	Use of modular propellant Procurement of ADHPM Overall range and accuracy improvements	Countermeasures Improved munitions, e.g., extended range, DPICM and thermobaric ADHPM, e.g., sensor-fuzed munitions and course corrected rounds or rockets

Emerging Technology Trends

In order to provide a realistic OPFOR for use in Army training simulations, we must describe the spectrum of contemporary and legacy OPFOR forces in the current timeframe, as well as capabilities in emerging and subsequent operational environments (OEs). This chapter does not predict the future, rather notes emerging adversary capabilities which can affect training.

The OPFOR timeframes for emerging OPFOR are: 2016-2021 (Near Term) and 2022-2029 (Mid-Term). The subsequent timeframe is "future" OPFOR timeframe. Timelines were determined in part to assist in building OPFOR systems and simulators and for use in Army training simulations. The timeframes are arbitrary and selected for ease in focusing and linking various trends. However, they also generally match force developments for U.S. Army forces, as well as thresholds in emerging and advanced technologies which will pose new challenges to military force planners and developers.

In these timeframes, the mix of forces will continue to reflect tiered capabilities. The majority of the force mix, as with all military forces, will use legacy systems. Periods 2016 and after will also see new OPFOR systems and whole new technologies. The most notable difference between the OPFOR force mix and U.S. forces is that the OPFOR will have a broader mix of older systems and a lower proportion of state-of-the-art systems. Instead, OPFOR will rely more on adaptive applications, niche technologies, and selected proven upgrades to counter perceived capabilities of their adversaries. Force developers for OPFOR will retain expensive legacy systems, with affordable upgrades and technology niches. A judicious mix of equipment, strategic advantages, and sound OPFOR principles can enable even lesser (lower-tier) forces to challenge U.S. military force capabilities.

The OPFOR systems must represent reasonable responses to U.S. force developments. A rational thinking OPFOR would study force developments of their adversaries as well as approaches of the best forces worldwide, then exploit and counter them. Thus worldwide and adversary equipment upgrades will trigger OPFOR forces to modify their equipment and tactics to deter, match, overmatch, or counter those changes.

OPFOR Technologies and Emerging Operational Environments

As noted in Chapter 1 on COE OPFOR, the adaptive OPFOR will introduce new combat systems and employ upgrades on existing systems to attain a force structure which supports its plans and doctrine. Because a legacy force mix and equipment were historically selected earlier in accordance with plans and options, upgrades versus costly new acquisitions will always be an attractive option. A key consideration is the planned fielding date. To project OPFOR capabilities in the future, we should look at the technologies in various stages of research and development today, as well as those in the concept stage for applications in the Future OPFOR timeframe. Military engineering experience has demonstrated that the process of formulating military requirements, as well as technology, engineering, and budgeting factors can dramatically affect equipment modernization time lines. In addition, scientific discoveries and breakthroughs in the civilian sector have greatly contributed to the so-called "Revolution in Military Affairs," which has increased the capability for battlefield awareness, integration, timeliness, and lethality. The table below shows OPFORs in emerging and Future OEs, and some considerations.

Considerations in Determining Emerging OPFOR Technologies by Timeframe

OPFOR Consideration	Near-Term (2016-2021)	Mid-Term (2022-2026)
Challenging OPFOR	Emerging OPFOR	Objective OPFOR
Technology Source	Current marketed/fielded systems and subsystems	Recent major weapons, upgrade applications
Budget	Constricted but available for niche technologies	Improved, some major system acquisitions
Implications for OPFOR equipment	Many subsystem upgrades, BLOS weapons, remote sensors, countermeasures	More costly subsystems, recent major weapons, competitive in some areas.
Implications for OPFOR tactics and organization, Implications for U.S.	COE tactics with contingency TTP updates. Slight subunit changes add BLOS and AT systems for integrated RISTA and strikes.	Integrated RISTA with remotes. Strikes all levels. Combined arms integrated in small units for increased lethality and autonomy.

The information revolution has also decreased response time in which system developers in the military marketplace can seize a new technology and apply it in new systems or in upgrades to older systems. The following technologies and possible applications of those technologies will influence R&D as well as fielding decisions for future force modernization and expected OPFOR capabilities to be portrayed in future operating environments.

Technologies and Applications for Use by OPFOR: Near and Mid-Term

TECHNOLOGY CATEGORY	TECHNOLOGY	TECHNOLOGY APPLICATION
Psychological Operations	Mood altering aerosols Reproductive terrorism Non-lethal technologies	Military and civilian targets, for short-term and long-term goals.
Information Operations: Sensors	Higher-resolution multispectral satellite images New sensor frequencies for acquisition New sensor frequencies operational security Use of other light bandwidths (ultraviolet, etc) Passive detection technologies and modes Auto-tracking for sensors and weapons Image processing and display integration Micro-sensors/imaging system miniaturization Unmanned surveillance, target acq/designation Multispectral integrated sensors and Multispectral integrated transmission modes Precision navigation (cm/mm three-dimension) Undersea awareness (sensors, activity) Underground awareness (sensors/mines)	High-intensity use of LITINT (internet, periodicals, forums) Increased use of information from commercial, industrial, scientific and military communities Increased use dual-use technologies
Information Operations: Computers and Comms	Low-Probability-of-Intercept communications New power sources and storage technologies: Micro-power generation Energy cells Advanced Human/Computer Interface Automatic Language Translators	New communities (Blogs, flash mobs, etc, to coordinate and safeguard comms) Secure encryption software New communications tools (internet and subscriber links)
Electronic Attack	Anti-Satellite weapons for RF, EMP, Hard kill Wide area weapons (EMP graphite bombs, etc) EMP Precision (small area) weapons Computer Network Attack Worms, viruses, trojan horses Net-centric warfare	Attack electronic grid or nodes at critical times

TECHNOLOGY CATEGORY	TECHNOLOGY	TECHNOLOGY APPLICATION
	Spoofing sensors Spoofing/Intercepting data stream/ spyware	
Chem/Bio/ Radiological Attack	Dirty bombs Genetic/Genomic/DNA tagging to assassinate Genetic/Genomic/DNA targeting for Bio attack Designer Drugs/Organisms/Vectors Biologically based chem (Mycotoxins) Anti-materiel corrosive agents and organisms	Agricultural attack (animal and plant stocks and supplies) Use of tagging to incapacitate political leaders.
Physical Attack	Mini-cruise/ballistic missiles for precision, surgical strikes, and widespread use Atk UAVs (land, sea, undersea-UUV, Micro-aerial vehicles-widespread use Swarming for coordinated attack Notebook command semi-autonomous links Vehicle launch for NLOS attack/defense Multi-mode guidance: pre-programmed/ guided/homing New types of warheads Wider area/different effects Tailorable warhead effects Precision Munitions Course-corrected/guided/homing Widespread - almost all weapons Loiter/IFF DEW Blinding/high energy lasers RF Weapons against electronics RF against people, vs structures/systems Directed acoustic weapons	
Sustainment, Protection	New battery/power cell technologies Neurological performance enhancers Better lightweight seamless body armor Personal actuators, exoskeletons, anti-RF suits Active armor and active protection systems Countermeasures to defeat rounds and sensors Counter-precision jammers, esp GPS All-spectrum low observable technologies Anti-corrosives Biometric prosthesis and cybernetics Robots assist dismounts, sensors, and logistics Robotic weapon systems	Battlefield fabrication of spare parts Airborne/ship borne refineries Potable water processing systems Transportable power generation systems

OPFOR Capabilities: Near- and Mid-Term

The next table provides projected system description and capabilities for analysis of the OPFOR environment facing U.S. forces in subsequent timeframes. Data for the first timeframe (2016-2021) reflects generally known systems and subsystems, with their introduction to the emerging OPFOR adversary force. Timelines reflect capability tiers for systems which may be fully fielded (not Interim Operational Capability or First Unit Equipped) in brigade and division unit levels during respective timeframes.



The systems projections are not comprehensive, and represent shifting forecasts. They may accordingly shift as we approach the specified timeframes. Once we get beyond the turn of the decade, our current view of the future trends becomes less specific. Therefore, the second column (Mid-Term 2022-2029) focuses more on technologies—less on defined systems.

The columns can be treated as capability tiers for specified timeframe OPFOR. Please note: ***No force in the world has all systems at the most modern tier.*** The OPFOR, as with all military forces worldwide, is a mix of legacy and modern systems. Thus the emerging OPFOR force comprises a mix of COE timeframe Tier 1-4 systems and newer systems. One would expect that some Near- or Mid-term adversaries with lower military technology capabilities could move up one or two capability tiers from (for instance) current COE capability Tier 4, to COE Tier 2. The most likely upgrade for emerging OPFOR used in most training simulations would be to move the OPFOR from COE Tier 2 to Tier 1, with added niche emerging systems.

We have previously stated that an OPFOR force can portray a diverse force mix by separating brigades and divisions into different tiers. The OPFOR also has the option of incrementally adding higher tier systems to lower tier units, as selective upgrades. Because most of the below systems in the 201-2021 column are currently fielded, an adversary might also incrementally upgrade COE Tier 1 or 2 units by adding fielded assets from 2015-2020 as described in that column. However, until that timeframe, we cannot assure beforehand when all of those technologies will appear. Again, the tables are not predictive. The OPFOR force designer may choose a middle road between current Tier 1-4 and future systems; in many countries they are upgrading legacy and even recent systems to keep pace with state-of-the-art systems. Thus they may look to subsystem upgrades such as noted in Chapter 15.

If a specialized system for specific role is missing from the table below, continue to use the OPFOR system noted in Tiers 1-4. Please remember that these projections reflect "possible" technology applications for future systems. They incorporate current marketed systems and emerging technologies and subsystems, may be combined in innovative ways. The table below is not a product of the US intelligence community, and is not an official US Army forecast of future "threats." It is approved only for use in Army training applications and simulations.

Future OPFOR (2029 and after) is described in various portrayals. But it is generally FOUO or classified and is not included in the WEG.

OPFOR Capabilities: Near- and Mid-Term

SYSTEM	NEAR-TERM OPFOR (FY 16-21)	MID-TERM OPFOR (FY 22-29)
INFANTRY WEAPONS		
Infantry Assault Rifle	Rifle 6.8mm to 600 m day/night, w/EO LRF/pointer computer sight. Fire around corner sight EO link. Under-barrel grenades 600 m (CS gas, HEDP, EO recon, starburst, HE airburst, concussion). Rifle grenades 400m: HEAT, DP, smoke	On-bipod range 600 m. Sight on all weapons link to laptop/PDA/NVG/ helmet viewer w/real-time RF link. Multispectral smoke, TV/II recon/ atk rd, tandem HEAT grenades. Remote fire platform, 60m link.
Thermobaric grenades and Magazine grenade launcher	43-mm 4-round hand-held launcher for urban fight to 350m. Thermobaric grenades, also for hand throw, underbarrel.	Range 600 m for hand-held and under-barrel launchers, night sight. Add flechette, TV/II recon grenade.
AT/AP Hand Grenade	HEAT/Frag, 165-mm penetration, 20 m Frag radius, 20 m range, weighs 1.1 kg. Rifle grenades: HEAT 150mm to 300m	Hand grd to 40 m. Dual purpose bullet-thru rifle grd, no recoil, 150mm/Frag 20 m, 3 in belt pack.

SYSTEM	NEAR-TERM OPFOR (FY 16-21)	MID-TERM OPFOR (FY 22-29)
Squad Machinegun	7.62x54 mm, frangible/sabot rds 1,300m. EO/3 gen II computer LRF sight 1,500m.	Add MMW radar, 5 km detection.
Combat Shotgun (replace one assault rifle)	12-gauge pump or semi-auto, 12 rds. Short and long change-out barrels, day/ night sights. Variable choke. Shells: HE, AP-sabot, door-buster, starburst, slug, concussion, frangible, flechette/anti-UAV	Time fuzed focused fragmentation airburst rd for use against dug in personnel, aircraft and UAVs. Multispectral smoke, CS grenades. TV/II recon rounds to 400 m.
Sniper Rifle Light	Bolt action, 7.62 mm rd, 15 lbs max weight with ammo. 10X optic w/2 gen II night channel. Range to 1000m.	Ballistic EO holographic LRF sight. Fused IR/FLIR channel 1,500m. Remote fire robot. Laser designator
Anti-Material Rifle (AMR) or Sniper Rifle (Heavy)	Semi-auto .50 cal. Weight 25 lbs. AMR/ anti-armor range 1,800 m. Armor pen 20 mm. As sniper rifle, range 1,000-1,500 m. Frangible multipurpose rd (AP 11 mm, incendiary 20 fragments). EO sight (20x) with 3 gen II night channel.	Ballistic EO holographic laser range-finder sight. Night sight fused IR/FLIR. Range 2,500+ m. Remote fire platform-60m link or weapon robot option. Laser designator.
Automatic Grenade Launcher (AGL)-Light	35mm man portable launcher with 6/9/12-round drums. HEAT grenade range 600 m 80mm penetration. Frag-HE grenade range 1,500m. Buckshot grenade. EO day/ 3 gen II night sights. 1 per infantry squad	Air-burst munition (ABM), ballistic sights. EO and Fused IR/FLIR sight. Remote fire. Multispectral smoke grenades. Recon, HEAT/HE TV-guided atk grenades to 1,000 m
Automatic Grenade Launcher (AGL)-Heavy Weapons squads and vehicles	40 x 53 mm weight 17 kg. Range 2,200m. Ballistic fire control computer w/ EO sight. Dual-purpose grenade, HE with 60mm armor penetration. Buckshot round. Electronic fuzed HE air-burst munition (ABM). 32/48-round cans. Thermal night sight, range 2,200 m.	HEAT rd defeats 200+ mm armor. EO/ fused IR/FLIR sight. Multispectral smoke, unattended ground sensor (acoustic, seismic RF), and comms jam grenades. Robot option. Mount on all maneuver/recon vehicles. TV/IR attack grenades.
Multi-purpose Grenade Launcher (disposable)	76mm thermobaric HEAT, 250m range, 440 mm penetration. Reusable II sight.	Range to 400m. Fire from enclosed spaces. Nil smoke, little noise.
Antitank Grenade Launcher (disposable)	125mm tandem HEAT 300m range, 1000+ mm. Shoulder fired. Nil smoke.	Multipurpose DP effects, 500 m. Reduced recoil-enclosed spaces.
Antitank Grenade Launcher (ATGL - medium range) Mid-Term: Expand to AD/AT Missile Launcher	60mm launch tube, from enclosed spaces. Tandem warhead (1,150 mm to 600m), dual purpose 1700m. Ballistic LRF/3 gen II night sight to 1,500 m. Remote launch tripod. Nil smoke. High velocity 57-mm DP high vel rocket 1,000m, 300 mm pen	SAL-H, TV/IR-guided grenades to 1,000 m. Fused IR/FLIR night sight. ADAT KE dart fits converted launcher. Range 4 km. Laser designator 5 km, including artillery and mortar rounds.
Antitank Grenade Launcher (long range) Mid-Term: Expand to AD/AT Missile Launcher	125mm tandem HEAT 800+m range, 1100+ mm. HE-Thermobaric grenade to 1700 m. LRF computer sight. EO day/3 gen II Night sight. Nil smoke. Remote-fire platform option. Tripod and bipod.	SAL-H/TV/IR-guided: HEAT and HE grenades 1,200 mm. ADAT SAL/LBR KE dart to 4 km. EO and fused IR/FLIR sight, laser designator to 5 km for arty/mortar rds.
Remote-fire Platform and Weapon Robot or Laser Target Designator (LTD) Robot	Man-portable, <15 kg, 60m Laptop/PDA link. EO/3 gen II sight. MG/AGL/rifle. LTD robot TV/2nd gen FLIR, 10km range	Tracked, 24 kg, 2 hour charge, fused II/FLIR 10 km, 10 km rg RF link. LTD has 3rd gen FLIR, range 15km
Acoustic Targeting System (ATS)	Backpack/vehicle triangulates on aircraft, vehicle weapons to 6 km, MGs 2.5 km. Helmet mount to 800 m. Light display.	Increased range (10 veh weapon, 5 MG). Add auto-return fire for MG. Link to veh weapons/nets auto-slew

SYSTEM	NEAR-TERM OPFOR (FY 16-21)	MID-TERM OPFOR (FY 22-29)
General Purpose and Air Defense Machinegun	12.7mm low recoil on ground tripod. Chain gun version on light vehicles, ATV, motorcycle, etc. TUV/LAV use RWS. Remote operated ground or robot version. Frangible rd 2 km, sabot 2.5 km. RAM/RAP/IR camouflage/ screens. TV/FLIR fire control. Lightweight MMW radar 5 km. Display link to AD azimuth warning net. Emplace in 10 sec. RF/radar DF set. ATS control option.	Stabilized gun and sights. Remote-operated computer FCS with PDA or laptop. Fused FLIR/ II to 5 km. Frangible, sabot rds to 3 km. Laser dazzler blinds enemy. Micro-recon/ heli atk UAVs. Robot version. Some light/AD vehicles replace w/ 30-mm recoilless gun on RWS. AHEAD round 4 km, FCS 10 km. Add-on ADAT missile launcher
Man-portable attack UAV (NLOS Backpack Munition)	2.5 kg tube launch with PDA, CCD/IR image, 10 to km and 155 m altitude, at 100-160 km/hr, with 10 min loiter, in-flight arm for HE charge, NLOS dive attack vs moving/static targets	Ranges to 20 km with 40 min loiter. Remote, air, ground, water craft, vehicle launch. 3rd gen thermal view. AT/AP remote sensor mines.
Infantry Flame Weapon	Reusable thermobaric 90-mm grenade (2/lchr) to 800 m. Effects = 152mm artillery rd. Targets personnel, bunkers, LAVs, etc. Nil smoke. EO/II night sight	Precursor (200 mm pen) DP grd. Computer LRF day/night sight. SAL-H guided. Remote fire and robot option. Use in enclosed space
Vehicle/Man-portable Close Protection System (CPS)	Smoke grenade launchers can use multi-spectral smoke, CS smoke, Frag-HE grenades, range 3-40 meters, depending on angle. ATS control. Man-portable.	Man-portable remote control launcher. Quick load 3-6 grenades. Other Grds: CS gas, HE, AT/AP mines. 2-4 pods/vehicle.
Infantry Weapon Night Sight (Night Optical Device- NOD)	3d gen II night vision goggles/sights/ IR pointers for riflemen range 1,000. AGLs, MGs, sniper rifles/AMRs, ATGLs to 1,500m. FLIR recon sensors 3,000 m.	Uncooled 3rd gen FLIR (thermal and II combined) NVGs and weapon sights infantry 600m. Priority weapon sights 2,000+ m.
INFANTRY WEAPONS		
Armored Personnel Carrier (APC)	8x8 wheeled chassis. Add ERA. 30-mm gun (and imp rd), coax MG. FOG NLOS ATGM lchr 4 km. Thermobaric ATGM. FLIR. 2 remote 7.62-mm MGs and 40 mm ABM AGL. CPS and ATS. Attack UAV launch	10x10 wheeled hybrid drive. Box ERA. CPS. Fused FLIR/II sight 13 km. 30-mm recoilless chain gun, RWS. Air-burst rds. ADAT KE missile and NLOS ATGM to 8 km. TV/IR attack grenades.
APC Fire Support Vehicle (Weapons Squad APC or Infantry Support Vehicle [1/ pltn or company], or Company Command Vehicle in Mech APC Bn)	Wheeled 8x8 chassis with ERA. 100mm & 30mm guns, 40 mm ABM AGL, auto-tracker, hunter-killer FCS. Gun-launch ATGM NLOS (SAL) 8 km fire on move. 30 and 100-mm HE elec fuzed rd 7 km. Imp 30-mm rd. 12.7 mm AD MG, 2 remote 7.62 MG. ADAT KE msl lchr 7+ km. Laser designator 10 km. CPS, ATS.	Above chassis & drive, ERA, fused FLIR/II sight. 100mm KE/600 CE protection. Cased telescoped gun 45-mm. ADAT KE dart rd 4 km, SAL/LBR ATGM 8-12 km. CPS. Micro-UAVs recon/attack. Tunable laser designator to 15 km. Radar/ MMW radar. SATCOM. Atk grds
APC Air defense/Antitank (ADAT) Vehicle	APC Bn and Bde MANPADS btry, selected other units	See AIR DEFENSE
Infantry Fighting Vehicle	2-man turret, amphib tracked. Add ERA. 30mm gun (sabot, 110+mm pen). Frag-HE Electronic-fuzed ammo 5 km. Buckshot rd for UAVs. 40-mm ABM AGL, 4 x fiber-optic guided ATGM 8 km launch on move, 2nd gen FLIR. Auto-track, hunter-killer FCS. Remote MGs 12.7mm, 2 x 7.62. Laser designator 15 km. CPS/ATS	Hybrid drive. Box ERA 100mm KE /600 CE. 45-mm CTG. Fused FLIR /II sight 13 km. ADAT dart rd 4 km. SAL/LBR ATGM 8-12 km. MMW radar. Micro-UAVs recon/atk. Radar warner, laser radar. Tunable LTD 15 km. CPS. 2 remote MGs, 1x 12.7. TV/IR attack grenades
IFV ADAT Vehicle IFV Bn/Bde MANPADS	IFV chassis and APC ADAT weapons and upgrades	See AIR DEFENSE, APC ADAT for weapons and upgrades

SYSTEM	NEAR-TERM OPFOR (FY 16-21)	MID-TERM OPFOR (FY 22-29)
Heavy Infantry Fighting Vehicle (Heavy IFV in Heavy Bn, Infantry Fire Support Vehicle, or IFV Company Command Vehicle, as Required)	2-man turret, amphib tracked, Box ERA. Auto-track, hunter-killer FCS, ATGM lch on move. 100 and 30mm guns. 100 mm HEAT, DPICM rounds. 40mm ABM AGL, NLOS (LBR/SAL) ATGM 8+km lch-on-move. 30/100-mm HE electronic fuzed rd 7 km. 30-mm buckshot rd for UAVs. AD 12.7mm MG, 2 remote 7.62 MG. Laser designator 15 km. CPS/ATS	Hybrid drive. Armor and box ERA protects 300mm KE/800 CE. 45-mm CTG, KE, HE, ADAT rds. KE missile 8 km. Micro-UAVs recon/ atk. CPS. Fused FLIR/II sight 13 km. ATGM 8-12 km. Tunable laser designator to 15 km. Radar/ MMW warners. AGL, 2 remote MGs, 1x 12.7. TV/IR atk grds
HIFV ADAT Vehicle HIFV and Amphib Bn/Bde	HIFV chassis with APC ADAT weapons and upgrades	See AIR DEFENSE, APC ADAT for weapons and upgrades
Main battle tank	Welded turret, 3rd gen ERA, more armor. 125mm gun, bigger sabot (800+mm pen), LBR ATGM 6 km. SAL/IR-homing rd to 5 km in 1 sec, SAL-H ATGM 8 km.. Improved 2nd gen FLIR (7 km) and 50X Day/night sights. ATGM fire on move. Auto-tracker, laser radar, laser dazzler blind sights. Focused frag HE rd for heli, light AT targets. HEAT-MP, DPICM sub munitions rds. IR/MMW CM. Active suspension. CPS/ATS. Controls robot	Reduced remote turret, compartmented crew, electronic/ceramic armor, 500 mm top/mine armor. Laser/radar warners. Hybrid drive. CPS/ATS/APS. Sabot defeats 1000 mm KE. KE ATGM to 12 km. Tunable LTD to 15 km. ADAT msl 8 km. Fused 3rd gen FLIR/II sight 100 X to 13 km. MMW FC. Atk/recon micro-UAV, atk grds. Controls a robot tank.
Tank Robot (Near Term) Robotic Tank (Mid-Term)	Tracked LTD tank robot fits on platoon cmd tank when unused. Light armor, MMW/ IR screens - no signature. It designates SALH ATGMS and rds.	1/2 size MBT. Driver seat for pre-battle. Armor, weapons, mobility/ survivability (CPS/ATS/APS) same as tank. ATGM launch veh version
Tank ADAT Vehicle Tank Bn/Bde MANPADS	Tank chassis and APC ADAT weapons and upgrades	See AIR DEFENSE, APC ADAT for weapons and upgrades
Armored Tactical Utility Vehicle (TUV)	4x4 swims, 1/4 mt amphib trailer, Remote 12.7-mm MG and 40-mm AGL). Multirole (mech/recon/C4/AD/AT/security/ log). Run-flat, central tire inflation. CPS/ATS	6x6 hybrid drive, mine protection. 30-mm gun, RWS (see APC). Recon masted radar/fused FLIR/II sights. Smoke, recon/atk grenades. CPS.
Armored TUV ADAT Vehicle Infantry, SF, other units	12.7-mm MG, 2x lchr FOG/ IR-homing ATGM, EO/FLIR sight, manpack ADAT lchr. AD net azimuth warning. CPS/ATS	See above. Tunable laser designator, range 15 km. Radar warning receiver. MMW radar.
MANPADS Vehicle	Bn/Bde, insurgents. Truck, TUV, ATV. Remote launch, EO/thermal sight. Azimuth warner. Smoke/ATS	See Air Defense
Light Strike Vehicle	4x4 rear engine, 4-person, 2 m ford. 35-mm AGL, 12.7-mm MG, and 40-mm ATGL. ATS	Light armor/mine shields. Hybrid drive. Amphib (Bladders). 30-mm gun RWS (see APC). ATGM 8 km.
Light Strike Vehicle ADAT	4x4 rear engine, 4-person, 2 m ford. 35-mm AGL, 12.7-mm MG, KE LBR Msl. FOG/IR-hom ATGM 4 km. ATS	Light armor/mine shields. Hybrid drive. Amphib (Bladders). 30-mm gun RWS (see APC). ATGM 8 km.
Tactical Motorcycle Motorcycle ADAT version	Low noise diesel engine, 35-mm AGL Swim sacks. MMW/IR camouflage and screen. ATS	Continuous rubber track. FOG/ IR-homing ATGM, imp MANPADS. Track conversion in snow/swamp.
All-Terrain Vehicle (ATV) and ATV ADAT	6x6, 4-person capacity, 3.5 mt payload. Swim. Has 12.7-mm MG, 35-mm AGL. ADAT, AT, other roles. Amphib trailer. Track conversion in snow/swamp. ATS	8x8. Mine protection. Hybrid electric/diesel drive. Snap-on cab for cold weather etc. 23-mm light chain gun on pintle mount.
RECONNAISSANCE, INTELLIGENCE, SURVEILLANCE, TARGET ACQUISITION		

SYSTEM	NEAR-TERM OPFOR (FY 16-21)	MID-TERM OPFOR (FY 22-29)
Binocular Laser rangefinder and Goniometer	Handheld 20km detection, 5-7km recognition, GPS. Thermal channel (below) goniometer, computer - digital transmit	See Thermal Binoculars (below). Heads-up display links to terminal. Transmit images to net.
Helmet Cam	Soldier camera link to laptop/PDA 2 km. NVG feed. Remote mast-mount.	Improved night viewer with 3 gen II or thermal. Nigh range 2 km.
Thermal Binoculars	Uncooled 2 gen FLIR. 2x electronic zoom (EZ), image stabilization. Detect 9 km (13 EZ), recognition 3.5 km (5.5 EZ)	Add LRF, laser pointer, internal GNSS. Fused FLIR/II camera. FOs call indirect fires 10-13 km, 6+ with precision, direct fire 5.5 km+. IDs heli at 7 km w EZ, detects at 13 km
Laser Target Designator/ Rangefinder (Manportable)	Man-portable, encoded, designate SAL-H rounds, bombs, ATGMs to 10 km. 2 gen thermal sight. Mounts on sensor robot	Tunable laser designator with encoded pulse to 15 km. Mounts on sensor robot
Observer Sensor Suite For Recon, SPF, Security, Anti-tank, Air Defense, Artillery (Dismount, ATV, Motorcycle, Vehicle)	Goniometer/laser designator base. Laptop or radio link. GPS, thermal laser range-finder binoculars, manpack radar. Aircraft azimuth warner. Net with UGS, remote camera, micro-UAVs.	Mount on Sensor Robot. Increased range, encryption, SATCOM. Fused FLIR/II night sight. Tunable encoded LTD to 15 km designates for all SAL-H munitions.
Laptop Computer for Digital Sensor Network	System accesses sensor links: video cameras tactical units, UGS monitor, maps/unit status displays, azimuth and alert nets. Digital data links, microphones for discussion, ground station terminal. Access encrypted internet links, long-range cordless and SATCOM phones. Terminal to remote-detonate mines and control minefields.	Personal data assistant for dismount use or for mounting in or linking to weapon FCS. Solar rechargeable batteries, extended range on links with retransmission UAVs. Use for hand-off control of UAVs, in-flight munition retargeting. Fuse UAV, weapons, cameras, TV recon grde image, battle management data.
Surveillance radar	Man-portable low probability of intercept GS radar to detect/classify vehicles 30km, detect personnel 18km. Netted digital/graphic display.	Remotely operated, on a mast, with man-portable day/night EO sensor suite or from concealed base.
Mortar and Grenade Recon Rounds TV/IR attack grenades: Mid-Term	82 mm mortar round with a CCD TV camera to 5,700 m, aerial NLOS zoom view to laptop for 20 sec. Rifle/hand-held/AT grenades with TV cameras send video to PDA or laptop on descent.	Mortar rds (81/120), grenades with slewable fused FLIR/II and zoom. 40mm AGL grd 2,200 m. Shotgun grds. Recon, TV/IR attack grenades (HEAT/HE) from vehicle 82-mm smoke grenade launchers to 1,000m
Unattended Ground Sensor Set	Netted, acoustic, seismic, magnetic, IR. Acoustic sensor UGS array extends 12 km, for accuracy within 3m.	Robotic sensors with sleep mode, underground concealed hide position (self-relocate, dig in). Nil visual/IR/MMW signature.
Remote Cameras and Sensors	Motorized, masted, with constant-on, command-on or acoustic/seismic wakeup. 20-30km link range. CCD measures and in-ground mount. 2 gen FLIR day/night passive scan.	Robotic sensor entrenched and concealed. On wake-up, mast rises to RISTA mode. Integrated net digital display, link to sensor robots and robotic weapons.
Smart Dust	Rocket/UAV/aircraft scattered crush sensors emit for 1/2 hour.	Scatterable, attach to metal. Acoustic/crush/seismic. Emit 1 hour.
Sensor Robot	Man-portable tracked robot w/cameras in multi-sensor pods (acoustic/EO/ seismic) w/wake-up. Transmits image to monitor. Camera range 3 km. RAM. Laser designator direct munitions 10 km	Solar charge and vehicle quick charge, longer charge capability. Camera/link range 20-30 km. Self-entrench. Composition chassis and RAM is undetectable to sensors.

SYSTEM	NEAR-TERM OPFOR (FY 16-21)	MID-TERM OPFOR (FY 22-29)
Acoustic sensor vehicle	Vehicle mounts microphones or dismount array, DFs/acquires aircraft, vehicles, or artillery. Rapid queuing and netted digital display. Range 10 km, accuracy 200m. Three vehicle set can locate artillery to 30 km with 1-2% accuracy in 2-45 sec. DF/ cueing rate 30 targets/min.	Range extends to 20-30 km with 10 m accuracy. Micro-UAVs with microphones to supplement the network in difficult terrain. Track and engage multiple targets. Range and accuracy SAB. Hybrid electric/diesel drive.
Wheeled Armored Reconnaissance Vehicle (ARV)	4x4 and 4 aux wheels, low profile. 12.7-mm AD MG. NLOS FOG ATGM 8 km Multi-sensor mast, 2nd gen FLIR. GS radar classify vehicles 30 km, detect person 18km, laser designator 15 km, UGS, laser radar, MANPADS, ATGM. CPS/ ATS. Conformal MMW-IR net, MMW/IR grds. Canister UAV 10 km.	Hybrid drive. IFF. Fused FLIR/II to 24 km. Micro-UAV range 35 km. 30 mm recoilless chain gun on RWS (see APC). SAL/LBR ATGM 8-12 km. Tunable LTD 15 km. Multi-spectral smoke launcher and recon and TV/IR attack grenades to 1,000 m. Sensor robot. CPS.
Tracked Reconnaissance Vehicle	2-man turret, 30-mm gun, 12.7-mm AD MG, MANPADS, ATGM. Masted multi-sensor suite, 2 gen FLIR, laser radar, auto-tracker, laser target designator direct arty /mortar rds/bombs, ATGMs 15 km. GPS/ inertial nav, digital data. Radar detects vehicles 30 km, personnel 18. UGS net. Canister UAV. CPS/ATS	Hybrid drive. Fused FLIR/II to 24 km. IFF, Micro-UAVs to 35 km. 45 mm CT gun. ADAT KE round 4 km. SAL/LBR ATGM 8-12 km. Multi-spectral smoke launcher and recon and TV/IR atk grenades. Tunable laser designator 15 km. Sensor robot. CPS.
Long-range sensor vehicle	Tracked vehicle with elevated sensor suite on pod. Day/night TV, MMW radar detect to 45 km vehicle, 20 km personnel. 2 gen FLIR Net to UGS, UAVs, etc. Digital links to arty, AT, AD, recon, etc. 12.7-mm AD MG. Laser target designator to 15 km. CPS/ATS.	Longer range, increased target handling/transmission capacity. Manpack AD/AT LBR missile to 8 km. Fused FLIR/II to 24 km. Tunable laser designator to 15 km. Hybrid electric/diesel drive. CPS. Recon and TV/IR atk grenades.
Ground or Vehicle Launch Mini-UAV	2-backpack system. Man-portable ground launcher, and laptop terminal. Vehicle-launch from rail or canisters. TV/FLIR. Range 35 km, 3-hr endurance.	IR auto-tracker. Laser designator. Cassette launcher for vehicles. Signal retransmission terminal. Bus dispense micro-UAVs, UGS, mines
Micro-UAV	Hand-launch 4-rotor, 4 kg, 5 km/1 hr, GPS map/view on PDA/netbook. Atk grenade	< 1 kg for dismount sqd/tm, 2 km range. Add grenade for atk UAV
Heliborne MTI Radar	Range 200 km, endurance 4 hrs.	Range 400 km. Add SAR mode.
Commercial Satellite Imagery	Resolution 5 m for IR, SAR also available. <2 days for request. Terminal on tactical utility vehicle at division. Can be netted to other tactical units.	Response time reduction (to <6 hours). 1-m resolution.
ANTI-TANK		
Manpack Air Defense and Antitank (ADAT) Kinetic-Energy Missile Launcher (also listed in Air Defense)	Co/Bn substitute for ATGMs and AD. Targets helicopters and LAVs. Shoulder launch missile with 3 KE LBR submissiles 8 km, 0 m altitude. Submissiles have 25-mm sabot/HE warhead. Nil smoke. Mount on robotic launcher (below). FLIR night sight.	Fits in 45-100mm guns. Defeats all targets up to 135 mm KE. Range 8 km, time of flight 6 sec. Fused FLIR/II sight 10 km. Launch from enclosed spaces. Can mount on robotic ADAT launcher or ADAT Robot vehicle (below).
Man-portable ATGM Launcher (Also pintel/vehicle dismount)	SACLOS guided to 3 km. Tandem warhead defeats 1,200mm. Thermal sight. Jam-proof low noise/smoke. Fire from enclosed spaces. Can mount on robotic launcher (below)/vehicles.	Twin ATGM remote ground veh/ launch station with auto-tracker. Fused FLIR/II sight 5 km. NLOS /IIR homing missile to 4 km. Can use ADAT missile. Laser dazzler

SYSTEM	NEAR-TERM OPFOR (FY 16-21)	MID-TERM OPFOR (FY 22-29)
Ground Turret	Ready-made hole mount turret for hoist installation, w/12.7 mm MG, 4 km ATGM launcher, thermal night sight, and radar absorbent/IR reflective paint on cover. Invisible until activated.	Add remote/unmanned pop-up turret. FOG-M top-attack or IIR-homing attack 8 km. Tandem warhead 1,300 mm. Fused FLIR/II sight to 10 km. CPS
Ground/ Vehicle Pintle Mount ATGM Launcher	Combat support vehicle with portable robotic twin launcher (below). FOG-M top-attack or IIR-homing direct attack 4 km. Tandem warhead defeats 1,000+ mm. Thermal sight 5 km range. Low noise/smoke, countermeasure-resistant.	Range increase to 8 km and 1300 mm penetration. Thermobaric ATGM. Fused FLIR/II sight to 10 km. Launch from enclosed spaces. Laser dazzler. ADAT robot vehicle.
Robotic ADAT Launcher ADAT Robot Vehicle	Pintle mount shoulder/ground/ATV/ vehicle launch. Robotic launcher-60 m link. Twin auto-tracker. Operator in cover/spider hole. MMW/IR absorbent screen and net for operator, launcher and surrounding spall. CPS/ATS.	Masted 4-launcher, hybrid drive to self-entrench, then move to launch point. Fused FLIR/II sight to 10 km. Remote link 10 km. Most AD and AT host vehicles have 2 control stations and 2 robots. ATGM same as above. CPS.
Towed Antitank Gun	125mm gun, larger sabot (700+mm), LBR/SAL-homing ATGM 8 km. Stabilized FCS sights, auto-tracker. Auxiliary propulsion unit. TV day sight with (32x). Combined MMW radar and 2nd gen thermal night sight (5-7 km). Add SAL-H/IR HEAT rd 5 km in 1 sec, HEAT-MP, DPICM submunition round. ATS.	Remote unmanned gun with cassette, towed, dug into position, netted into AT net. Concealed position (retractable base and IR/MMW concealed). Fused FLIR/II sight to 10 km. KE ATGM (8 km), direct link to micro-UAVs and UGVs). Laser dazzler
Heavy Recoilless Gun, 106 mm and Recoilless Gun Vehicle (RGV)	TOW or RGV on TUV. Tandem HEAT round 700+mm 3 km. SAL-H, tandem ATGM (1,000+ mm), 8 km dive attack. .50-cal spotter rifle to 2,500 m. Laser designator. Computer sight, 2gen FLIR. HE, flechette rounds. RGV CPS/ATS.	HEAT rd 900+mm. Remote weapon system mount for APC, IFV, and TUV chassis. Fused FLIR/II sight to 10 km. Nil smoke/noise. Tunable laser designator for SAL munitions 15 km. Hybrid drive for RGV.
Self-Propelled Antitank Gun	Amphibious airborne tracked, 125 mm gun, larger sabot (700+ KE), SAL ATGM to 8 km. SAL-H/IR HEAT rd 5 km in 1 sec, DPICM submunition round , focus frag HE rd. Stabilized TV day sight (32x), 2 gen FLIR 5 km, auto-tracker. Laser designator 15 km. CPS/ATS.	Hybrid drive. MMW FC radar, NLOS ATGMs (8/12 km), direct link to micro-UAVs, UGVs). Fused FLIR/II sight 10 km. Micro-UAVs recon/atk. Laser dazzler. Tunable LTD 15 km. CPS, TV/IR attack grenades
Tracked ATGM Launcher Vehicle	Box ERA 300mm. NLOS/IIR ATGM launcher on IFV. 1,300 mm dive attack, 8 km. HE Thermobaric ATGM. Low noise/ smoke signature. 12.7-mm AD MG. Laser designator to 10 km. CPS/ATS. Manport ADAT KE missile launcher.	Imp ERA (300mm KE, 600 CE). Hybrid drive. NLOS/KE ATGMs LBR/SAL defeats 1,300mm at 8/12 km. EMP option. Fused FLIR/II 13 km. 2-target auto-track. Launch on move. Laser dazzler. Micro-UAV atk/ recon. 2 robots. Atk grds.
Wheeled ATGM Vehicle	4x4 Armored TUV with same launcher system as above. CPS/ATS.	Same launcher as above. Hybrid drive. Robot vehicle.
Airborne Infantry ATGM Launcher Vehicle	Airborne/amphib tracked light armored. Same launcher as above. CPS/ATS.	Same launcher as above. Hybrid drive, ERA, atk grds. Robot veh.
Heavy ATGM launcher Vehicle	Tracked, 6 lchrs, SAL-homing ATGM 1,400mm dive attack, 10 km. Warheads HEAT, Multi-purpose (HEAT/Frag-HE). 12.7-mm MG. Jam-proof auto-tracker, Laser designator 15 km. CPS/ATS.	Hybrid drive. Add IIR homing, 12 km range, EMP, and thermobaric. Warheads. Fused FLIR/II 13 km. Laser dazzler. Designator UAV 30 km range and 3-hr loiter. Atk grds

SYSTEM	NEAR-TERM OPFOR (FY 16-21)	MID-TERM OPFOR (FY 22-29)
Heavy ATGM Launcher Vehicle (and Land Attack Cruise Missile - LACM)	Tracked vehicle with 16 x SAL-homing ATGMs, Hybrid drive. RF-guided phase, 40 km. Fused FLIR/II acq to 10 km. MMW TA radar to 40 km. Warhead: 28-kg Frag-HE=1,300 mm penetration. UAV to 40 km with LTD (15 km range). FW and boat mounts. Anti-heli radar guided or SAL-homing. Atk grds.	Hybrid drive. Guidance adds radar or IIR homing. Warheads: Multi-purpose (HEAT/ Frag-HE) defeats 1,400mm), Bus for sensor-fuzed sub munitions, EMP warhead. Laser designator UAV range 100 km, 3-hr loiter time.
Attack UAV	Hit-to-kill system. Day/night 60+ km, up to 2 hours. GNSS/inertial navigation, TV/FLIR, Frag-HE warhead. They include an anti-radiation variant.	Cargo UAV 100 km dispenses IR/ MMW/SAL DP (600mm HEAT) sub munitions, EMP munitions, SAL ATGMs – UAV LTD 30 km.
Attack UAV Launcher Vehicle	Hit-to-kill UAV launch from modular launcher, 18 UAVs. GNSS/inertial nav, to 500 km. First version anti-radiation homing. Added TV guided and multi-seeker attack (hit-to-kill) UAV. Laser designator range 15 km. CPS/ATS.	Hybrid drive. Bus reusable UCAV with 4 ATGMs to 10 km, SAL-H bombs, or bus dispensing 16 terminally-homing sub munitions (with MMW/ IR seekers, or laser-homing DP sub munitions). CPS. LTD
Micro-Attack UAV	Hand or canister -launch UAV with TV and FLIR guidance to 10 km, 100-600 m altitude, with .25-.5 kg warhead.	Cassette/smoke grenade launcher launch for tactical vehicles. Recon and attack (top-attack) UAVs.
Mini-Attack UAV	Hand or vehicle canister -launch UAV with TV and FLIR guidance to 35 km, 100-600 m altitude, 1-4 kg warhead.	Cassette launcher launch for tactical vehicles. Recon and attack (DP with tandem 600 mm top-attack).
FIRE SUPPORT		
Man-portable Mortar	Conventional munitions, 82mm FRAG-HE 6.7 km, RA 13.0 km. SAL-H 6.7 km. Day/night direct/indirect fire sight. GPS. Prox fuze. Tandem ATGM 7 km.	Increased range and accuracy. Ballistic computer sight. Fused FLIR/ II 10 km.Self-lay. Dual guided (diff GNSS course correct/SAL) 13 km
Towed Mortar Upgrade	120-mm FRAG-HE – 9 km. Prox fuze. ADHPM: SAL-H and IR-homing HEAT – 9 km, Sensor-fuzed – 7 km. Night capable direct/indirect fire sight, self-lay.	Improved range/precision. Ballistic computer sight. Fused FLIR/II 10 km. Dual guided round (differential GPS corrected, SAL) to 12 km.
Towed Combination Gun	GPS gun lay/nav system. Frag-HE range 8.1 km (and prox), RAP 12.8, HEAT 1 km, SAL-H 12.8. Mortar rds SAB.	Automated fire control, Fused II/ FLIR 13 km. Autonomous lay, diff GNSS. Auxiliary propulsion unit.
Self-Propelled Combination Gun	120-mm gun/mortar system. GPS gun lay. Cannon Frag-HE (prox fuze option) 13 km, -RAP 18, HEAT 1 km. All mortar rounds. ADHPM: Mortar SAL-H and IR-homing 9 km, Sensor-Fuzed 7 km. Cannon SAL-H rd 9 km. CPS/ATS.	IFV chassis. Hybrid drive. Laser designator 15 km, diff GPS, automated FCS, autonomous lay. Fused FLIR/II 13 km. SAL-H, GPS rounds 12 km. SAL tandem HEAT ATGM to 20 km. APS
Towed Medium Gun-Howitzer	FRAG-HE - 30 km, FRAG-HE BB - 39 km, Artillery delivered high precision munitions (ADHPM): SAL-H - 25 km, Sensor-Fuzed – 27 km. GPS 40 km	Autonomous lay/fire direction. Enhanced lethality, differential GPS corrected munitions (and sensor-fuzed) 60 km.
Self-Propelled Medium Gun-Howitzer	45-cal gun. GNSS/inertial land nav, self emplace, FC. Munitions: FRAG-HE – 30 km, FRAG-HE base bleed - 39 km. ADHPM: SAL-H - 25 km, Sensor-Fuzed – 27 km, GPS-corrected 40 km.	Automated fire control. Barrel cooling, thermal warning systems. Autonomous lay/fire direction. Differential GNSS corrected rds (and sensor-fuzed) 60 km.

SYSTEM	NEAR-TERM OPFOR (FY 16-21)	MID-TERM OPFOR (FY 22-29)
Self-Propelled Medium Gun-Howitzer Tracked	Ford depth 5.5 m. 40-cal gun. GPS/ inertial land nav, self emplace and FC. FRAG-HE 23 km, FRAG-HE rocket ast 31.5 km. SAL-H rd 25 km, Sensor-Fuzed rd 27 km, GPS corrected 40 km	Automated FC. Autonomous lay/FD. Barrel cooling, thermal warning systems. Differential GNSS course corrected rds (and sensor-fuzed) 60 km.
Self-Propelled Medium Gun	Conventional munitions, FRAG-HE-BB – 30.5 km, FRAG-HE-RA–40 km. ADHPM: SAL-H - 25 km, Sensor-Fuzed – 24 km. GPS corrected 40 km.	Automated FC, barrel cooling and thermal warning, autonomous fire direction. Diff GNSS corrected rounds (and sensor-fuzed) 60 km.
Manportable Single Round Rocket Launcher	122mm FRAG-HE – 10.8 km. SAL-H, Sensor fuzed 10.8 km. On tripod	Increased range and accuracy. Enhanced lethality.
Rocket Launcher Pod (107mm) For Use on Improvised/ Modified Launch Platforms	6-tube (2x3 rockets) pod mounts on cart, vehicle (e.g., amphibious/airborne APC), or ground stand. Remote launch fire control. Cart/vehicle 1-3 pods. GNSS. Range 8.5 km. Limited lateral launcher adjustment (move vehicle). Mines and DPICM warhead option.	Improved launcher mount with servo-motors and remote computer FCS and in-view GNSS data. Munitions include: EMP, smoke, UGS, SAL-homing HE, tandem HEAT, recon, chem. Use with laser designator. Range 10 km.
SP Medium Rocket Launcher (100mm to 220mm)	122mm 50-tubes. Self-emplace (GNSS/ inertial nav). Onboard FCS. Munitions: Frag-HE 90° precision fall 40 km, GPS course-corrected DPICM and Frag-HE 36 km, RF jammer rd 18.5, SAL-H rkt 32 km, Sensor fuzed 33 km.	Extended range. Increased accuracy and lethality. Course corrected diff GPS/ inertial) in DPICM, multi-role (HEAT, HE, incendiary). Motorized spades for quick displace.
SP Heavy Rocket Launcher (220-240 mm)	Self-locating launcher, 16 tubes. GNSS/ inertial nav. Onboard fire direction. Rockets: 220mm FRAG-HE –43 km, DPICM, Chemical. Thermobaric – 43 km ADHPM: Sensor-Fuzed – 43 km	Increased accuracy. Enhanced lethality. MRL can launch cruise missiles, UAVs. Diff GNSS Course corrected munitions (DPICM, sensor fuzed, mines) to 70 km.
SP Heavy Rocket Launcher (240-300 mm and larger)	Self-emplace 300-mm 12-tube launcher. GNSS/inertial nav, onboard FCS. Inertial course-corrected rockets 100 km: mines, DPICM, Chemical, and Thermobaric. Sensor-Fuzed 90 km, UAV rocket 90 km	Range (100+ km). Differential GPS Inchr, GNSS course-corrected rkts. Enhanced lethality. Launch cruise missiles (attack UAVs) and recon UAVs to 470 km.
Weapon Locating Radar Vehicle (Counter Mortar/ Counter-Battery Radar)	Detection range with low error rate Mortar: 30 km, Cannon artillery: 20-25km, Rocket: 40km, Tactical Missile: 55km.	Faster computer processors with digital links, differential GNSS, and decreased radial error
ENGINEER		
Improvised Explosive Device (IED)	Command (RF, wire) arm/detonate. Also sensor armed/fuzed. Large shaped charge, EFP, daisy chain arty rds, large IED, mine converted to cmd/SF. Defeat RF jammers, magnetic detectors.	Fuzes and radio links which can convert explosive devices and materials into intelligent IED fields (see intelligent minefield)
Minelayer, Towed	Lays 10 to 12 mines per min. Lines 20/40 m apart. Can also lay controllable minefields.	Advanced sensors. Target discrimination. Can lay intelligent mines.
Minelayer Vehicle	Armored chassis w/7.62mm MG, lays 1,000 m AT field with 5m between mines. Lay controllable mines. CPS/ATS	Add vehicle mount mine launchers. Also lays intelligent minefields. Hybrid electric/diesel drive.
Infantry Portable Scatterable Minelaying System	Remotely lays AT/AP mixed minefield 200-400m square from a distance up to 1090m. At platoon. 6 lb, 5 min set-up. Controllable mines.	Add intelligent mines. ATGL and AGL-delivered mines.

SYSTEM	NEAR-TERM OPFOR (FY 16-21)	MID-TERM OPFOR (FY 22-29)
Scatterable Mines	Deliver by artillery, cruise missile, UAV, rotary or fixed-wing aircraft. Non-metallic case, undetectable fill, resistant to EMP and jammers, w/self-destruct.	Advanced multi-sensor mines with wake-up and target discrimination. Prox fuze mines. Controlled minefields and intelligent mines.
Artillery Scatterable Mine Rounds and Rockets	Cannon, MRL, mortar, gun/mortar. 122-mm MRLs can fire AT and/or AP mines and covers 24-81 hectares.	Extended range. Controlled minefields (RF link)
Remote Mine Launcher Pod System (Vehicle, trailer, ground)	APC w/180 x 140-mm pods, scatters mines, UGS, jammers, CS gas, and smoke grenades, 30-60m from pod. Can lay field AT/AP 1-1.2km x 30-120m. CPS/APS	Multi-sensor mines with wake-up, target discrimination. Controlled minefields, intelligent mines. Prox fuze mines (up to 540) 2 km 10 sec
Off-Route Mines (Side-Attack and Top-Attack)	Autonomous weapons that attack vehicles from the side as the vehicles pass. 125-mm Tandem HEAT (900+ mm). Target speed 30-60 km/h, range 150m acoustic and infrared sensors.	Sensor-fuzed EFP 600mm KE top attack. Remote or sensor actuated (controller turn-on/off), 360-degree multi-sensor array. Hand/ heli/ UAV/arty/ATGL mortar emplace.
Controlled Mines and Minefield	AT/AP, machine emplaceable. Armed, disarmed, detonated by RF command. Chemical fills and non-metallic cases are undetectable. With CM and shielding, negate jammers/pre-detonating systems.	Control may be autonomous, based on sensor data and programmed in decision logic, or by operators monitoring with remote nets.
Smart Mines	Wide-area munitions (WAM) smart autonomous, GPS, seismic/acoustic sensors. AT/AV top-attack, stand-off mine. Lethal radius of 100 m, 360°. Hand-emplace	Discriminate targets. Reports data to a monitor, evaluate target paths, built-in logic. Use GPS to artillery/ heli-emplace. Non-nuclear EMP or HPW options
Unexplosive Ordnance (UXO)	Artillery cannon or rocket DPICM sub munitions in impact pattern.	Unused blue remote-launch precision munition pods may be seized and used against them.
Intelligent Minefields (including Non-nuc EMP, Jam, and HP Microwave)	Developmental programs and not proliferated	Self-healing, autonomous monitoring of obstacle integrity. Advanced sensors, target discrimination, built-in logic. Non-nuclear EMP or HPW.
Engineer Reconnaissance Vehicle	Tracked IFV chassis. Amphibious- recon equip: sonar, NODs, rangefinder, soil analyzer, gyrocompass, underwater mine detection. CPS/ATS	Hand-held and vehicle-mounted ground-penetrating radars for mine detection. Hybrid electric/diesel drive. CPS
Obstacle Clearing vehicle	Tank chassis, NBC-protected, dozer (3.8m), crane (2mt), scoop/ripper, and mine detonator. CPS/ATS	Hybrid electric/diesel drive.
Vehicle or Towed Line Charge Mineclearing System	Mounted on truck, IFV, APC, TUV or tank. Rocket launch 10 tubes HE or FAE, to 3km. Breach lanes 10x60m.	
Line-Charge Mineclearing Vehicle	Clears lane 6x9 m. 2 line charges. CPS/ATS.	Hybrid electric/diesel drive.
INFORMATION WARFARE		
Lightweight Mobile ESM/DF	0.7-40 GHz, ESM/DF	SATCOM intercept capabilities
Electronic Warfare Radio Intercept/DF /Jammer System, VHF	Intercept, DF, track & jam FH; identify 3 nets in non-orthogonal FH, simultaneous jam 3 fixed freq stations (Rotary/fixed wing/UAV capable)	Integrated intercept/DF/jam for HF/VHF/UHF

SYSTEM	NEAR-TERM OPFOR (FY 16-21)	MID-TERM OPFOR (FY 22-29)
Radio Intercept/DF HF/VHF/UHF	Intercept freq range 0.1-1000 MHz. (Rotary/fixed wing/UAV capable)	Wider Freq coverage. SATCOM intercept. Fusion/cue w/other RISTA for target location/ID
Radio HF/VHF/UHF Jammer	One of three bandwidths; 1.5-30/20-90/100-400 MHz, intercept and jam. Power is 1000W. (Rotary/fixed wing/UAV capable)	Increased capability against advanced signal modulations. UAV and mini-UAV Jammers.
Portable Radar Jammer	Power 1100-2500W. Jam airborne SLAR 40-60km, nav and terrain radars 30-50km. Helicopter, manpack.	UAV and long range fixed wing jammers.
High-Power Radar Jammer	Set of four trucks with 1250-2500 watt jammers at 8,000-10,000 MHz. Jams fire control radars at 30-150 km, and detects to 150 km.	UAV jammer and airship jammer. Hybrid electric/diesel drive.
Portable GNSS jammer	4 -25 W power, 200-km radius. Man-portable, vehicle & airborne GNSS jammers, airship-mounted jammers	Man portable, vehicle & airborne (UAV) GNSS jammers-increased range and power, and improvements in antenna design
Arty-delivered and ATGL-launch Jammer	HF/VHF (1.5-120 MHz), 700m Jamming radius, est. (1-hr duration). 300 m for ATGL-launched version	Increased capability against advanced signal modulations
Missile and UAV-delivered EMP Munition	Cruise missiles and ballistic missile unitary warhead and submunition.	Increased capability against advanced signal modulations
Artillery-delivered and Manpack EMP Munition	Cannon (152/155-mm), rocket (122/220 /300-mm), and mortar (82/120-mm).	Increased power, capability, and range.
Cruise Missile Graphite Munitions and Aircraft "Blackout Bombs"	400-500 kg cluster bombs/ warheads with graphite strands to short out transmission stations and power grids.	Rocket precision and UAV-delivered munitions.
EMP Mine	Larger EMP mine. Effective radius 350 m, irregular/ disruptive 500 m.	See intelligent minefields and smart mines
COMMAND AND CONTROL		
Radio, VHF/FM, Frequency-hopping	30-88 MHz, 100 hps, channels: 2,300, Mix of analog and digital radios, tactical cellular/digital phone, all nets digitally encrypted. Burst trans. UAV Retrans	Digital radios, tactical cellular/digital phone, and satellite phones, all nets encrypted
Radio Relay Station, VHF/UHF,	60-120/390-420 MHz, range 30-40km per hop LOS	Digital communications networks. Network management station, automated battlefield management system
Command Post Vehicle, Division (wheeled and tracked versions)	4xHF/VHF high power, 1x VHF, 75-2000km. Digital comms, graphics, voice back-up. SATCOM digitally encrypted.	Completely digital comms net thru all levels, fiber-optic cables. Networked automated, secure, and integrated battle management system
DECEPTION & COUNTERMEASURE SYSTEMS		
Armored Vehicle Decoy, Mobile	Towed trailers & decoy heater units, and flares. Used in concert with obscured target vehicle for positioning near target to divert homing munitions. Radar (and motorized) corner reflectors. Inflatables, tethered, move w/air currents.	Acoustic decoys w/seismic effects. Multi-spectral (high-fidelity) decoys powered for acoustic and IR signatures. Linked to vehicle warning systems
Armored Vehicle Decoy, Stationary	Multi-spectral (high-fidelity) erectable/ inflatable vehicle mock-ups, w/heaters & motorized radar corner reflectors	Acoustic decoys w/seismic effects. Multi-spectral decoys powered acoustic/IR signatures

SYSTEM	NEAR-TERM OPFOR (FY 16-21)	MID-TERM OPFOR (FY 22-29)
Vehicle and Weapon System Camouflage and Concealment	Tactical vehicles have MMW/IR paint and conformal nets, multi-spectral grenades, side skirts, thermal blankets, Thermal screens, laser/radar warners, acoustic engine & track noise modifiers.	Add mist thermal image concealment systems.
Camouflage and Concealment for Dismounts	Thermal screens and pop-up stands conceal from overhead, front, side visual/ thermal day/night vs MMW & IR. Face masks/ gloves. Foxhole blast devices.	Ready-made spider hole covers, invisible to visual/ MMW/ IR sensors. Remote control option
Air Defense System Decoy	Manufactured and improvised decoys used with decoy emitter. Covered by AD systems in air defense ambushes.	Multispectral simulators of varied gun and missile systems mounted on robotic chassis.
Air Defense System Decoy RF Emitter	Expendable RF remote emitters with signal to match specific nearby radars, to trigger aircraft self-protection jammers.	Mounted on robotic chassis.
Non-Lethal (or Less Lethal) Weapons	Acoustic directed energy system, sticky foam, rubber bullets, acoustic disrupters	RF crowd disruption emitter. Water cannons. Laser dazzlers
ROTARY WING AIRCRAFT		
Attack Helicopter	30-mm auto-cannon, 8 NLOS FOG/IIR-homing ATGMs, range 8 km. Two pods semi-active laser homing (SAL-H) rockets 80mm (20x 8 km) or 122mm (5x 9 km). 2x LBR KE ADAT msl (warhead w/3 KE submissiles, 8 km range). Laser designator 15 km. UAVs to 30 km. 2nd gen FLIR auto-tracker. Radar and IR warners and jammers, chaff, flares	Tandem cockpit, coax rotor, 30-mm auto-cannon. 8 x RF/SAL-H ASMs to 18 km (28+kg HE=1300+mm), 2x SAL-H rocket pods (80mm or 122mm), 2 ADAT KE msl 8 km, and 2x MANPADs. 1/3 have ASM to 100 km. Fire control with fused II/ FLIR to 30 km, and MMW radar, link to ground LTD. Radar jammer. Atk and LTD UAVs to 30 km.
Multi-role Medium Helicopter and Gunship	24 troops or 5000kg internal. Medium transport helicopter. Range 460km. 30-mm auto cannon, 8 FOG-M/IIR ATGMs to 8 km, 40 x 80 mm laser-homing rockets, 4 AAMs. ATGM launchers can launch mini-UAVs and more AAMs. Mine pod option. Day/night FLIR FCS.	Fused FLIR/II to 15 km. 6x SAL-H ATGMs 18 km, 2 AAMs, 2 x 80/ 122-mm SAL-H rocket pods (20 or 5 ea). Laser designator to 15 km, and links to ground LTD. Aircraft survivability equipment (radar jammers and IR countermeasures).
Multi-role Helicopter and Gunship	12 troops (Load 400 kg internal, 1,600 external. Range 860 km. 23 mm cannon, 2 AAM, 4 SACLOS ATGMs to 13 km, TV/FLIR, day/night. Mine delivery pods	Launch 6x SAL-H ATGM to 18 km, 28+kg HE warhead. 2 x AAM Air-to-surface missile to 100 km. Pod w/7x SAL-H 90-mm rockets. Fused FLIR/II to 15 km. ASE
Light Helicopter and Gunship	3 troops (Load 750 kg internal, 700 external). Range 735 km. 20 mm cannon, 1 x 7.62mm MG, 6 SAL-H ATGMs to 13 km, 2 AAMs. FLIR night sight. Laser target designator. Mine pods	Launches 4x SAL-H ATGMs, to 18 km range. Fused FLIR/II to 15 km.
Helicopter and Fixed-Wing Aircraft Mine Delivery System	Light helicopter pod scatters 60-80 AT mines or 100-120 AP mines per sortie. Medium helicopter or FW aircraft scatters 100-140 AT mines or 200-220 AP mines per sortie.	Controllable and intelligent mines for aircraft delivery. Larger aircraft can hold multiple pods.
FIXED WING AIRCRAFT		
Intercept FW Aircraft	30-mm auto-gun, AAM, ASM, ARMs TV/laser guided bomb. 8 pylons Range 3,300 km. Max attack speed: Mach 4.	Stealth composite. ASE. Max G12+ All weather day/night. Unmanned option

SYSTEM	NEAR-TERM OPFOR (FY 16-21)	MID-TERM OPFOR (FY 22-29)
Multi-Role Aircraft	30-mm gun, AAM, ASM, ARM pods, guided, GPS, sensor fuzed bombs, 14 hard points. Thrust vectoring. FLIR	Improved weapons, munitions. Unmanned option. ASE all radars. Max G12+ All weather day/night
Ground-Attack Aircraft	Twin 30-mm gun, 8 x laser ATGMs 16 km 32 kg HE, 40 SAL-H 80mm rockets, ASMs, SAL-H and GPS sensor fuzed bombs, AA-10 and KE HVM AAM. 10 hard points. Range 500+km. FLIR	Stealth composite design. ASE. Unmanned option. Max G12+ 80-mm/122-mm rockets SAL-H, SAL-H ASM (28+kg HE=1300+ mm), to 40 km, 2 gen FLIR, radar jammer, day/night
OTHER MANNED AERIAL SYSTEMS		
High-altitude Precision Para-chute and Ram-air Parachutes	High-altitude used with oxygen tanks. Ram-air parachute includes powered parachute with prop engine.	Increased range and portability. Reduced signature. Increased payload.
Ultra-light Aircraft.	Two-seat craft with 7.62-mm MG, and radio. Folds for carry, 2 per trailer.	Rotary-winged, two-seat, MG, 1/ trailer. Auto-gyro, more payload.
UNMANNED AERIAL VEHICLES		
UAV (Brigade) It may also be employed in other units (e.g., artillery, AT missile, and naval)	Rotary wing, TV/FLIR/auto-tracker, with LRF and LTD designates targets to 15 km. Flies 180 km/6 hours, 220 km/hr, 2- 5,500 m alt, 100 kg payload. Can carry 2 AD/anti-armor missiles+MG for atk	Range extends to 250 km. Increased payload. Attack version can carry 2 SAL-H ATGMs (12 km range) or 1+ 4 70-mm SAL-H rockets (7 km, defeats 200 mm).
UAV (Divisional)	Day/night recon to 250 km. GNSS/inertial nav, digital links, retrans. SLAR, SAR, IR scanner, TV, ELINT, ECM suite, jammer/ mine dispensers. Laser designator 15 km.	Increased range, endurance. Diff GNSS. Composite materials, low signature engine. SATCOM Retrans relay links. Attack sub munitions.
UAV (Operational)	Day/night recon to 400+km. GNSS/ inertial nav with digital links. SLAR, SAR, TV, IR scanner, ELINT, ECM suite. Jammer option. Mine dispense. Laser target designator 15 km. Retrans/relay	Increased ranges, endurance. Diff GNSS. High altitude ceiling (35 km) option. Retrans/ relay/SATCOM links. UAV attack sub munitions. Laser target designators.
Unmanned Combat Aerial Vehicle (on Operational UAV platform)	Medium UAV with 4 ATGMs (fly out 10 km), laser guided bombs. Laser designator 15 km. Mine dispensers. GPS jammer, EW jammers. Range 400+ km.	Stealth composite design. ASE. Twin dispensers (pylons) with 16 terminally-homing sub munitions, MMW/IR seekers. Range 500+ km
THEATER MISSILES		
Short-Range Ballistic Missile Transporter-Erector Launcher (TEL) and Cruise Missile (CM) Launcher	Twin launch autonomous vehicle (GPS/ inertial nav, self-emplace and launch). Range 450 km. Non-ballistic launch, separating GPS corrected reentry vehicle (RV) with decoys, CCD, 10-m accuracy. ICM, cluster, nucs. EMP warhead. CM option. TEL may convert to 6 x CM TEL (500 km, 3-m accuracy, below radar). Vehicle decoys. Vehicle has visual/MMW/ IR signature of a truck.	Missile improve range (TBM 800 km, cruise 1,000), with 1-m accuracy. TBM has GNSS-corrected maneuvering RV. Warheads for both include terminal-homing sub munitions, precision cluster munitions, EMP. Cruise missiles pre-program or enroute waypoint changes. Countermeasures include penetration aid jammers.
Medium-Range Ballistic Missile	Autonomous vehicle. Separating maneuvering warhead to 1300 km. GNSS,10-m CEP. Warheads include ICM, cluster, EMP, nucs. Penaids include decoys, jammers. Visual/MMW/IR signature of a truck.	Range 2,300 km, 1-m CEP. Differential GNSS, terminal homing, separating warhead. Warheads include EMP, terminal-homing cluster munitions. Non-ballistic launch and trajectory
Land-attack SAM system (secondary role for system)	The SAM system uses its EO sight and LRF (short/med range, strat “hittiles”)	Range extends with SAM ranges. Passive operation with TV/FLIR.

SYSTEM	NEAR-TERM OPFOR (FY 16-21)	MID-TERM OPFOR (FY 22-29)
Cruise Missile Launcher Vehicle (Multi-Role) Category includes specialized cruise missiles, long-range ATGMs, and SAM systems to engage targets at 12+ km.	Includes truck with 24 missile launchers. Range is 40 km. 28-kg Frag-HE warhead =1,300 mm penetration. Pre-program phase GNSS/inertial nav is used. LTD to 25 km range. Thermal night camera to 10 km. Support UAV with LTD is used. FW, RW, and sea-launch options.	Range 100 km. Penetration aids (countermeasures). IR Terminal-homing warhead or IR-homing submunitions can be used. Armored/ tracked launcher will mount 16 x 40 km missile launchers.
Cruise Missile Cassette Launcher Vehicle	Off-road truck, GPS nav for autonomous ops. 16/lchr. Range 470 km; preprogram GNSS inertial guidance, with in-course correction, 10 CEP. Munitions include cluster munitions, thermobaric, chemical, DPICM/mine submunition scatter.	Launcher fire direction. Supersonic missile Diff GNSS/ inertial nav, 1-m CEP. Range 900 km. EMP warhead option. Warheads include homing cluster munitions. Penetration aids-countermeasures.
AIR DEFENSE		
General Purpose and Air Defense Machinegun	12.7mm low recoil for ground tripod. Chain gun light strike vehicle, ATV, motorcycle, etc, on pintle. TUV/LAV use RWS. Remote operated ground or robot option. Frangible rd 2 km, sabot 2.5 km. RAM/RAP/IR camouflage/ screens. TV/FLIR fire control. Lightweight MMW radar 5 km. Display link to AD azimuth warning net. Emplace 10 sec. RF/radar DF set. ATS control option.	Stabilized gun and sights. Remote-operated computer FCS with PDA/ laptop. Fused II/ FLIR 5 km. Frangible, sabot rds to 3 km. Laser dazzler blinds sights. Micro-recon/ heli atk UAVs. Robot mounts MG. Some light and AD vehicles replace gun with 30-mm recoilless chain gun on RWS, fires AHEAD round 4 km, plus Add-on ADAT missiles.
Improvised Multi-Role Man-Portable Rocket Launcher (AD/Anti-armor)	4-tube 57-mm launcher with high-velocity dual-purpose rockets. EO day/ night sight. Blast shield. Range 1,000 m. Penetration 300 mm, 10 m radius.	Prox fuze, 1,500 m range. Penetration 400 mm, 20 m radius.
Man-portable SAM launcher	6 km day/night range/ 0-3.5 km altitude all aircraft, velocity mach 2.6. Thermal night sight. Proximity fuze, frangible rod warhead (for 90% prob hit and kill). Approach/ azimuth link to AD warning net. Twin launcher vehicle quick mount. Nil smoke. Mount on robotic AD/AT launcher. RF/radar DF set on helmet.	Warhead/lethal radius increased air/ground targets. Improved seekers - not be decoyed by IR decoys/jammers. Fused II/ FLIR 10 km. Launch from enclosed spaces. Laser dazzler. Optional AD/AT LBR KE warhead missile – 8 km. Mount on AD/AT robot vehicle
MANPADS Vehicle Conversion Kit (Lt Stk Veh, Van, recon TUV, truck, etc)	Twin launcher and ADMG on improvised IR SAM vehicle. Day/night IR auto track FCS, MMW radar. Display link AD net. RF/radar DF set to 25 km. Camouflage	Replace launcher with 3-missile launcher: 2x ADAT KE SAMs, 1x IR SAMs. Total 6 missiles, (3+3)
Manpack Air Defense and Antitank (ADAT) Kinetic-Energy Missile Launcher (also listed in Anti-tank)	At company/Bn, can replace ATGMs and SAMs. Targets heli and LAVs. Missile has 3 KE LBR darts (submissiles) 8 km, 0 m altitude. Camo screen. Dart is 25-mm sabot with HE sleeve. Nil smoke. Fits on robotic ADAT launcher. Helmet RF/radar DF.	Larger sabot kills all targets up to 200 mm (KE) armor. Range 8 km, time of flight 5 sec. Fused II/ FLIR 10 km. Launch from enclosed spaces. Can mount on 3x remote launcher w/ IR auto-tracker, which. fits on AD/AT robot vehicle

SYSTEM	NEAR-TERM OPFOR (FY 16-21)	MID-TERM OPFOR (FY 22-29)
Towed/Portee/Vehicle Mount AA Short Range gun/missile system	2x23mm gun. MMW/IR Camou/screen. Frangible rd to 3,000 m (17mm pen). Onboard radar/TV fire control, ballistic computer, 5 km MMW radar, thermal night sight, auto-tracker, net azimuth warner. Add twin MANPADS. RF/radar DF set, 25 km. RWS on veh hull/turret. CPS/ATS.	Replace with twin 30-mm recoilless chain gun, range. Frangible, sabot, AHEAD rds to 4 km. TV/fused II/FLIR auto-tracker 10 km. MMW radar, Twin MANPADS/ADAT KE missile 8 km) lchr. APU to 15-kph self relocation. Robotic option. Laser dazzler.
Air Defense System Decoys (visual decoy, decoy emitter)	See DECEPTION & COUNTERMEASURE SYSTEMS	
Brigade gun/missile turret for mount on tracked mech IFV, wheeled mech APC, truck (motorized) chassis	Twin 30-mm gun, APFSDS/frangible rds 4 km. 30-mm buckshot rd for UAVs. Mounts 4x hyper-velocity LBR-guided SAMs to 8 km, 0 m min altitude. Passive IR auto-tracker, FLIR, MMW RADAR. 2/battalion. Track/launch on move. Targets: air, LAVs, other ground targets. RF/radar DF set with 25 km range. CPS/ATS.	Dual mode (LBR/radar guided) high velocity missile, 12 km, 0 m min altitude. Auto-tracker, to launch and fire on move. Phased array radars. Fused II/FLIR to 19 km. Twin 30-mm recoilless chain gun with AHEAD-type rds to 4 km. Micro recon/heli atk UAVs. TV/IR attack grenades.
Divisional gun/missile system on tracked mech IFV, wheeled mech APC, truck (motorized) chassis	Target tracking radar 24km. TV/FLIR. 8 x radar/EO FCS high velocity missiles to 18 km/12 at 0 m min altitude. Auto-track and IR or RF guided. 2 twin 30mm guns to 4 km. 30-mm buckshot rd for UAVs. RF/radar DF. CPS/ATS	Hybrid drive. Missile 18 km at 0 m, can kill LAVs. Fused II/FLIR auto-tracker 19 km, launch on move. Radar 80 km. Home on jam. Twin 30-mm recoilless chain gun with electronically fuzed air-burst rds to 4 km. Micro-recon/heli-atk UAVs. TV/IR attack grenades.
APC Air defense/AT Vehicle in APC Bn (Company Command Vehicle, MANPADS Vehicle in Bn/Bde)	1-man turret on 8x8 chassis. 30mm gun, 30-mm buckshot rd for UAVs. 100-X TV, 2 gen FLIR. 2x LBR ATGM lchrs 6 km, 2x veh MANPADS lchrs. Two dismount teams. 1x MANPADS lchr, 1x ADAT KE lchr. Total 18 msls. 12.7-mm MG. RF/radar DF to 25 km. CPS/ATS.	10x10 chassis, hybrid drive, box armor. Gun 30-mm recoilless gun on RWS. Ammo includes AHEAD-type to 4 km. Add 2 veh launchers for 5 HVM AD/AT (KE LBR) missiles, 8 km. Anti-helicopter surveillance/attack micro-UAVs. Fused II/FLIR 10 km. MMW radar. TV/IR attack grenades.
IFV ADAT Vehicle IFV Bn/Bde MANPADS	IFV chassis with features noted above. APC ADAT weapons and upgrades	See AIR DEFENSE, APC ADAT for weapons and upgrades
HIFV ADAT Vehicle HIFV Bn/Bde MANPADS	HIFV chassis with features noted above. APC ADAT weapons and upgrades	See AIR DEFENSE, APC ADAT for weapons and upgrades
Tank ADAT Vehicle Tank Bn/Bde MANPADS	Tank chassis with features noted above. APC ADAT weapons and upgrades	See AIR DEFENSE, APC ADAT for weapons and upgrades
Towed Medium Range AA gun/missile system	35mm revolver gun 1,000 rd/min. Gun rds: frangible, HE prox, electronic-fuzed. 4 SAMs/lchr, 45 km, 0 min altitude. Radar 45 km for 4 tgts. Resists all ECM. 2 gen FLIR auto-tracker to 20 km. RF/radar DF 25 km. SAM modes include active homing, home-on-jam. RAP/RAM/IR camo. CPS/ATS	Hybrid-drive auxiliary power units for local moves. Improved FCS, phased array radar, low probability of intercept, and acq to 80 km. Fused II/3rd gen FLIR auto-tracker to 35 km in day/night all-weather system. Ability to track and engage 8 targets per radar.
Medium-range ground SAM system	Tracked lchr. Radar to 150 km. 4 x radar-homing SAMs to 45km, 0 m min altitude (4 targets at a time). Home on jam. Use as cruise missile - priority ground tgts to 15 km, water 25 km. Fused 3rd gen FLIR auto-tracker. RF/radar DF. CPS/ATS	Hybrid drive. Improved FCS with radars and EO fused II/3rd gen FLIR day/night all-weather system to range 50 km. Radar range 200 km.

SYSTEM	NEAR-TERM OPFOR (FY 16-21)	MID-TERM OPFOR (FY 22-29)
Strategic SAM System	Cross-country truck launchers, 1 x track-via- missile SAMs 400 km, at Mach 7. 1x ATBM/high maneuver missile to 200 km. Also 8 x "hittile" SAMs to 120 km. Modes are track-via-missile and ARM (home-on-jam). All missiles 0 m to 50 km altitude vs stealth aircraft/UAVs/ ASMs. All strat/op missiles in IADS. Local IADS all AD. Battery autonomous option. Over-the-horizon TA radar veh to 400 km. Mobile radar to 350 km. Site CM, decoys.	Off-road trucks and tracked with hybrid drive. All missiles Mach 7. 1 x "big missile to 500 km. OTH radar to 600 km range with 5-min emplace-displace. Targets include all IRBMs. Increased target handling capacity (100/ battery in autonomous operations).
Operational-Strategic SAM System	Same as above on tracked chassis. Mobile FOs all batteries. AD radars on airships.	Same as above on tracked chassis.
Anti-helicopter Mines (Remote and Precision Launch)	In blind zones force helos upward or deny helo hides and landing zones. Range 150m. Acoustic and IR fuse, acoustic wake-up, or cmd detonation. Directed fragmentation. Precision-launch mines use operator remote launch, proximity fuze for detonation. RF/radar DF.	Stand-alone multi-fuse systems. Remote actuated hand-emplaced mines with 360-degree multi-sensor array, pivoting/orienting launcher, 4-km IR-homing missile. Operator monitors targets and controls (turns on or off) sections, mines or net.
Helicopter Acoustic Detection System	Early warning of helicopters. Acoustic sensors to 10km, 200m CEP. IR sensors can also be linked to air defense net.	Range 20 km, 50 m CEP. Track and engage multiple targets. Digital link to AD net, AD unit, IADS.

Military Technology Trends 2029

Year 2029 is a demarcation line for focusing on future military technologies. Even with the "Revolution in Military Affairs," most major technology developments are evolutionary, requiring one or more decades for full development. Subsystem upgrades can be added in less time. Most of the technologies noted below are in conceptual or early developmental stage or fielded at this time. Many exist in limited military or commercial applications, and can be easily extrapolated to 2029 and the near future timeframe. Over this period and beyond, military forces will see some legacy systems fade to obsolescence and be replaced, or be relegated to lesser roles or lower priority units. Most will be retained and updated several times. New systems and technologies will emerge, be developed, become widely implemented, and mature, requiring updates.

Infantry
• Infantry with improved weapons/sensors as primary lethal agent for combined arms • Weapon-delivered remotely-guided sub munitions and sensors for infantry weapons • Day/night sensors integrated, netted, with UAVs, robotics, and direct links to fire support • Visual/IR/MMW materials with signature management to avoid detection • Increased lethality weapons and precision for man-portable and vehicle weapons, robotic weapons • Increased range and effectiveness for use in Beyond Line-Of-Sight (BLOS) and MOUT operations • Tube launch UAVs, UCAVs, and remote overhead camera munitions for vehicles and dismounts limit collateral damage
Armor
• Tank crew in hull, with insensitive ammunition, electromagnetic armor, and active protection systems • Hybrid (diesel/electric) drive, and MMW/IR signature management • Overhead guns and missiles, electro-thermal chemical gun, and cased telescoped rounds • BLOS precision 12+km, 1,500+ mm lethality, KE missiles, and sensor/attack UAVs and robots • Infantry carrier remote weapons manned by passengers for 360° all-aspect protection • Heavy combat support vehicles/Heavy IFVs option to accompany tanks/IFVs • Micro-UAVs, attack UAVs, and UCAVs for vehicle launch
Anti-Armor
• Increased penetration (1,500+ HEAT/1,000+ KE), including lightweight capability for infantry • Infantry homing grenades with top-attack EFP or tandem • KE hypervelocity missiles/missile rounds 10+ km vehicles. KE ATGMs for infantry • Laser designators on AT grenade launchers, also used for precision artillery/air/naval rounds/ATGMs • Attack UAVs and laser target designator UAVs for precision strikes throughout the battle zone
Artillery
• Autonomous operation/rapid self-emplace/displace with integrated netted FCS • Precision munitions: laser/IR/MMW homing, EFP multi-sensor fuzed • Inertial/GPS/muzzle-velocity radar course-correction on conventional rounds/rockets • Combination guns integrate tactical unit BLOS fires and strikes
Sensors
• Multi-spectral immediate all-weather sensor transmission with real-time display • Remote unmanned sensors, weapon-launch and robotic sensors and manned sensors • Sensor nets integrated and netted from team to strategic and across functional areas • Micro-UAVs and remote overhead camera munitions for vehicles and dismount teams
Aircraft



- Continued but selective use of FW and rotary wing for stand-off weapons, sensors
- Aircraft critical for transport, minelaying, jamming, other support missions
- Laser designators on AT grenade launchers, also used for precision artillery/air/naval rounds/ATGMs

Other Aerial Systems

- High-altitude UAVs, long-endurance UAVs, and UCAVs seamlessly integrated with other intelligence and support systems
- Recon/attack low-signature UAVs and UCAVs and stand-off munitions at all levels down to squads
- Ballistic missiles with non-ballistic trajectories, improved GNSS/homing re-entry vehicles, precision sub munitions, EMP
- Shift to canister launchers of tactical cruise missiles with precision homing and piloted option, cluster warheads, EMP
- Laser designators on AT grenade launchers, also used for precision artillery/air/naval rounds/ATGMs
- Airships and powered airships for long-duration and long-range reconnaissance, and variety of other roles
- Increased use of ultra-lights and powered parachutes

Air Defense

- Integrated Air Defense System with day/night all-weather RISTA access for all AD units
- Improved gun rounds (AHEAD/guided sabot) and missiles (anti-radiation homing, jam-resistant)
- Autonomous operation with signature suppression, counter-SEAD radars and comms
- Shoulder-launch multi-role (ADAT) hypervelocity missiles/weapons immune to helicopter decoys and jammers,
- Micro-UAVs and airships for multi-role use includes air defense recon and helicopter attack
- Acquisition/destruction of stealth systems and aerial munitions and ground rockets to 500+ km

Information Warfare

- Jammer rounds most weapons, electro-magnetic pulse rounds, weapons of mass effects
- UAVs, missiles and robots carry or deliver jammers/EMP/against point targets and for mass effects
- Multi-spectral decoys for most warfighting functions
- Computer network attack and data manipulation

Access Denial

- Use of nuclear/bacteriological/chemical weapons to deny entry, access to areas or resources
- Use of media and public opinion for access denial
- Remotely delivered RF-controlled, smart and wide-area remote delivered sensor-fuzed and mines and IEDs defeat jamming

Non-Lethal Weapons

- EMP/graphite/directed energy weapons to degrade power grid, information networks, and military systems
- Space-based data manipulation to deny adversary use of satellite systems
- Population control effects (acoustic devices, bio-chemical and genetic weapons, resources attack, dirty bomb)
- Anti-materiel agents and organisms (microbes, chemicals, dust, and nanotech)
- Countermeasures, tactical and technical, in all units to degrade enemy sensor and weapon effectiveness.

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Worldwide Equipment Guide

Chapter 11: Irregular Forces



TRADOC G-2 ACE–Threats Integration
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Chapter 11: Irregular Forces

The conflict spectrum in the Complex Operational Environment includes not only modernized systems in upper tier forces but also older systems in less developed forces. Forces all across the capability spectrum use older, cheaper or improvised weapons because that is what they are able to procure, afford or require to blend in with their environment. Generally, Irregular forces are lightly armed attack troops and their equipment is not based on what they want or in some cases need but what is available. The equipment of an Irregular threat actor tends to improve over time as they increase their lines of supply, which complements their usual strategy of lassitude.

Irregular forces are armed individuals or groups who are not members of the regular armed forces, police, or other internal security forces (JP 3-24). Irregular forces can be insurgent, guerrilla, or criminal organizations or any combination thereof. Any of those forces can be affiliated with mercenaries, corrupt governing authority officials, compromised commercial and public entities, active or covert supporters, and willing or coerced members of a populace.

Arms Procurement. To maintain a force that is prepared to deal with its security challenges requires an equipment program of acquisition and procurement. Irregular forces do not usually have the luxury of the acquisition methods available to states such as internal manufacture or purchase through international defense agreements. There are laws and regulations that govern the control of military equipment such as the Arms Export Control Act and International Traffic in Arms Regulations (ITAR) specifically to stop Irregular forces and large criminal organizations from obtaining military grade equipment. Despite all the obstacles Irregular forces can acquire weapons from regional military sources, through purchase on the black market or fabricate them internally.

Regional Procurement. An Irregular force has a number of ways in which it can procure weapons and explosives regionally. The most dangerous Irregular forces are those that are supplied directly from an external country. Hezbollah are a recipient of support from Iran and Syria, and what began with caution and relatively small amounts of weapons in the 1980's has become a strategic alliance that supplies short-range precision guided munitions such as the Fateh-100 or the M-600.

Areas of instability, corruption, state weakness and long running conflict can be awash with uncontrolled weapons that are easy to procure. In 2003, Iraqi forces abandoned their positions as the coalition forces advanced on Baghdad, they left military bases and storage depots unguarded. Millions of tons of weapons and explosives were left for the taking by anybody. These weapons fueled the insurgency that followed.

Weapons and explosives can be taken using force or guile from legitimate government sources in the Irregular actors AO. Much of Boko Haram's (BH) military hardware is stolen from the Nigerian Army. BH fighters have conducted raids against remote military outposts and looted ammunition bunkers. In addition BH sympathizers in the Army have been accused of leaving armory doors unlocked which has left the militants well-armed.

Illicit Arms Trade. Insurgents, Guerrillas, armed gangs, and terrorists can all multiply their force through the use of illegally acquired firepower but an alternative to seizing weapons by force is to purchase them unlawfully through the Black Market. It is important not to underestimate the magnitude of the Black Market as it is possible to purchase top of the line tanks and radar systems with the latest technology. The illicit circulation of small arms, light weapons and their associated ammunition alone values around $1bn a year. The lack of a lengthy procurement chain which often hampers a Regular force ensures that Irregular forces can often field state-of-the-art technology relatively soon after development. Road-testing is often conducted in the field or



'on task', rather than on a proving ground, this enables Irregular forces to quickly identify weaknesses in their equipment, allowing for remedial action to be taken immediately.

The arms market is a good example, for all the wrong reasons of increasing globalization. The illicit arms trade takes maximum advantage of all the open trade developments including minimized custom regulations and relaxed border controls which leads to easier movement. The faking of shipping manifests or end-use certificates, bribing officials and concealing arms as humanitarian aids are common practice. The structure of the small arms black market is complex and stretches across the globe and the activities of the black market arms dealer's stretch to other trans-national criminal organizations, like drug and human traffickers.

Sources of small arms supplies to the black market are varied but most weapons start off the legal side and then get diverted to the illegal sphere. Small arms can enter illegal circulation through theft, leakage and divergence. The management of government's stockpiles is an acute problem and a prominent source of the illegal weapons in circulation. Stockpiles consist of obsolete and surplus weapons that are often collected as part of a disarmament program and not destroyed. Much of the international focus and funding is on the destruction or containment of chemical weapons stockpiles and the destruction of post conflict and legacy mines and thus small arms stockpiles remain comparatively under the radar and uncontrolled.

Improvised Weapons. Improvised weapons can be everyday objects made from non-military materials utilized without alteration, such as machetes, pocket knives or baseball bats. These weapons are characterized as primitive but continue to be effective. Systems encountered in Vietnam such as punji stakes, Malayan Gates and blowguns are an example of using natural materiel in an innovative way for the accomplishment of a military task such as an obstacle to movement.

Some seemingly ubiquitous military systems can be missing from an Irregular threat actor's arsenal because they are not suited to the fight. In Iraq heavy mortars were absent because coalition counter battery fire could quickly and accurately destroy the large caliber hard-to move equipment. Instead the Insurgents chose to repeatedly fire Type 63 107mm rockets at coalition bases. The Type 63 was self-stabilizing and could be fired from a simple ramp, it was easy to conceal and could be set on a timer thus reducing the danger to the shooter.

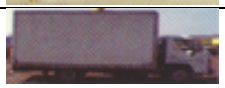
Improvised weapons include also include flame and incendiary devices to ignite fuels and ammunition supplies. Fuel-air-explosive IEDs or "Molotov cocktails" have been employed in almost all conflicts, and an air droppable version of incendiary devices known as "barrel bombs" have been seen in a recent conflict. These improvised bombs include large containers filled with flammable and shrapnel producing material and are pushed from a helicopter over a variety of military and civilian targets.

Improvised weapons are most associated with less robust forces, but they can also be the most effective method of accomplishing the mission. Military or non-military materials could be used to trigger major disasters such as forest or urban fires, breached dams or levees to initiate floods. The list of improvised weapons available and there methods of employment are limited only by human imagination.

The most populous class of improvised weapons is the improvised explosive device (IED). Any explosive devices can be used to make a type of IED, they can be of various design with differing amounts of explosive fill and different detonation mechanisms. Historically, the most numerous IEDs encountered on the battlefield use hand grenades, these can be rigged by wedging them into objects to act as camouflage or by tying them to trip wires. Often grenades are hidden on bodies, weapons, or objects to be picked up by soldiers. Artillery rounds are also favored for IED construction for their larger size, they can be placed in vehicles and delivered to target with devastating accuracy, examples of Vehicle Bourne IEDs range in size from a bicycle to a dump truck. Mines have

long had capability for sophisticated fuzing and remote control units seen in some IEDs. Both mines and IEDs can be converted for command-arming and detonation, and for precision sensor fuzing.

Many IEDs are not made from military munitions. Bulk explosives (such as Dynamite, TNT, C-4, etc.) are used in IEDs. Terrorists such as the shoe bomber and anti-Israeli groups used Triacetone Triperoxide (TATP), precisely because it is highly sensitive. The most common explosive in the US is ammonium-nitrate fuel oil (ANFO, an insensitive slurry mixed onsite with the bulk of the mix as common fuel oil) for mining and road construction. The slurry can then be poured or pumped deep into spaces where other explosives cannot fit. Explosives can be improvised from common materials. In 1995 domestic terrorist Timothy McVeigh created a home-made variant of ANFO in a VBIED (vehicle-borne IED, with "volumetric explosive" effects) to blow up the Murrah Building in Oklahoma City. VBIEDs are only limited by the inventiveness of an irregular actor and the size and type of vehicle in which it is housed.

Threat Description		Explosives Capacity[1]	Building Evacuation Distance[2]	Outdoor Evacuation Distance
	Compact Sedan	500lbs/200kg	320ft/98m	1,500ft/457m
	Sedan	1,000lbs/454kg	400ft/122m	1,750ft/533m
	Passenger/ Cargo Van	4,000lbs/1,814kg	600ft/183m	2,750ft/838m
	Small Moving Van/ Delivery Truck	10,000lbs/4,536kg	1,240ft/378m	6,500ft/1,981m
	Moving Van/ Water Truck	60,000lbs/27,216kg	1,500ft/457m	7,000ft/2,134m

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[1] Based on the maximum amount of material that could reasonably fit into a container or vehicle. Variations possible.
[2] Governed by the ability of an unreinforced building to withstand severe damage or collapse

BELGIAN FABRIQUE NATIONALE 7.62X51MM NATO MAIN BATTLE RIFLE, FAL



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation:	None	7.62x51mm NATO	Ball, tracer, armor piercing. All known variants.
Date of Introduction:	1954		
Proliferation:	Widespread		
Weight(kg):	FAL 50.00: 4.3		
	FAL 50.61: 3.90		
	FAL 50.63: 3.79		
	FAL 50.41: 5.95		
Length(mm):	FAL 50.00 (fixed stock): 1,090		
	FAL 50.61 (stock extended): 1,095		
	FAL 50.63 (stock extended): 998		
	FAL 50.41 (fixed stock): 1,125	VARIANTS	SPECIFICATIONS
Barrel length(mm):	FAL 50.00: 533	Numerous	Particularly among those manufactured under license from FN in other nations. Most common variants are the standard FN infantry weapon with a fixed stock. Also the para models with a 436mm (17.2 in) barrel and folding stocks.
	FAL 50.61: 533		
	FAL 50.63: 436		
	FAL 50.41: 533		
Action:	Gas-operated, tilting breechblock		
Firing Modes:	Selective, automatic or semi-automatic		
Muzzle Velocity(m/s):	FAL 50.00: 840		
	FAL 50.63: 810		
	FAL 50.61: 840		
	FAL 50.41: 840		
Effective firing range(m):	400–600		
Feed System:	20 or 30 round detachable & 50-round drum magazines.		
Sights:	Aperture rear sight, post front sight		
Sight radius(mm):	FAL 50.00, FAL 50.41: 553		
	FAL 50.61, FAL 50.63: 549		
	Various telescopic and night visions sights are available		

NOTES
LIKE THE HK G3, ONE OF THE MOST PROLIFIC MAIN BATTLE RIFLES EVER PRODUCED; CAN BE FOUND VIRTUALLY AROUND THE WORLD, STILL IN SERVICE WITH SOME THIRD WORLD MILITARIES AND SECURITY ORGANIZATIONS.

RUSSIAN 7.62-MM ASSAULT RIFLE AK-47/AKM



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designation:	AK, Kalashnikov	Rate of Fire(rd/min):	
Date of Introduction:	1949 (AK) 1961(AKM)	Cyclic	600
Proliferation:	Widespread (over 50 million)	Practical:	
Weight(kg):		Automatic:	100
Loaded with magazine:	3.8	Semi-Automatic:	40
Empty w/o magazine:	3.3	AMMUNITION	SPECIFICATIONS
Length(mm):	880	Caliber/length:	7.62x39-mm
Barrel length(mm):	415	M1943 (57N231S)	Ball, steel core
Action:	Gas	Armor Penetration(m):	
Firing Modes:	Selective, automatic or semi-automatic	6mm Mild Steel Plate	300
Muzzle Velocity(m/s):	718	Steel Helmet	1,000
Firing range(m):		Flak Vest	60
Effective	300	M1943 (T-45 or 57N231P)	Ball-Tracer
Maximum	800	Trace(m):	800
Feed System:	30-round curved box magazine	VARIANTS	SPECIFICATIONS
Sights:	Fore: pillar, Rear: U-notch	AKS:	Folding stock AK-47
Night Sights Available:	Yes	AKM:	Improved AK-47, sights, magazine, and stock
		AKMS:	Folding stock variant of AKM

NOTES

PHOTO IS OF AN AKM. ALL 7.62X39 MM KALASHNIKOV ASSAULT RIFLES ARE VERY DEPENDABLE WEAPONS. THEY PRODUCE A HIGH VOLUME OF FIRE AND ARE SIMPLE TO MAINTAIN AND PRODUCE. THE PRIMARY DIFFERENCE BETWEEN THE AK-47 AND THE IMPROVED AKM IS THE RECEIVER. THE RECEIVER OF THE AK-47 IS FORGED AND MACHINED WHILE THE RECEIVER OF THE AKM IS STAMPED METAL FACILITATING EASIER AND LESS COSTLY MANUFACTURING. BOTH THE AK-47 AND THE AKM CAN MOUNT A 40-MM UNDER-BARREL GRENADE LAUNCHER. THE AK-47 AND AKM HAVE BEEN REPLACED IN MANY ARMIES BY THE NEWER AK-74. THE AK-74 IS BASICALLY AN AKM RE-CHAMBERED TO FIRE A 5.45X39 MM CARTRIDGE. THE 7.62X39 MM RPK LIGHT MACHINEGUN IS BASED ON THE AK/AKM DESIGN WHILE THE RPK-74 IS A LIGHT MACHINEGUN VERSION OF THE AK-74. BOTH ARE INFANTRY SQUAD LEVEL SUPPORT WEAPONS.

HANDHELD SHAPED CHARGE GRENADE RKG-3 / RGK-3M

RKG-3/RGK-3M



RKG-3EM



SYSTEM	SPECIFICATIONS
Alternative Designations	M79, PR Type 3, HEAT
Date, Country of Origin	1950, RUS
Proliferation	
Crew	1
Weight Firing (kg)	1.1
Length Firing (m)	0.38
Diameter (m)	0.065
Rifling	No
Emplacement Time (min)	1
Fire from Inside Building	Yes
SIGHTS	**SPECIFICATIONS**
Name	N/A
Type	N/A
Sight Range Direct (m)	Line Of Sight
VARIANTS	
RKG-3E – Steel Liner for hollow charge and an increased 170mm armor penetration. RKG-3EM – Copper liner for hollow charge and an increased 220mm armor penetration. UPG-8 – Training grenade	

AMMUNITION	SPECIFICATIONS
Missile Type, Name	Shaped Charge Grenade, RKG-3
Max Aimed Range (m)	20
Penetration (mm)	125
Warhead Type	Hollow Charge with Drogue Parachute
Fuse Type (mm)	Point Detonating
Explosive Quantity (g)	384
Missile Type, Name	Shaped Charge Grenade, RKG-3M
Max Aimed Range (m)	20
Penetration (mm)	165
Warhead Type	Hollow Charge with Drogue Parachute
Fuse Type (mm)	Point Detonating
Explosive Quantity (g)	560
AMMUNITION	**SPECIFICATIONS**
Missile Type, Name	Shaped Charge Grenade, RKG-3
Max Aimed Range (m)	20
Penetration (mm)	125
Warhead Type	Hollow Charge with Drogue Parachute
Fuse Type (mm)	Point Detonating
Explosive Quantity (g)	560

NOTES

DUE TO IMPROVEMENT IN MODERN TANK ARMOR, ANTITANK GRENADES ARE GENERALLY CONSIDERED OBSOLETE IN CONVENTIONAL WARFARE. HOWEVER, THEY CAN BE AND HAVE BEEN USED EFFECTIVELY BY GUERILLAS AND INSURGENTS AGAINST ARMORED PERSONNEL CARRIERS AND RECONNAISSANCE VEHICLES WHICH LACK THE HEAVIER MODERN ARMOR.

RUSSIAN 7.62-MM LIGHT MACHINEGUN RPK



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation:	None	Caliber/length:	7.62x39-mm
Date of Introduction:	1964	M1943 (57N231S)	Ball, steel core
Proliferation:	Widespread	Armor Penetration(m):	
Weight(kg):		6mm Mild Steel Plate	300
Loaded with magazine (40rd):	5.67	Steel Helmet	1,000
Empty w/o magazine:	4.9	Flak Vest	60
Length(mm):	1,035	M1943 (T-45 or 57N231P)	Ball-Tracer
Barrel length(mm):	591	Trace(m):	800
Quick Change Barrel:	No	M1943 (API)	
Mount:	Bipod	Armor Penetration(m):	
Action:	Gas	8mm Mild Steel Plate	500
Firing Modes:	Selective	VARIANTS	SPECIFICATIONS
Rate of Fire(rd/min):		RPKS:	Folded stock version (820 mm in length)
Cyclic	600		
Practical:			
Automatic:	100		
Semi-Automatic:	40		
Muzzle Velocity(m/s):	718		
Firing range(m):			
Effective	800		
Maximum	800		
Feed System:	40 round-curved box or 75-rd drum magazine. Can also use the 30-round curved box magazine used by the AKM		
Sights:	Leaf		
Night Sights Available:	Luminous Front/Rear		

NOTES

THE RPK IS THE LIGHT MACHINEGUN VARIANT OF THE AKM AND AS SUCH IS AN EXTENDED VERSION OF THE AKM. IT HAS A LONGER, HEAVER BARREL THAN THE AKM (591 MM VS 414 MM). MOST MOVING PARTS ARE INTERCHANGEABLE WITH THE AK-47 OR AKM ASSAULT RIFLES. THE SUSTAINED RATE OF FIRE CANNOT EXCEED 80 RDS PER MINUTE DUE TO "COOK OFF". IT HAS BEEN REPLACED BY THE 5.45-MM RPK-74 IN MANY ARMIES. THE RPK FILLS THE ROLE OF A SQUAD LEVEL SUPPORT WEAPON.

RUSSIAN 7.62-MM GENERAL PURPOSE MACHINEGUN PKM AND PECHENEG (PKP)



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation:	See variants	Caliber/length:	7.62x54-mm rimmed
Date of Introduction: (PKM/PKT/PKP)	1971/1968/2001	57-N-323S	Ball
Proliferation:	Widespread (PKM/PKT)	Armor Penetration(m):	
Weight(kg):		6mm Mild Steel Plate	520
Empty w/o magazine: (PKM/PKT)	8.4/10.66	Flak Vest	110m
Ammo box (only) with 100/200-rd belt:	3.9/8.0	Muzzle Velocity(m/s): (PKM/PKT)	825/855
Tripod (lightweight):	4.75	7BZ-3	Armor piercing incendiary
Length(mm):		Armor Penetration(m):	
Overall: (PKM/PKT)	1,160/1,080	10mm Mild Steel Plate	200
On tripod (PKS):	1,267	Muzzle Velocity(m/s): (PKM/PKT)	808
Barrel:	658	VARIANTS	SPECIFICATIONS
Quick Change Barrel:	Yes	PKM:	Squad machinegun
Mount:	Pintle, coaxial, bipod or tripod (Stepanov)	PKT:	Vehicle mounted MG with solenoid electric trigger, remote sight, and a longer heavier barrel. It lacks a stock and, bipod. Some are coaxial to a main gun and use its sights. Others operate separately. They generally do not dismount for ground use.
	Bipod		
Action:	Gas		
Firing Modes:	Automatic		
Rate of Fire(rd/min):			
Cyclic	650		
Practical:			
PKM:	250	PKS:	Lightweight tripod-mounted infantry weapon
Pecheneg/PKP	600		
		PKMS:	Lightweight tripod-mounted variant of the PKS
Firing range(m): (PKM/PKT)		PKB(PKBM):	Pintle-mounted on APCs, SP guns, BRDM, BTRs, has butterfly trigger rather than solenoid, double spade grips, and front and rear sights
Effective	1,000/2,000		
Maximum	3,800/4,00		
Night	300/INA		
Feed System:	Belt, 100-rd belt carried in a box fastened to the right side of the receiver. 25-rd belts can be joined		

	in several combination lengths (100/200/250)		
Sights:	Leaf		
Night Sights Available:	Luminous Front/Rear		

NOTES

THE 7.62-MM GENERAL-PURPOSE MACHINEGUN (PKM) IS A GAS-OPERATED, BELT-FED, SUSTAINED-FIRE WEAPON. THE BASIC PKM IS BIPOD-MOUNTED BUT CAN ALSO FIT IN VEHICLE FIRING PORTS. IT IS CONSTRUCTED PARTLY OF STAMPED METAL AND PARTLY OF FORGED STEEL. THE NEWER VARIANT PKP (PECHENEG) FEATURES IMPROVED COOLING SYSTEM, AND A HEAVY, FIXED BARREL THAT DOES NOT REQUIRE CHANGING NOR CAN IT BE CHANGED BY THE CREW. IT IS DESIGNED TO FILL THE ROLE OF A TRUE, SQUAD LEVEL GPMG FOR SUPPORT IN RUSSIAN INFANTRY AND SPETSNAZ UNITS.

RUSSIAN 12.7MM HEAVY MACHINEGUN NSV/NSVT/KORD



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation:	NSVS (when mounted on tripod)	Caliber	12.7mm
Date of Introduction:	1974	API (B-32)	
Proliferation:	Widespread	API-T (BZT-44) HEI	
Weight(kg):		Typical Combat Load:	300
Total system (w/6T7):	43	Caliber and Length:	12.7x108-mm
Empty:	25	B-32	Armor Piercing Incendiary
Loaded:	INA	Firing range(m):	
Length(mm):		Maximum	7,850
Overall:	1,560	Effective:	
On 6T7 tripod:	1,900	AA:	1,000
Width on Tripod (mm):	860	Ground:	2,000
Height on Tripod (mm):	380	Armor:	800
Barrel life (rds):	5,000	Night (w/1PN52-1):	1,000
Quick Change Barrel:	Yes (5 secs)	Armor Penetration(m):	
Barrel weight (kg):	9.2	@ 0° obliquity @ 500/1,000m Range (mm)	20/13.2
Mount:	6T7 (infantry) tripod or 6U6 (w/seat) universal tripod	Muzzle Velocity(m/s):	860
Traverse (°):	360	Rate of Fire(rd/min):	
Elevation (°):	-5 to +75	Cyclic	680-800
Action:	Gas	Practical:	100
Firing Modes:	Automatic; short bursts, long bursts (10 to 15), or continuously	Feed System:	Left or right from metal link belt from 50-rd boxes

Variants

NSVT: Tank-mounted version. A tripod-mount (6T7) version is available for infantry use in a ground role. However, the NSVT appears more commonly mounted on the turrets of tanks as an antiaircraft machinegun

Russian NSV/NVST: The Russian version can produce the guns for either Russian 12.7x108 or NATO 12.7 x 99 (.50-cal) ammunition.

Kord: A Russian modernized version of the NSV/NSVT. Improvements include reduced weight (50% for hand-carry 6P57), reduced recoil, increased barrel life, improved reliability, improved accuracy, increased burst rate capacity, and improved reliability and maintenance. Reduced weight and recoil permits use with the 6T19 light machinegun bipod. Like the above Russian MGs, the Kord can be produced in either ammunition version. Vehicle version is 6P49.

Swivel mount hand-operated versions are 6P58 and 6P59.

(The original plant is in Kazakhstan (NSV/NSVT). After dissolution of the USSR, a Russian plant now produces the KORD HMG)

NOTES
THE 7.62-MM GENERAL-PURPOSE MACHINEGUN (PKM) IS A GAS-OPERATED, BELT-FED, SUSTAINED-FIRE WEAPON. THE BASIC PKM IS BIPOD-MOUNTED BUT CAN ALSO FIT IN VEHICLE FIRING PORTS. IT IS CONSTRUCTED PARTLY OF STAMPED METAL AND PARTLY OF FORGED STEEL. THE NEWER VARIANT PKP (PECHENEG) FEATURES IMPROVED COOLING SYSTEM, AND A HEAVY, FIXED BARREL THAT DOES NOT REQUIRE CHANGING NOR CAN IT BE CHANGED BY THE CREW. IT IS DESIGNED TO FILL THE ROLE OF A TRUE, SQUAD LEVEL GPMG FOR SUPPORT IN RUSSIAN INFANTRY AND SPETSNAZ UNITS.

RUSSIAN 7.62-MM SNIPER/MARKSMEN RIFLE SVD



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation:	SVD, Dragunov	Name:	57-N-323S
Date of Introduction:	1963	Caliber and Length:	7.62x54-mm rimmed
Proliferation:	Widespread	Type:	Ball, standard steel-core
Weight(kg):		Range (m):	
Loaded with magazine:	4.5	Effective:	600
Empty w/o magazine:	4.3	Effective Night:	300 sight INA
Length(mm):	1,230	Armor Penetration (mm):	
With Bayonet:	1,370	Steel plate:	6 @ 520 m
Barrel length(mm):	620	Flak vest:	Yes @ 110 m
Action:	Gas	Muzzle Velocity (m/s):	828
Firing Modes:	Semi-Automatic only		
Feed System:	10-rd detachable box magazine (15-rd available for the SVD-S)	Name:	Sniper (7N1)
		Caliber and Length:	7.62x54R-mm rimmed
Rate of Fire (rd/min):	30	Type:	Steel core
Sights:		Range (m):	
Name:	PSO-1	Effective with scope:	1,000
Type:	Infrared detection; capability for night firing	Effective w/o scope:	800
		Armor Penetration (mm):	INA
Magnification:	4x	Muzzle Velocity (m/s):	823
Field of View (°):	6		
Sighting Range (m):	1,300	Name:	7N13
Night Sights available:	Yes (NSPU-3) Increases accuracy to 1,000 m at night or during poor visibility.	Caliber and Length:	7.62x54R-mm rimmed
		Type:	Steel core
		Range (m):	
VARIANTS	SPECIFICATIONS	Effective with scope:	1,000
SVD-S:	Folding stock, 15-rd magazine	Effective w/o scope:	800
		Armor Penetration (mm):	
SVU:	Bullpup (trigger forward of magazine)	Steel plate:	6 @ 660 m
		Flak vest:	800m
OTs-03AS:	SVU w/PSO-1 sight	Muzzle Velocity (m/s):	828
6V1:	SVD with PSO-1 sight	Name:	7B2-3
		Bullet:	B-32

6V1-N3:	SVD with NSPU-3 night sight	Caliber and Length:	7.62x54R-mm rimmed
		Type:	API
		Range (m):	
		Effective with scope:	
		Effective w/o scope:	
		Armor Penetration (mm):	
		Muzzle Velocity (m/s):	
		Name:	
		Bullet:	
		Caliber and Length:	
		Type:	
		Range (m):	
		Effective with scope:	
		Effective w/o scope:	
		Trace (m):	
		Time of Trace (sec):	
		Muzzle Velocity (m/s):	
		Range (m):	
		Effective with scope:	1,000
		Effective w/o scope:	800
		Armor Penetration (mm):	10 @ 200m
		Muzzle Velocity (m/s):	808
		Name:	7T2m
		Bullet:	T-46
		Caliber and Length:	7.62x54R-mm rimmed
		Type:	Tracer
		Range (m):	
		Effective with scope:	1,000
		Effective w/o scope:	800
		Trace (m):	1,200
		Time of Trace (sec):	3
		Muzzle Velocity (m/s):	798

NOTES

THE BOLT MECHANISM AND GAS RECOVERY SYSTEM OF THE SVD ARE SIMILAR TO THOSE OF THE AK AND AKM. THE 7.62X54-MM RIMMED CARTRIDGE OF THE SVD IS NOT INTERCHANGEABLE WITH THE 7.62X39-MM RIMLESS ROUND OF THE AK-47/AKM. THE SVD PERFORMS BEST WHEN USING TARGET GRADE AMMUNITION, HOWEVER STANDARD (PKM/PKT) 7.62X54-MM RIMMED ROUNDS MAY ALSO BE FIRED. EVERY OPFOR INFANTRY SQUAD HAS AN SVD EQUIPPED DESIGNATED MARKSMAN (DM).

UNITED STATES .50-CAL ANTI-MATERIEL RIFLE M82A1A



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation:	None	Name:	Raufoss Grade A (match) (DODIC A606) (USMC)
Date of Introduction:	1984	Caliber and Length:	.50-cal BMG/12.7-mm x 99-m (NATO)
Proliferation:	Widespread (45+ nations)	Type:	Standard operating round
Weight(kg):		Range (m) (equipment- size targets):	
Empty w/o magazine:	14.75	Maximum with scope:	1,800
Length(mm):	1,448	Muzzle Velocity (m/s):	854
Barrel length(mm):	736		
Action:	Recoil	Name:	MP NM140 (Nammo) MK211 Mod 0
Firing Modes:	Semi-automatic only	Caliber and Length:	.50-cal BMG/12.7-mm x 99-m (NATO)
Feed System:	10-rd detachable box magazine	Range (m) (equipment- size targets):	
Typical combat load (rds):	30	Maximum with scope:	1,800
		Armor Penetration (mm):	11mm @45° @1,000 m
Sights		Fragmentation:	20 fragments after hitting 2 mm steel
Name:	Unertl		
Type:	Optical (matches trajectory of .50-cal Raufoss Grade A)	Incendiary effect:	Ignition of JP4 and JP8
		Accuracy:	<15 cm @ 550 m
Magnification:	X 10	Muzzle Velocity (m/s):	915
Name:	Swarovski		
Type:	Optical (with ranging reticle)		
Magnification:	10x42	Name:	AP-S NM173 (Nammo)
Night Sights Available:	Yes	Caliber and Length:	.50-cal BMG/12.7-mm x 99-m (NATO)
Name:	Barrett Optical Ranging System (BORS)	Type:	Armor piercing
Type:	Ballistic Computer	Range (m) (equipment- size targets):	
This add-on device couples to the telescope, in place of the rear scope ring. It can then adjust for range, air temperature, round used, and other factors.		Maximum with scope:	1,800
		Armor Penetration (mm):	11 mm @30° @1,500 m
		Accuracy:	<15 cm @ 550 m
		Muzzle Velocity (m/s):	915
VARIANT		Name:	M903(Olin)



M107-A1: a product improvement of the M82A1A. Improvements include: reduction in weight by 5 pounds; cylindrical titanium muzzle brake; titanium barrel key/recoil buffer system in order to operate with a Barrett suppressor; functional modifications to increase durability and ease of operation. Barrett introduced this variant in 2013.		Caliber and Length:	.50-cal BMG/12.7-mm x 99-m (NATO)
		Type:	Saboted Light Armor Penetrator (SLAP) (actual bullet is a tungsten .30 inch penetrator wrapped in a .50-cal plastic sabot)
Ammunition Types:	Raufoss Grade A	Range (m) (equipment- size targets):	
	Ball (M2/M33)	Maximum with scope:	1,500
	AP (M2)	Armor Penetration (mm):	19 mm (.75 in) @1,500m
	AP-I (M8)	Accuracy:	INA
	API-T (M20)	Muzzle Velocity (m/s):	1,014
	Tracer (M10/21)		
	SLAP (M903)	Name:	M8
	MP (MK211 Mod 0)	Caliber and Length:	.50-cal BMG/12.7-mm x 99-m (NATO)
		Type:	API
		Range (m) (equipment- size targets):	
		Maximum with scope:	1,800
		Armor Penetration (mm):	20mm @ 100m
		Accuracy:	<25 cm @ 550 m
		Muzzle Velocity (m/s):	881
		Name:	M20
		Caliber and Length:	.50-cal BMG/12.7-mm x 99-m (NATO)
		Type:	API-Tracer
		Trace (m):	91-1463
		Armor Penetration (mm):	20 mm @ 100 m
		Accuracy:	<25 cm @ 550 m
		Muzzle Velocity (m/s):	887

NOTES

THE M82A1A PROVIDES MANEUVER COMMANDERS WITH THE TACTICAL OPTION OF EMPLOYING SNIPERS WITH AN ANTI-MATERIEL WEAPON TO AUGMENT PRESENT 7.62-MM ANTI-PERSONNEL SNIPER RIFLES. RECOIL EQUALS 7.62X51-MM LEVELS. THE USMC USES RAUFOSS GRADE A AMMUNITION, BUT THE RIFLE IS CAPABLE OF FIRING ANY STANDARD 12.7X99-MM BROWNING MACHINEGUN AMMUNITION.

CHINESE 60-MM LIGHTWEIGHT LONG RANGE MORTAR TYPE WX-90



SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations	W90	Caliber(mm)	60.75
Date, Country of Origin	1990, CHI	Rate of Fire (prac, cyclic)	30
Proliferation	INA	Fire on Move	No
Crew	3	Elevation (deg min, max)	-0, + 80
Weight Firing (kg)	23.6	Traverse (deg)	7
Weight Travel (kg)	14	AMMUNITION	SPECIFICATIONS
Weight Bipod (kg)	9	Caliber(mm), Type, Name	60mm, Mortar, Western
Length Barrel (cm)	1200	Max Eff Range (m)	4700
Height Firing (m)	1200	Max Range, Extended (m)	5,500Number
Rifling	No	Min Range (m)	72
Feed	Manual	Muzzle velocity (m/s)	314
Breech Mechanism Type	NA	Combat Load (ready, stow)	NA
Emplacement Time (min)	INA	VARIANTS	
Fire from Inside Building	No	Name	W89t
SIGHTS	SPECIFICATIONS	Barrel Length (cm)	1200
Name		Barrel weight (kg)	9
Name		Range (m)	Number
Type		Name	WW90-60Lt
Sight Range Direct (m)		Barrel Length (cm)	1300
Sight Range Indirect (m)		Barrel weight (kg)	11.7
		Range (m)	5775
		Name	WW90-60M
		Barrel Length (cm)	1080
		Barrel weight (kg)	9.7
		Range (m)	4400

NOTES

THIS MORTAR WAS PRODUCED FOR THE PEOPLES LIBERATION ARMY BUT IS ALSO AVAILABLE ON THE EXPORT MARKET. IT IS RELATIVELY CHEAP AND FIRES WESTERN 60MM AMMUNITION.

RUSSIAN ATGM LAUNCHER FOR AT-4 AND AT-5 9P135



SYSTEM	SPECIFICATIONS	AMMUNITION	VARIANTS
Ground mounted portable launcher for AT-4 and AT-5 family of missiles. Alt designations: AT-4B/ AT-5B, 9P135M Firing Post, Fagot/Fagot M Date of introduction: 1973 Proliferation: At least 25 countries	Crew: 3 Weight, excluding missile (kg): 22.5 Length, in firing position (m): 1.1/1.3 Launcher: 9P135 (AT-4 only), 9P135M (AT-4/AT-5) Launch method: Disposable launch canister Rate of launch (min): 2-3, range dependent Ready/Stowed – 4/0 dismounted, 4/4 veh Fire Control System: Name: 9S451M1 Guidance control box Guidance: SACLOS Command Link: Wire Beacon Type: Incandescent Infrared bulb Tracker Type: IR, 9S451M1 Susceptible to: EO Jammers, smoke, counter-fire Counter-countermeasures: Encoded pulse beacon, EO jammers Counter-dazzler adjustments to 9S451M1 Filter can be mounted on reticles Sights w/magnification: Day: 9Sh119M1, 4x Field of view (deg): 4.5 Acquisition Range (m): 4,000+ Night: 1PN86/Multi thermal sight Acquisition Range (m) 3,600+	Name: Konkurs Alt: AT-5/Spandrel-A Weight (kg) 25.2 (in tube) Type: Shaped Charge (HEAT) Penetration (mm): 650 Min/Max Range (m): 75/4000 Probability of hit(%): 90 Velocity (m/s): 200 Name: Konkurs-M Alt: AT-5b/Spandrel-B Weight (kg) 26.5 (in tube) Type: Tandem Shaped Charge (HEAT) Penetration (mm): 925 Min/Max Range (m): 75/4000 Probability of hit(%): 90 Velocity (m/s): 208 Name: Fagot Alt: AT-4/Spigot-A Weight (kg) 13 (in tube) Type: Tandem Shaped Charge (HEAT) Penetration (mm): 480 Min/Max Range (m): 70/2000 Probability of hit(%): 90 Velocity (m/s): 186 Name: Factoria (Fagot-M) Alt: AT-4b/Spigot-B Weight (kg) 12.9 (in tube) Type: Shaped Charge (HEAT) Penetration (mm): 550 Min/Max Range (m): 75/2500 Probability of hit(%): 90 Velocity (m/s): 180	P135M3: Konkurs-M Complex. Launcher with 1PN65 thermal sight and AT-5B missiles. Night range is 2,500m Tosan-1: Iranian version of AT-5 Launcher can be modified to launch other missiles such as the Indian Nag (TV/IR/SAL-homing) and the AT-3E/Malyutka-2 TPVP/1PN65 thermal sight is available with a range of 2,500. It weighs 13kg Slovenian TS-F sight has a 3,600-meter detection range

NOTES
THE RUSSIANS CATEGORIZE THE AT-4/4B SYSTEM AS PORTABLE RATHER THAN MAN PORTABLE. FOR DISMOUNT CARRY LOAD IT IS DIVIDED AMONG THREE PACKS. DUE TO ITS GREATER WEIGHT AT5/5B FITS INTO THE HEAVY CLASS AND SHOULD ONLY BE CARRIED SHORT DISTANCES FROM VEHICLE <500M.

RUSSIAN 40-MM ANTITANK GRENADE LAUNCHER RPG-7V



SYSTEM	SPECIFICATIONS	AMMUNITION	VARIANTS
Alternative Designation: N/A Date of Introduction: 1962 Proliferation: 70+ countries	Crew: 2 RPG-7V is light enough to be carried and fired by one person if needed. With a crew of 2, an assistant grenadier normally deploys left of the gunner to protect him from small arms fire. The full set has two bags: one has two grenades, spare parts, tools and accessories. The other has three more grenades. Caliber Launcher (mm): 40 The grenade warhead is forward of tube. Thus grenade diameter can be 105 mm or more. Weight (kg): 7.9 empty, loaded varies with grenade Length (mm): 950 Rate of Fire (rd/min): 4-6 Fire From Inside Building: No	40-mm grenade PG-7V PG-7VM PG-7VS PG-7VL PG-7VR TBG-7V OG-7V OG-7VM Combat load: 5 rockets Grenade Components: Warhead, rocket motor, tail assembly See Infantry Weapons for further details.	This is the most widely proliferated infantry AT system in the world. There are dozens of copies and variants of this launcher. RPG-250: Prototype and test base for the RPG-7V. RPG-7B1N3, -7N, and -7N1: Night site variant RPG-7V1: Upgrade w/bipod and improved PGO-7V3 sight. This is the standard production ATGL version since the late 1990s. RPG-7D, RPG-7DV1, and RPG-7D2N3 (night): Folding variants used by airborne troops. RPG-7D3 is the airborne counterpart to RPG-7V1. Type 69-1, II, III: Chinese upgrades variants with lighter weight, a wide range of munitions, and 3.0 x longer range sights.

NOTES

RPG-7V IS THE STANDARD (TIER 4) SQUAD ANTITANK WEAPON IN USE BY THE OPFOR. IT REQUIRES A WELL-TRAINED GUNNER TO ESTIMATE RANGES AND LEAD DISTANCES FOR MOVING TARGETS. THE RPG-7V HAS BEEN USED TO SHOOT DOWN HELICOPTERS IN SEVERAL CONFLICTS.

RUSSIAN 72.5-MM ANTITANK DISPOSABLE LAUNCHER RPG-22



SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations		Caliber(mm)	72.5
Date, Country of Origin	1985, RUS	Rate of Fire (prac, cyclic)	1, 1
Proliferation	At least 9 countries	Fire on Move	No
Crew	1	Elevation (deg min, max)	Shoulder held
Weight Firing (kg)	2.8	Traverse (deg)	Shoulder held
Weight Travel (kg)		AMMUNITION	SPECIFICATIONS
Weight Tripod (kg)		Missile Type, Name	HEAT,
Length Firing (m)	0.85	Max Aimed Range (m)	250
Length Travel (m)	0.75	Max Effective Range(m)	250
Rifling	Yes or No	Penetration (mm)	390, C
Feed	Disposable	Missile Diameter (mm)	72.5mm
Breech Mechanism Type	NA	Missile Weight (kg)	1.48
Emplacement Time (min)	1	Initial Muzzle Velocity (m/s)	133
Fire from Inside Building	No	Maximum Velocity (m/s)	300
ARMAMENT	SPECIFICATIONS		
Name			
Type	Iron		
Sight Range Direct (m)	50, 150, 200, 250		
Sight Range Indirect (m)			
Night Sights	No		

NOTES

THE RPG-22 IS A LIGHTWEIGHT, SHOULDER-FIRED, PRELOADED, DISPOSABLE ANTI-ARMOR WEAPON INTENDED FOR FIRING ONE ROUND, AFTER WHICH THE TUBE IS DISCARDED. IT IS BASICALLY A SCALED-UP VERSION OF THE RPG-18 (SIMILAR TO THE US LAW) AND HAS NO DEDICATED GRENADIER; HOWEVER, ALL SOLDIERS TRAIN TO USE THE SQUAD-LEVEL DISPOSABLE WEAPON.

CHINESE 107MM IMPROVISED ROCKET LAUNCHER TYPE 63



SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations	None	Caliber(mm)	107
Date, Country of Origin	1960's, CHI	Rate of Fire (prac, cyclic)	1, 2
Proliferation	At least 20 countries	Fire on Move	No
Crew	2	Elevation (deg min, max)	-0, + est 60
Weight Firing (kg)	3	Traverse (deg)	0
Weight Travel (kg)		AMMUNITION	SPECIFICATIONS
Weight Tripod (kg)	10	Caliber(mm), Type, Name	107, Rocket, Type 63
Length Firing (m)		Max Aimed Range (m)	8000
Length Travel (m)		Warhead Type	Frag HE Spin stabilized
Height Firing (m)	1.5	Weight (Kg)	18.8
Width Firing (m)	1	Effect	1600 Steel Balls
Rifling	No	Caliber(mm), Type, Name	107, Rocket, Type 63 II
Feed	Manual	Max Aimed Range (m)	8500
Breech Mechanism Type	Electric Battery	Warhead Type	Controlled Frag HE
Emplacement Time (min)	3	Weight (Kg)	18.84
Fire from Inside Building	No	Effect	1214 Frag
SIGHTS	SPECIFICATIONS	Caliber(mm), Type, Name	107, Rocket, Type 63 SS
Name	N/A	Max Aimed Range (m)	8500
Type	Estimation	Warhead Type	HE Incendiary White Phosphorous
Sight Range Direct (m)	Line of Sight	Weight (Kg)	18.74
Sight Range Indirect (m)		Effect	1600 Frag
Night Sights		Caliber(mm), Type, Name	107, Rocket, Type 81 DP
		Max Aimed Range (m)	8000
		Warhead Type	DPICM
		Weight (Kg)	8.4
		Effect	Sub munitions with HE effect 80mm penetration

NOTES

THE TYPE 63 CAN ALSO REFER TO A TOWED 12-TUBE MBRL PRODUCED IN CHINE IN THE EARLY 1960'S. IT WAS WIDELY USED BY THE PLA UNTIL THE 1980 AND IS VERY SIMILAR TO THE SOVIET BM-14. ALTHOUGH THE MBRL'S HAVE BEEN USED BY IRREGULAR ACTORS THEY ARE MORE LIKELY TO HAVE ACCESS TO THE MUNITIONS AND BE FORCED TO IMPROVISE THE LAUNCHER.

INSURGENT 57-MM IMPROVISED ROCKET LAUNCHERS C-5K





SYSTEM	SPECIFICATIONS
Alternative Designations	S-5K
Date, Country of Origin	2000, INS
Proliferation	At least 2 Insurgent groups
Crew	1
Weight Firing (kg)	8
Length Firing (m)	1.42
Rifling	No
Feed	Manual
Breech Mechanism Type	Open
Emplacement Time (min)	1
Fire from Inside Building	INA
Launch control	Trigger, wire connecting to a battery in the stock

SIGHTS	SPECIFICATIONS
Name	Post, PGO-7
Type	Iron, Optical
Sight Range Direct (m)	Line of Sight
Aiming Limitation	Heat and Ash distract user
Night Sights	No

VARIANTS

Launcher tubes are extracted from UB32 Helicopter launch air to surface rocket pods. Tubes can be fabricated from pipe and some launchers have been seen with a blast shield to protect the user.
Early Chechen launchers were all welded, including grips and appeared to be sturdy.
In Tikrit a pedestal-mounted launcher with 4 unused rockets was found in the street.

ARMAMENT	SPECIFICATIONS
Caliber(mm)	57
Rate of Fire (prac, cyclic)	1, 2
Fire on Move	No
Elevation (deg min, max)	Est -10, est +65
Traverse (deg)	360

AMMUNITION	SPECIFICATIONS
Caliber(mm), Type, Name	57, Rocket, S5K
Free Flight Range (m)	2000
Max Eff Range, Day (m)	400
Rocket Weight (Kg)	3.65
Warhead Weight (Kg)	1.13
Rocket Length (m)	0.83
Fuze Type	Point Detonating
Penetration (mm)	150, C
Caliber(mm), Type, Name	57, Rocket, S5
Free Flight Range (m)	4000
Max Eff Range, Day (m)	400
Rocket Weight (Kg)	5.1
Warhead Weight (Kg)	1.1
Rocket Length (m)	1.42
Fuze Type	Point Detonating
Penetration (mm)	Damage light armored vehicles

NOTES

MOST LAUNCHERS USE A SINGLE TUBE BUT VARIANTS HAVE BEEN MADE WITH TWO THREE OR FOUR TUBES. VERSIONS HAVE BEEN SEEN WITH WOOD, METAL, AND PLASTIC HELD WITH A METAL STRAP, TAPE, AND WELDS THE S-5K ROCKETS FLAT TRAJECTORY OFFERS A MORE ACCURATE MUNITION FOR USE OVER DISTANCE BEYOND 200M THAN THAT OF THE HIGH BALLISTIC ARC OF AN ATGL, SUCH AS RPG-7V

IMPROVISED EXPLOSIVE DEVICE ANTI-PERSONNEL FRAGMENTATION PIPE BOMB





SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations	Anti-Personnel Fragmentation Device, Nail Bomb, Blast Bomb	Caliber(mm)	NA
Date, Country of Origin	NA	Rate of Fire (prac, cyclic)	1,1
Proliferation	Worldwide	Fire on Move	Yes
Crew	1	Elevation (deg min, max)	Hand Thrown
Weight Firing (kg)	Usually <2	Traverse (deg)	360
Weight Travel (kg)		EXPLOSIVE	
Length Firing (m)	Usually < 0.30	Usually low grade without the need for a detonator. Black powder, fireworks or chlorate mixture are popular.	
Feed	Single Use		
Breech Mechanism Type	NA	VARIANTS	
Emplacement Time (min)	1	Virtually any type of container that would provide confinement for an explosive material, glass jars, plastic pipe and appliances. Some common variants are the Pressure Cooker bomb or the Letter Bomb	
Fire from Inside Building	Yes		
SIGHTS	SPECIFICATIONS		
Type	Line Of Sight		
Sight Range Direct (m)	50		
Sight Range Indirect (m)			
Night Sights	No		

NOTES
A CRUDE DEVICE, OFTEN A PIPE CAPPED AT BOTH ENDS AND FILLED WITH EXPLOSIVE. CAN BE PACKED WITH NAILS OR SCREWS TO INCREASE DAMAGE. PIPE BOMBS CONCENTRATE PRESSURE AND RELEASE IT THROUGH THE FAILURE OF THE OUTER CASING. THEY ARE EASY TO MAKE IN ANY SHAPE OR SIZE BUT THE SIMPLE UNSOPHISTICATED NATURE OF THE DEVICE MAKES THEM DANGEROUS IF INCORRECTLY HANDLED.

IMPROVISED EXPLOSIVE ANTI-ARMOR DEVICE EXPLOSIVE FORMED PROJECTILE



SYSTEM	SPECIFICATIONS	AMMUNITION
Alternative Designations	Dragon (Taliban)	Usually High Explosive EFP components have been found with: C4 Explosive / Gunpowder / TNT / HME / RDX
Date, Country of Origin	2006, Insurgents	**VARIANTS**
Proliferation	Iran, Lebanon, Hezbollah, Iraq, and Afghanistan	EFPs were reportedly provided to Hezbollah proxy groups fighting in Iraq in kit form. Machinery for forming the copper cones was discovered in Sadr City, Iraq indicating another variant. Improvised EFP devices have been found cased in foam and painted to look like rocks
Crew	1	
Weight Firing (kg)	Various	
Length Firing (m)	>0.25	
Rifling	Yes or No	
Feed	Text	
Breech Mechanism Type	Text	
Emplacement Time (min)	Various	
Fire from Inside Building	Yes	
SIGHTS	**SPECIFICATIONS**	
Name		
Type	NA	
Sight Range Direct (m)	Line of Sight	
Sight Range Indirect (m)	Remoted and unmanned	
Night Sights		

NOTES

EFP TECHNOLOGY WAS INVENTED IN THE 1930'S BY THE OIL INDUSTRY. IT HAS BEEN USED IN ANTI-ARMOR WEAPONS SINCE WW2.

EFPS WERE USED WITH DEVASTATING EFFECT IN IRAQ BY IRANIAN BACKED GROUPS AND IN AFGHANISTAN BY THE TALIBAN. A NORMAL IED WOULD CAUSE DAMAGE TO A HUMVEE AND EFP WOULD COMPLETELY DESTROY IT.

TOYOTA (DOUBLE CAB) HILUX "TECHNICAL" MULTI-ROLE VEHICLE





SYSTEM	SPECIFICATIONS	PROTECTION	SPECIFICATIONS
Alternative Designations	Pick-up Truck	Radio	
Date, Country of Origin	1968, JPN	Armor, Turret Front (mm):	No
Proliferation	Worldwide	Applique Armor (mm)	No
Crew	1	Reactive Armor (mm):	No
Troop Capacity	10	Mobility (mine clearing, self-entrenching)	No
Combat Weight (kg)	2810	NBC Protection System	No
Length (m)	5.26	Smoke Equipment	No
Height (m)	1.86	PROTECTION	SPECIFICATIONS
Width (m)	1.83	Radio	
Ground Pressure (kg/cm²)	INA	Armor, Turret Front (mm):	No
Drive Formula	4x4	Applique Armor (mm)	No
AUTOMOTIVE	SPECIFICATIONS	Reactive Armor (mm):	No
Engine Type	Water-cooled, in-line, 6-cylinder gasoline Text	Mobility (mine clearing, self-entrenching)	No
Cruising Range (km)	436	VARIANTS	
Max On-Road (km/h)	113	The Toyota Hilux can be up armored however most technical will be regular civilian vehicles used by an irregular force. There are reports that drug cartels have used armored pick-ups in the past. A Hilux can be made to accommodate rockets, air defense guns or heavy machine guns. The photos above are from Libya and Afghanistan and illustrate examples fitted with DShK heavy machineguns. A technical can be almost any civilian truck or vehicle that can be armed with different weapon systems (rockets, air defense guns, or heavy machineguns).	
Max Off-Road (km/h)	100		
Max Cross-Country (km/h)	INA		
Max Swim (km/h)	NA		
Fording Depth (m), note	0.7t		

NOTES

THE TOYOTA HILUX IS A GOOD EXAMPLE OF A TECHNICAL BASED ON REPORTING FROM LIBYA, SYRIA, AFGHANISTAN, AND MALI. IRREGULAR FORCES USE THESE PARTICULAR TYPE OF VEHICLE BECAUSE OF THE VEHICLE'S RELIABILITY IN HOSTILE CONDITIONS. MOST ARE 4X4 VEHICLES TO ALLOW MOBILITY IN RESTRICTIVE TERRAIN. THEY ALLOW THE THREAT ACTOR TO BE AGILE, FAST AND BLEND INTO THE CIVILIAN POPULATION. THE DOWNSIDE OF HAVING LIMITED ARMOR IS OFFSET BY HIDING IN PLAIN SIGHT.

SUDANESE 4X4 LIGHT TACTICAL VEHICLE KARABA VTG01





SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations	Safir	Caliber(mm), Type, Name	73, Recoilless Gun, SPG-9 RR
Date, Country of Origin	2008, SUD	Rate of Fire (prac, cyclic)	6
Proliferation	Iran, Libya, CAR	Fire on Move	No
Crew	1	Elevation (deg min, max)	-3, + 7
Troop Capacity	5	Caliber(mm), Type, Name	0, ATGM, AT-3 or AT-5
Combat Weight (mt)	1500	Rate of Fire (prac, cyclic)	2,3
Length (m)	3.51	Fire on Move	INA
Height (m)	1.88	Elevation (deg min, max)	INA
Width (m)	1.9	VARIANTS	
Ground Pressure (kg/cm^2)	INA	Radio Station Command Post Ambulance	
Drive Formula	4 x 4		
AUTOMOTIVE	SPECIFICATIONS		
Engine Type	Diesel		
Cruising Range (km)	500		
Max On-Road (km/h)	130		
Max Off-Road (km/h)	Number		
PROTECTION	SPECIFICATIONS		
Radio	Yes		
NBC Protection System	No		
Smoke Equipment	No		

NOTES

THE KARABA VTG01 IS BASED ON THE IRANIAN-MADE SAFIR, ALTHOUGH SHOWN OPEN TOPPED IT CAN HAVE AN OPTIONAL SOFT COVER. IT IS AN EXAMPLE OF A MODERN TACTICAL UTILITY VEHICLE THAT COULD BE PROCURED BY IRREGULAR ACTORS

DEC
2016

Worldwide Equipment Guide

Chapter 12: Chemical, Biological, Radiological, and Nuclear (CBRN) Weapons



TRADOC G-2 ACE–Threats Integration
Ft. Leavenworth, KS

Distribution Statement: Approved for public release; distribution is unlimited.

Chemical, Biological, Radiological, and Nuclear (CBRN) Weapons

This section provides a basic primer for threat characteristics for selected CBRN Weapons/agents/platforms. This portion also discusses the following topics: overview of OPFOR's rational on CBRN weapons, CBRN Threats, and WEG sheets representative of blister agents, nerve agents, choking agents, biotoxins, and decontamination platforms. These types of threats discussed in this segment are either in the real world and or readily available and therefore likely to be encountered by US forces in varying levels of conflict in the future. CBRN weapons can be used by a hybrid threat and is not limited to regular actors, but also irregular and criminal elements.

The list of CBRN systems/agents within this chapter is not meant to be encyclopedic. This chapter will be further developed with additional agents in upcoming editions. This edition of the CBRN chapter provides the US training community with a list of representative capabilities that allow scenario developers and the rest of the training community to create a dynamic threat to prepare today's warfighter for tomorrow's battlefield.

The section is divided into two major categories—***The CBRN Primer and WEG Sheets on CBRN assets/systems***. The CBRN primer provides insight into how the OPFOR composite views CBRN weapons. The second section of the primer address current CBRN threats. The WEG sheets (section) examine types of agents, and decontamination systems.

Questions and comments on data listed in this chapter should be addressed to:

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This portion of the WEG is broken into two distinct but connected narratives. The first section discusses the OPFOR's rationale with regards to usage of CBRN systems. This OPFOR segment will not go into considerable depth on OPFOR tactics due to the fact that this subject is addressed in detail in Training Circular (TC) 7-100.2 chapter 13 (CBRN and Smoke). The second piece of this narrative discusses CBRN threats and has supporting CBRN related WEG sheets.

OPFOR and CBRN Issues

This section consists of a number of significant excerpts from TC 7-100.2 in order to provide a basic context for OPFOR CBRN related topics (for additional information on the subject of OPFOR CBRN and smoke tactics see the link in the above paragraph).

Key points on the OPFOR's CBRN issues:

- The OPFOR maintains a capability to conduct chemical, nuclear, and possibly biological or radiological warfare.
- The OPFOR is most likely to use chemical weapons against even a more powerful enemy.
- The OPFOR is equipped, structured, and trained to conduct both offensive and defensive chemical warfare.
- The OPFOR is continually striving to improve its chemical warfare capabilities.
- The OPFOR views chemical defense as part of a viable offensive chemical warfare capability.
- The OPFOR use the threat of numerous methods of CBRN delivery systems as an intimidating factor.
- The OPFOR could use CBRN against a neighbor as a warning to any potential enemy.
- The OPFOR uses the fact that CBRN weapons place noncombatants at risk as a positive factor.
- The OPFOR may threaten to use CBRN weapons as a way of applying political, economic, or psychological pressure by allowing the enemy no sanctuary.
- The OPFOR might use CBRN weapons either to deter aggression or as a response to an enemy attack.
- The OPFOR will use CBRN weapons on own troops in order to reach overarching objectives.
- The use of INFOWAR at every echelon is a key component in the OPFOR's CBRN program.
- The OPFOR may develop and employ radiological weapons.
- The OPFOR has nuclear capabilities.

CBRN Delivery Systems

The OPFOR has surface-to-surface missiles (SSMs) capable of carrying nuclear, chemical, or biological warheads. Most OPFOR artillery is capable of delivering chemical munitions, and most systems 152-mm and larger are capable of firing nuclear rounds. Additionally, the OPFOR could use aircraft systems and cruise missiles to deliver a CBRN attack. The OPFOR has also trained special-purpose forces (SPF) as alternate means of delivering CBRN munitions packages.

The Effects of CBRN on the Battlefield

The use of CBRN weapons can have an enormous impact on the battlefield and in peacetime and wartime operational environments. These types of weapons are a subset of weapons of mass destruction (WMD). WMD are weapons or devices intended for or capable of causing a high order of physical destruction or mass casualties (death or serious bodily injury to a significant number of people). The casualty-producing elements of WMD can continue inflicting casualties on the enemy and exert powerful psychological effects on the enemy's morale for

some time after delivery. Conventional weapons e.g., precision weapons or volumetric explosives) can also take on the properties of WMD.

Real World Threats CBRN Primer

Classifying of chemical agents

- Lethal agents
- Nonlethal agents
- Persistent: Agent that remains able to cause casualties for more than 24 hours to several days or weeks.
- Non-Persistent: dissipates and/or loses its ability to cause casualties after 10 to 15 minutes.

Subcategories of agents as the following:

- **Nerve:** Occupational Safety & Health Administration (OSHA) defines as highly toxic chemicals called "organophosphates" that poison the nervous system and disrupt bodily functions which are vital to an individual's survival.

Types and Characteristics Chemical Agents

		PERSISTENCE	PERSISTENCE		ENTRANCE	
TYPE OF AGENT	**SYMBOL**	**SUMMER**	**WINTER**	**RATE OF ACTION**	**VAPOR/AEROSOL**	**LIQUID**
NERVE	GA, GB, GD	10 min-24 hr	2 hr-3 days	Very Quick	Eyes, Lungs	Eyes, Skin, Mouth

*ARMY FIELD MANUAL NO. 8-10-7. Health Service Support in a Nuclear, Biological, and Chemical Environment.

- **Blister agents:** OSHA defines blister agents or "vesicants" are chemicals which have severely irritating properties that produce fluid filled pockets on the skin and damage to the eyes, lungs and other mucous membranes. Symptoms of exposure may be immediate or delayed until several hours after exposure.

Types and Characteristics Chemical Agents

		PERSISTENCE	PERSISTENCE		ENTRANCE	
TYPE OF AGENT	SYMBOL	SUMMER	WINTER	RATE OF ACTION	VAPOR/AEROSOL	LIQUID
BLISTER	HD, HN	3 days-1 wk	Weeks	Slow	Eyes, Skin, Lungs	Eyes, Skin
	L, HL	1-3 days	Weeks	Quick	Eyes, Skin, Lungs	Eyes, Skin, Mouth
	CX	Days	Days	Very Quick	Eyes, Lungs, Skin	Eyes, Skin, Mouth

*ARMY FIELD MANUAL NO. 8-10-7. Health Service Support in a Nuclear, Biological, and Chemical Environment.

- **Biotoxins:** OSHA defines as biological agents include bacteria, viruses, fungi, other microorganisms and their associated toxins. They have the ability to adversely affect human health in a variety of ways, ranging from relatively mild, allergic reactions to serious medical conditions, even death.
  Properties of Selected Biological Agents

BW Agents[1]	Likely Methods of Dissemination	Transmissibility Person-to-Person	Infectivity	Lethality[2]	Stability[2]
Anthrax (Inhalation)	Spores in aerosols	None	Moderate	High	Spores are highly stable
Brucellosis	1. Aerosol 2. Sabotage (food supply)	None	High	Low	Long persistence in wet soil and food
Cholera	1. Sabotage (food/water supply) 2. Aerosol	Negligible	Low	Moderate to high	Unstable in aerosol and pure water; more so in polluted water
Glanders	Aerosol	DNA	DNA	DNA	DNA
Melioidosis	Aerosol	Negligible	High	Variable	Stable
Plague (Pneumonic)	1. Aerosol 2. Infected Vectors	High	High	Very high	Less important because of high transmissibility
Psittacosis	Aerosol	Negligible	Moderate	Very low	Stable
Shigellosis	Sabotage (Food/Water Supply)	DNA	DNA	DNA	DNA
Tularemia	Aerosol	Negligible	High	Moderate if untreated	Not very stable
Typhoid Fever	1. Sabotage (food/water supply) 2. Aerosol	Negligible	Moderate	Moderate if untreated	Unknown
Q Fever	1. Aerosol 2. Sabotage (food supply)	None	High	Very low	Stable
Rocky Mountain Spotted Fever	1. Aerosol 2. Infected Vectors	None	High	High	Not very stable
Trench Fever	1. Aerosol 2. Vector	None	DNA	Low	DNA
Typhus Fever	1. Aerosol 2. Infected vectors	None	High	High	Not very stable
Chikungunya	Aerosol	None	High	Very low	Relatively stable
Crimean-Congo Hemorrhagic Fever	Aerosol	Moderate	High	High	Relatively stable
Dengue Fever	Aerosol	None	High	Low	Relatively unstable
Eastern Equine Encephalitis	Aerosol	None	High	High	Relatively unstable
Western Equine Encephalitis	Aerosol	None	High	Low	Relatively unstable
Ebola Fever	Aerosol	Moderate	High	High	Relatively unstable
Far Eastern Tick-borne Encephalitis	1. Aerosol 2. Milk	None	High	Moderate	Relatively unstable
Hantaan Virus (Korean HFV)	Aerosol	None	High	Moderate	Relatively stable
Juinn Hemorrhagic Fever	Aerosol	DNA	DNA	DNA	DNA

- **Choking agents:** The Center for Disease Control and Prevention (CDC) defines choking agents or pulmonary agents as chemicals that cause severe irritation or swelling of the respiratory tract (lining of the nose, throat, and lungs). Chart not available.
- **Systemic/Blood Agents:** The Center for Disease Control and Prevention (CDC) defines blood agents as poisons that affect the body by being absorbed into the blood. Chart not available.

OTHER TOXIC CHEMICALS

In addition to traditional chemical warfare agents, the OPFOR may find creative and adaptive ways to cause chemical hazards using chemicals commonly present in industry or in everyday households. In the right combination, or in and of themselves, the large-scale release of such chemicals can present a health risk, whether caused by military operations, intentional use, or accidental release.

Toxic Industrial Chemicals

Toxic industrial chemicals (TICs) are chemical substances with acute toxicity that are produced in large quantities for industrial purposes. Exposure to some industrial chemicals can have a lethal or debilitating effect on humans. They are a potentially attractive option for use as weapons of opportunity or WMD because of—

- The near-universal availability of large quantities of highly toxic stored materials.
- Their proximity to urban areas.
- Their low cost.

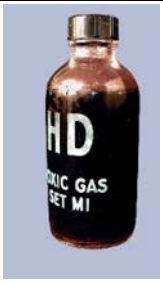
- The low security associated with storage facilities.

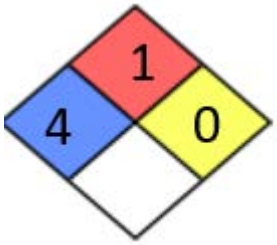
Employing a TIC against an opponent by means of a weapon delivery system, whether conventional or unconventional, is considered a chemical warfare attack, with the TIC used as a chemical agent. The target may be the enemy's military forces or a civilian population.

SULFUR MUSTARD: BLISTER AGENT



Sulfur Mustard





NFPA 704 Signal

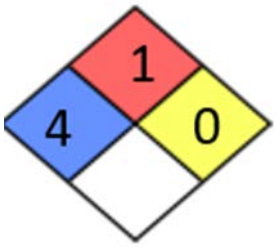
AGENT CHARACTERISTICS	SPECIFICATIONS		ROUTES OF EXPOSURE	SPECIFICATIONS
Alternative designations:	HD (distilled sulfur mustard), Mustard, Mustard gas		Inhalation:	Yes
Military designation:	HD		Ingestion:	Yes
Chemical abstracts service number:	505-60-2		Skin/eye absorption:	Yes
UN Number	2810		METHODS OF DISSEMINATION	
Date of introduction:	1822		Indoor air:	Yes
Chemical Formula:	C4H8Cl2S		Water:	Yes
Appearance:	Liquid	Food:	Yes	
Color:	Yellow or brown	Outdoor air:	Yes	
Description type agent:	Blister		Agricultural:	Yes
Description:	Blister agent (vesicant) that causes severe, delayed burns to the eyes, skin, and respiratory tract.		Indoor air:	Yes
Lethality:	Yes		Agricultural:	Yes
Nonpersistent:	No		Historic usage*:	Yes
Flammability*:	1			
Health*:	4			
Instability/reactivity*:	0			
Flashpoint° (F):	219.2			
Boiling Point ° (F):	422.6			

NOTES:

DESCRIPTION: MUSTARD GAS IS A VESICANT THAT WAS FIRST USED IN CHEMICAL WARFARE IN WORLD WAR I (EVEN THOUGH DISCOVERED PREVIOUSLY). IT CONSISTS OF AN OILY LIQUID OR CLEAR VAPOR. THE UN REPORTS 'AFTER WWI' THE FOLLOWING USAGES OF HD : RUSSIA (1919), MOROCCO (1923-1926), ABYSSINIA (1935-1940), MANCHURIA (1937-1945), YEMEN (1963-1967), IRAQ/IRAN (1982-1988), POSSIBLE SYRIA (2014). UN #: 2810 (GUIDE 153). CDC REPORTS HD DAMAGES CELLS WITHIN MINUTES OF CONTACT; HOWEVER, PAIN AND OTHER HEALTH EFFECTS ARE DELAYED UNTIL HOURS AFTER EXPOSURE. HD IN LARGE DOSES CAN BE FATAL. HD IS 2 TO 5 TIMES MORE PERSISTENT IN WINTER THAN IN SUMMER. UN #: 2810 (GUIDE 153). THE CDC STATES THAT HD AFFECTS THE NERVOUS SYSTEM CAUSING "CHOLINERGIC TOXICITY" WITH THE FOLLOWING SYMPTOMS: EXCESSIVE SALIVA, TEARS AND URINE; GASTROINTESTINAL (GI) CRAMPING AND DIARRHEA; VOMITING (EMESIS); AND CONSTRICTED OR PINPOINT PUPILS (MIOSIS). HD HAS AN ODOR OF GARLIC, ONION, HORSERADISH, OR MUSTARD.

SARIN: CHEMICAL NERVE AGENT





NFPA 704 Signal

AGENT CHARACTERISTICS	SPECIFICATIONS	ROUTES OF EXPOSURE	SPECIFICATIONS
Alternative designations:	Trilone, Zarin	Inhalation:	Yes
Military designation:	GB	Ingestion:	Yes
Chemical abstracts service number:	107-44-8	Skin/eye absorption:	Yes
UN Number	2810	Ingestion:	Possible
Date of introduction:	1938	METHODS OF DISSEMINATION	
Chemical Formula:	C4H10FO2P	Indoor air:	Yes
Appearance:	Liquid	Water:	Yes
Color:	Clear	Food:	Yes
Description type agent:	Nerve	Outdoor air:	Yes
Description:	Chemically similar to Organophospate	Agricultural:	Yes
Lethality*:	Yes	Indoor air:	Yes
Nonpersistent:	Yes	Agricultural:	Yes
Flammability*:	1	Historic usage*:	Yes
Health*:	4		
Instability/reactivity*:	0		
Flashpoint° (F):	>536		
Boiling Point ° (F):	297		

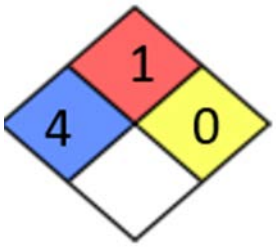
NOTES:

SARIN HAS BEEN USED BY REGULAR AND CRIMINAL ELEMENTS. MARCH 1995, AUM SHINRIKYO RELEASED SARIN GAS IN A TOKYO SUBWAY, 12 DEAD. IRAQI MILITARY USED SARIN DURING IRAN-IRAQ WAR (1980-1988) KILLING 26,000. LETHALITY: DEATH WITHIN MINUTES = 1 TO 10 MILLILITER (ML) ON SKIN ABSORPTION. INDICTORS OF ATTACK: ENEMY MOVING DECONTAMINATION UNITS FORWARD. ENEMY PUTTING ON CHEMICAL PROTECTIVE EQUIPMENT. SEVERE SIGNS OF EXPOSURE: LOSS OF CONSCIOUSNESS; SEIZURES, PARALYSIS; DEATH. SYMPTOMS: SKIN EXPOSURE: PROFUSE SWEATING, MUSCULAR TWITCHING, NAUSEA, VOMITING, DIARRHEA, AND WEAKNESS. INHALATION EXPOSURE: PINPOINT PUPILS, RUNNY NOSE, SHORTNESS OF BREATH.

VX: Nerve Agent



VX nerve agent



NFPA 704 Signal

AGENT CHARACTERISTICS	SPECIFICATIONS	ROUTES OF EXPOSURE	SPECIFICATIONS
Alternative designations:	Methylphosphonothioic acid, O-ethyl S-(2-diisopropylaminoethyl) methylphosphonothiolate	Inhalation:	Yes
Military designation:		Ingestion:	Yes
Chemical abstracts service number:	50782-69-9	Skin/eye absorption:	Yes
UN Number	2810	METHODS OF DISSEMINATION	
Date of introduction:	Early 1950s	Indoor air:	Yes
Chemical Formula:	C11H26NO2PS	Water:	Yes
Appearance:		Outdoor air:	Yes
Color:	Clear, Amber	Agricultural:	Possible
Description type agent:	Nerve	Historic usage:	
Description:	One of the most toxic tasteless and odorless human-made chemical warfare agents		
Lethality:	Yes		
Nonpersistent:	No		
Flammability:	1		
Health:	4		
Instability/reactivity:	0		
Flashpoint° (F):	318.2		
Boiling Point ° (F):	568.4		

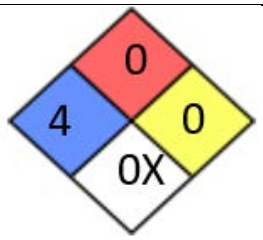
NOTES:

SYMPTOMS AND EFFECTS: BLURRED VISION, CONFUSION, DROOLING, EXCESSIVE SWEATING, COUGH, NAUSEA, DIARRHEA, SMALL PINPOINT PUPILS, CONVULSIONS, LOSS OF CONSCIOUSNESS, PARALYSIS, RESPIRATORY FAILURE POSSIBLY LEADING TO DEATH.

CHLORINE: CHOKING (LUNG DAMAGING) AGENT



WWI Chlorine Attack



NFPA 704 Signal

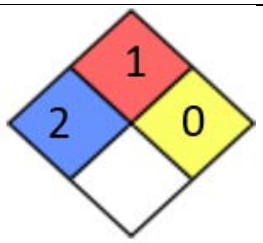
AGENT CHARACTERISTICS	SPECIFICATIONS	ROUTES OF EXPOSURE	SPECIFICATIONS
Alternative designations:	Molecular chlorine	Inhalation:	Yes
Military designation:		Ingestion:	Yes
Chemical abstracts service number:	7782-50-5	Skin/eye absorption:	Yes
UN Number	1017	METHODS OF DISSEMINATION	
Date of introduction:		Indoor air:	Yes
Chemical Formula:	Cl2	Water:	Yes
Appearance:	Gas	Food:	Unlikely
Color:	Greenish Yellow	Outdoor air:	Yes
Description type agent:	Choking	Agricultural:	Unlikely
Description:	Toxic gas with corrosive properties.	Indoor air:	Yes
Lethality:	Yes	Historic usage*:	Yes
Nonpersistent:	Yes		
Flammability:	0		
Health*:	4		
Instability/reactivity*:	0		
Flashpoint° (F):	INA		
Boiling Point ° (F):	-30.3		

NOTES:

CHLORINE IS USED AS AN INDUSTRIAL/HOUSEHOLD CLEANER/DISINFECTANT. IT IS USES RANGE FROM WATER TREATMENT TO CHEMICAL WARFARE (DATING BACK TO WORLD WAR I). PERSISTENCE: MINUTES TO HOURS. UN NUMBER: 1017. SYMPTOMS: BLURRED VISION. BURNING SENSATION IN THE NOSE, THROAT, AND EYES, COUGHING CHEST TIGHTNESS, DIFFICULTY BREATHING OR SHORTNESS OF BREATH, NAUSEA AND VOMITING, WATERY EYES, WHEEZING, LUNG PROBLEMS AND DEATH. BBC REPORTS POSSIBLE CHLORINE ATTACKS IN SYRIA IN APRIL/MAY 2014 AND MARCH 2015. UN SUPPORTED THE ABOVE STATEMENT WITH THE FOLLOWING: “HIGH DEGREE OF CONFIDENCE, THAT CHLORINE HAD BEEN USED AS A WEAPON IN THREE VILLAGES IN NORTHERN SYRIA FROM APRIL TO AUGUST 2014.”

CHLOROACETOPHENONE: Riot Control/Tear Agent





NFPA 704 Signal

AGENT CHARACTERISTICS	SPECIFICATIONS	ROUTES OF EXPOSURE	SPECIFICATIONS
Alternative designations:	2-Chloro-1-phenylethanone, 2-Chloroacetophenone, alpha-Chloroacetophenone, Chemical mace, Chloromethyl phenyl ketone, Phenyl chloromethylketone, Tear gas	Inhalation:	Yes
Military designation:	CN	Ingestion:	Yes
Chemical abstracts service number:	532-27-4	Skin/eye absorption:	Yes
UN Number	1697	METHODS OF DISSEMINATION	
Date of introduction:		Indoor air:	Yes
Chemical Formula:	C8H7ClO	Water:	Yes
Appearance:	Gas	Outdoor air:	Yes
Color:	Gray, white, or colorless	Agricultural:	Possible
Description type agent:	Riot Control/Tear Agent	Indoor air:	Yes
Description:	Military and law enforcement use CN for riot control.	Historic usage:	Yes
Lethality:	Yes*		
Nonpersistent:	Yes		
Flammability:	1		
Health*:	2		
Instability/reactivity*:	0		
Flashpoint° (F):	244		
Boiling Point ° (F):	472-473		

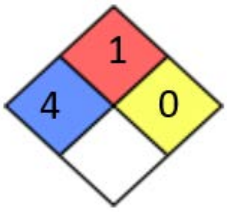
NOTES:

EXPOSURE (MILD TO MODERATE): RUNNY NOSE, EYE IRRITATION, COUGHING, SNEEZING, DIFFICULTY BREATHING, SHORTNESS OF BREATH, CHOKING, BURNING SENSATION, NAUSEA, VOMITING. (SEVERE): FLUID IN LUNGS, NARROWING OF AIRWAYS, FAINTING, INCREASED HEART RATE, LONG TERM EXPOSURE IN CONFINED SPACE CAN IN RARE INSTANCES CAUSES DEATH.

BIOTOXIN: RICIN



Caster Beans



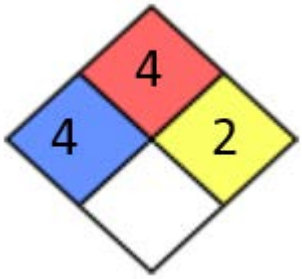
NFPA 704 Signal

AGENT CHARACTERISTICS	SPECIFICATIONS	ROUTES OF EXPOSURE	SPECIFICATIONS
Alternative designations:	Ricine, Ricins	Inhalation:	Yes
Military designation:		Ingestion:	Yes
Chemical abstracts service number:	9009-86-3	Skin/eye absorption:	Possible
UN Number	3462	METHODS OF DISSEMINATION	
Date of introduction:	INA	Indoor air:	Yes
Chemical Formula:	INA	Water:	Yes
Appearance:	Powder, Liquid, Crystalline	Outdoor air:	Yes
Color:	White	Agricultural:	Possible
Description type agent:	Biotoxin	Historic usage:	Yes
Description:	Toxic protein from Castor Bean plant		
Lethality:	Yes		
Nonpersistent:			
Flammability:	1		
Health*:	4		
Instability/reactivity*:	0		
Flashpoint° (F):	INA		
Boiling Point ° (F):	INA		

NOTES:

SYMPTOMS AND EFFECTS: RICIN INGESTION GENERALLY APPEARS WITHIN A FEW HOURS AFTER CONSUMPTION; HOWEVER, SOME PATIENTS CAN BE ASYMPTOMATIC FOR A PERIOD OF TIME. FEVER, COUGH, RESPIRATORY DISTRESS, BURING OF THE THROAT, ACCUMULATION OF FLUID IN THE LUNGS. RICIN ATTACKS THE LIVER, CENTRAL NERVOUS SYSTEM, KIDNEYS, AND ADRENAL GLANDS (2 TO 5 DAYS AFTER EXPOSURE). 3-5 DAYS AFTER CONTACT MAY LEAD TO DEATH.

HYDROGEN CYANIDE: SYSTEMIC AGENT



NFPA 704 Signal

AGENT CHARACTERISTICS	SPECIFICATIONS	ROUTES OF EXPOSURE	SPECIFICATIONS
Alternative designations:	Formonitrile, Hydrocyanic acid, Prussic acid	Inhalation:	Yes
Military designation:	AC	Ingestion:	Yes
Chemical abstracts service number:	74-90-8	Skin/eye absorption:	Yes
UN Number	1051	Historic usage*:	Yes
Date of introduction:		METHODS OF DISSEMINATION	
Chemical Formula:	HCN	Indoor air:	Yes
Appearance:		Water:	Yes
Color:	Colorless or pale blue	Food:	Yes
Description type agent:	systemic chemical asphyxiant	Outdoor air:	Yes
Description:	interferes with the normal use of oxygen by nearly every organ of the body	Agricultural:	Possible
Lethality*:	Yes	Indoor air:	Yes
Nonpersistent:	No	Historic usage:	Yes
Flammability*:	4		
Health*:	4		
Instability/reactivity*:	2		
Flashpoint° (F):	0		
Boiling Point ° (F):	78		

NOTES:

THE CDC REPORTS THAT AFTER INHALATION EXPOSURE, SYMPTOMS BEGIN WITHIN SECONDS TO MINUTES; DEATH MAY OCCUR WITHIN MINUTES. AFTER SKIN EXPOSURE, ONSET OF SYMPTOMS MAY BE IMMEDIATE OR DELAYED FOR 30 TO 60 MINUTES. INGESTION OF HYDROGEN CYANIDE (AC) SOLUTIONS OR CYANIDE SALTS CAN BE RAPIDLY FATAL.

RUSSIAN DECONTAMINATION/SMOKE GENERATOR VEHICLE TMS-65M



SYSTEM	SPECIFICATIONS	FEATURES (CONT.)	SPECIFICATIONS
System		Max Swim:	INA
Alternative Designations:	None	Fording Depths (M):	1.5
Date Of Introduction:	INA	Radios, Frequency, And Range:	INA
Proliferation:	At Least 1 Country	Nozzle Movement:	Yes
Description:		Traverse:	90
Crew:	2	Elevation	12
Troop Capacity:	INA	Depression	23
Chassis:	Ural 4320, 6x6	Operating RPM's of Turbine Engine:	INA
Combat Weight (Mt):	INA	Idle Speed (rpm):	INA
Length Overall (M):	7.3	Max Effective Speed (rpm):	INA
Height Overall (M):	2.5	Ability to Generate on the Move:	Yes
Width Overall (M)	2.8	Performance Characteristics:	
Ground Pressure (Kg/Cm2):	INA	Engine Name:	VK-1A modified gas turbine
Automotive Performance:		Fuel Type:	INA
Engine Type:	YaMZ-238M2; V-8 liquid cooled diesel	Fuel Capacity (l):	INA
HP:	240	Operating Time (min):	60
Cruising Range (Km):	1040	Time to Initiate Smokescreen (min):	10
Speed (Km/H):		Generator Efficiency (%):	96
Max Road:	82	Smoke Screening System:	Yes
Max Off-Road:	INA	Emplacement Time:	10-12 minutes
		Displacement Time:	10-12 minutes

NOTES

SMOKE GENERATOR: PHYSICAL CHARACTERISTICS: NAME: INA. LENGTH (M): INA. HEIGHT (M): INA. WIDTH (M): INA. NUMBER OF NOZZLES: 6 LOCATION OF NOZZLE: INA. NOZZLE ORIFICE SIZE (M): INASMOKE AGENT: GOST 305-73.

NOMENCLATURE: GOST-305-82 PETROLEUM OBSCURANTS: MANMADE AGENTS. CLOUD COLOR: WHITE. CAPACITY OF SMOKE AGENT (L): 1500. SMOKE AGENT CONSUMPTION RATE (L/HR): 1500. ODOR: FAINT SULFUR. PROTECTION REQUIRED: NONE. THE TMS-65M IS PRIMARILY USED FOR THE DECONTAMINATION OF VEHICLES AND EQUIPMENT WHETHER STATIONARY OR ON THE MOVE. ADDITIONALLY, THE SYSTEM CAN BE USED TO DECONTAMINATE GROUND AND HARD SURFACE ROADS AS WELL AS PRODUCE PROTECTIVE SMOKESCREENS. THE VK-1 TURBINE ENGINE (A MODIFIED MIG-17 ENGINE) ALONG WITH A SEALED CONTROL CAB IS MOUNTED ON AN URAL 4320, 6X6 TRUCK CHASSIS. THE TURBINE ENGINE CAN BE MOVED VERTICALLY OR HORIZONTALLY BY CONTROLS LOCATED IN THE OPERATOR'S CONTROL CAB. THE OPERATOR'S CONTROL CAB IS FIXED TO THE LEFT SIDE OF THE TURBINE ENGINE AND IS EQUIPPED WITH FLOODLIGHTS FOR LIMITED VISIBILITY OPERATIONS. TWO 1500-LITER TANKS ARE MOUNTED ACROSS THE FRONT OF THE TRUCK BED BETWEEN THE DRIVER'S CAB AND THE TURBINE ENGINE. ONE TANK IS USED FOR OBSCURANT, DECONTAMINANTS, OR WATER AND THE OTHER TANK IS USED FOR THE FUEL TO POWER THE TURBINE ENGINE. THE OBSCURANT, DECONTAMINANT, OR WATER IS FED THROUGH PIPES INTO THE TURBINE ENGINE EXHAUST STREAM. DEPENDING UPON THE SIZE AND LEVEL OF CONTAMINATION THE TMS-65M IS CAPABLE DECONTAMINATING EQUIPMENT AT A RATE OF 30 SECONDS TO 3 MINUTES PER ITEM.

Slovakian Decontamination/Smoke Generator Vehicle TZ-74



SYSTEM	SPECIFICATIONS	FEATURES (CONT.)	SPECIFICATIONS
System		Max Swim:	
Alternative Designations:	None	Fording Depths (M):	
Date Of Introduction:	INA	Radios, Frequency, And Range:	
Proliferation:	3	Nozzle Movement:	
Description:		Traverse:	120
Crew:	2	Elevation	30
Troop Capacity:	INA	Depression	20
Chassis:	Tatra 148 PPR 15, 6x6	Operating RPM's of Turbine Engine:	13,000 rpm (equals 84%)
Combat Weight (Mt):	21.9	Idle Speed (rpm):	5400
Length Overall (M):	8.49	Max Effective Speed (rpm):	1400
Height Overall (M):	2.5	Ability to Generate on the Move:	No
Width Overall (M)	3.2	Performance Characteristics:	
Ground Pressure (Kg/Cm2):	INA	Engine Name:	Type M701 C-500
Automotive Performance:	Tatra 2-298-1	Fuel Type:	Diesel
Engine Type:	V-8 air cooled diesel	Fuel Capacity (l):	2,000
HP:	1200	Operating Time (min):	22
Cruising Range (Km):	400	Time to Initiate Smokescreen (min):	1
Speed (Km/H):	INA	Generator Efficiency (%):	98
Max Road:	71	Smoke Screening System:	INA
Max Off-Road:	INA	Emplacement Time:	approximately 10-12 minutes
		Displacement Time:	approximately 10-12 minutes

NOTES

THE TZ-74 IS PRIMARILY USED FOR THE DECONTAMINATION OF VEHICLES AND EQUIPMENT WHETHER STATIONARY OR ON THE MOVE. ADDITIONALLY, THE SYSTEM CAN BE USED TO DECONTAMINATE GROUND AND HARD SURFACE ROADS AS WELL AS PRODUCE PROTECTIVE SMOKESCREENS. THE TZ-74 IS BASED ON THE CHASSIS OF THE TATRA 148 PPR 15, 6X6 TRUCKS. THE SYSTEM USES A GAS TURBINE ENGINE TO GENERATE A SMOKE SCREEN OVER A LARGE AREA. THE GAS TURBINE IS MOUNTED ON THE REAR OF THE VEHICLE WITH THE OPERATOR'S CABIN ON THE LEFT-HAND SIDE, AND AN OBSCURANT TANK ON THE RIGHT-HAND SIDE. THE REMAINDER OF THE REAR OF THE VEHICLE CONSISTS OF

STORAGE TANKS FOR LIQUIDS AND FUEL FOR THE TURBINE ENGINE. A SMOKESCREEN IS CREATED AS A RESULT OF THE INTRODUCTION OF OIL, DIESEL FUEL, OR A COMBINATION OF BOTH INTO THE EXHAUST NOZZLE OF THE TURBINE ENGINE. THE INTRODUCTION OF THE MIXTURE INTO THE TURBINE ENGINES EXHAUST CAUSES AN IMMEDIATE DISPERSION AND EVAPORATION OF THE MIXTURE THAT CONDENSES IN THE COOLER PART OF THE STREAM AFTER EXPULSION FROM THE MOTOR.

THE TZ-74 CAN PRODUCE SMOKE IN ABOUT A MINUTE AFTER THE TURBINE ENGINE IS TURNED ON. ALTHOUGH THE JET ENGINE HAS ENOUGH FUEL TO OPERATE FOR 3 HOURS, ITS MISSION TIME IS SEVERELY LIMITED BY THE CAPACITY OF THE INTERNAL LIQUID SOURCES AVAILABLE. HOWEVER, IF EXTERNAL SOURCES ARE USED, THE MISSION TIMES ARE DRAMATICALLY INCREASED. THE MAIN DECONTAMINANT TANK HAS A 5,000-LITER CAPACITY. THE FOG OIL TANK HAS A 200-LITER CAPACITY. THE FUEL TANK FOR THE GAS TURBINE HAS A 2,000-LITER CAPACITY.

Dec
2016

Worldwide Equipment Guide

Volume 2: Air and Air Defense Systems





TRADOC G-2 ACE–Threats Integration
Ft. Leavenworth, KS

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Opposing Force:
Worldwide Equipment Guide
Chapters Volume 2

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Chapter 3	UAVs
Chapter 4	Aviation Countermeasures, Upgrades, Emerging Technology
Chapter 5	Unconventional and SPF Arial Systems
Chapter 6	Theatre Missiles
Chapter 7	Air Defense Systems

Units of Measure

The following example symbols and abbreviations are used in this guide.

Unit of Measure	Parameter
(°)	degrees (of slope/gradient, elevation, traverse, etc.)
GHz	gigahertz—frequency (GHz = 1 billion hertz)
hp	horsepower (kWx1.341 = hp)
Hz	hertz—unit of frequency
kg	kilogram(s) (2.2 lb.)
kg/cm^2	kg per square centimeter—pressure
km	kilometer(s)
km/h	km per hour
kt	knot—speed. 1 kt = 1 nautical mile (nm) per hr.
kW	kilowatt(s) (1 kW = 1,000 watts)
liters	liters—liquid measurement (1 gal. = 3.785 liters)
m	meter(s)—if over 1 meter use meters; if under use mm
m^3	cubic meter(s)
m^3/hr	cubic meters per hour—earth moving capacity
m/hr	meters per hour—operating speed (earth moving)
MHz	megahertz—frequency (MHz = 1 million hertz)
mach	mach + *(factor)* —aircraft velocity (average 1062 km/h)
mil	milliradian, radial measure (360° = 6400 mils, 6000 Russian)
min	minute(s)
mm	millimeter(s)
m/s	meters per second—velocity
mt	metric ton(s) (mt = 1,000 kg)
nm	nautical mile = 6076 ft (1.152 miles or 1.86 km)
rd/min	rounds per minute—rate of fire
RHAe	rolled homogeneous armor (equivalent)
shp	shaft horsepower—helicopter engines (kWx1.341 = shp)
µm	micron/micrometer—wavelength for lasers, etc.

OPFOR AIR AND AIR DEFENSE SYSTEMS – TIER TABLES

The OPFOR organization and equipment must support the entire spectrum of Contemporary Operational Environment in U.S. forces training. The COE OPFOR includes "hybrid threats", and represents rational and adaptive adversaries for use in training applications and scenarios. The COE time period reflects current training as well as training extending through the Near Term. This chapter deals with current time frame systems. Lists of equipment on these tables offer convenient baseline examples arranged in capability tiers for use in composing OPFOR equipment arrays for training scenarios. For guidance on systems technology capabilities and trends after 2014, the user might look to Chapter 10, Countermeasures, Upgrades, and Emerging Technology. Those tables offer capabilities tiers for Near and Mid-Term.

OPFOR equipment is broken into four "tiers" in order to portray systems for adversaries with differing levels of force capabilities for use as representative examples of a rational force developer's systems mix. Equipment is listed in convenient tier tables for use as a tool for trainers to reflect different levels of modernity. Each tier provides an equivalent level of capability for systems across different functional areas. The tier tables are also another tool to identify systems in simulations to reflect different levels of modernity. The key to using the tables is to know the tier capability of the initial organizations to be provided. Tier 2 (default OPFOR level) reflects modern competitive systems fielded in significant numbers for the last 10 to 20 years.

Systems reflect specific capability mixes, which require specific systems data for portrayal in U.S. training simulations (live, virtual, and constructive). The OPFOR force contains a mix of systems in each tier and functional area which realistically vary in fielded age and generation. The tiers are less about age of the system than realistically reflecting capabilities to be mirrored in training. Systems and functional areas are not modernized equally and simultaneously. Forces have systems and material varying 10 to 30 years in age in a functional area. Often military forces emphasize upgrades in one functional area while neglecting upgrades in other functional areas. Force designers may also draw systems from higher or lower echelons with different tiers to supplement organizational assets. Our functional area analysts have tempered depiction of new and expensive systems to a fraction of the OPFOR force. The more common modernization approach for higher tier systems is to upgrade existing systems.

Some systems are used in both lower and higher tiers. Older 4x4 tactical utility vehicles which are 30 to 40 years old still offer effective support capability, and may extend across three tiers. Common use of some OPFOR systems also reduces database maintenance requirements.

Tier 1 systems are new or upgraded robust state-of-the-art systems marketed for sale, with at least limited fielding, and with capabilities and vulnerabilities representative of trends to be addressed in training. But a major military force with state-of-the-art technology may still have a mix of systems across different functional areas at Tier 1 and lower tiers in 2016.

Tier 2 reflects modern competitive systems fielded in significant numbers for the last 10 to 20 years, with limitations or vulnerabilities being diminished by available upgrades. Although forces are equipped for operations in all terrains and can fight day and night, their capability in range and speed for several key systems may be somewhat inferior to U.S. capability.

Tier 3 systems date back generally 30 to 40 years. They have limitations in all three subsystems categories: mobility, survivability and lethality. Systems and force integration are inferior. However, guns,

missiles, and munitions can still challenge vulnerabilities of U.S. forces. Niche upgrades can provide synergistic and adaptive increases in force effectiveness.

Tier 4 systems reflect 40 to 50 year-old systems, some of which have been upgraded numerous times. These represent Third World or smaller developed countries' forces and irregular forces. Use of effective strategy, adaptive tactics, niche technologies, and terrain limitations can enable a Tier 4 OPFOR to challenge U.S. force effectiveness in achieving its goals. The tier includes militia, guerrillas, special police, and other forces.

Please note: ***No force in the world has all systems at the most modern tier.*** Even the best force in the world has a mix of state-of-the-art (Tier 1) systems, as well as mature (Tier 2), and somewhat dated (Tier 3) legacy systems. Many of the latter systems have been upgraded to some degree, but may exhibit limitations from their original state of technology. Even modern systems recently purchased may be considerably less than state-of-the-art, due to budget constraints and limited user training and maintenance capabilities. Thus, even new systems may not exhibit Tier 1 or Tier 2 capabilities. As later forces field systems with emerging technologies, legacy systems may be employed to be more suitable, may be upgraded, and continue to be competitive. ***Adversaries with lower tier systems can use adaptive technologies and tactics, or obtain niche technology systems to challenge advantages of a modern force.***

A major emphasis in an OPFOR is flexibility in use of forces and in doctrine. This also means OPFOR having flexibility, given rational and justifiable force development methodology, to adapt the systems mix to support doctrine and plans. The tiers provide the baseline list for determining the force mix, based on scenario criteria. The OPFOR compensates for capability limitations by using innovative and adaptive tactics, techniques, and procedures (TTP). Some of these limitations may be caused by the lack of sophisticated equipment or integration capability, or by insufficient numbers. Forces can be tailored in accordance with OPFOR guidance to form tactical groups.

An OPFOR force developer has the option to make selective adjustments such as use of niche technology upgrades such as in tanks, cruise missiles, or rotary-wing aircraft, to offset U.S. advantages (see WEG Chapter 15, Equipment Upgrades). Forces may include systems from outside of the overall force capability level. A Tier 3 force might have a few systems from Tier 1 or 2. The authors will always be ready to assist a developer in selecting niche systems and upgrades for use in OPFOR portrayal. Scenario developers should be able to justify changes and systems selected. With savvy use of TTP and systems, all tiers may offer challenging OPFOR capabilities for training. The Equipment Substitution Matrices can help force designers find weapons to substitute, to reflect those best suited for specific training scenarios.

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OPFOR TIER TABLES, AIRSPACE AND AIR DEFENSE SYSTEMS

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Some systems are used in both lower and higher tiers. Older 4x4 tactical utility vehicles which are 30 to 40 years old still offer effective support capability, and may extend across three tiers. Common use of some OPFOR systems also reduces database maintenance requirements.

Tier 1 systems are new or upgraded robust state-of-the-art systems marketed for sale, with at least limited fielding, and with capabilities and vulnerabilities representative of trends to be addressed in training. But a major military force with state-of-the-art technology may still have a mix of systems across different functional areas at Tier 1 and lower tiers in 2016.

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guns, missiles, and munitions can still challenge vulnerabilities of U.S. forces. Niche upgrades can provide synergistic and adaptive increases in force effectiveness.

Tier 4 systems reflect 40 to 50 year-old systems, some of which have been upgraded numerous times. These represent Third World or smaller developed countries' forces and irregular forces. Use of effective strategy, adaptive tactics, niche technologies, and terrain limitations can enable a Tier 4 OPFOR to challenge U.S. force effectiveness in achieving its goals. The tier includes militia, guerrillas, special police, and other forces.

Please note: ***No force in the world has all systems at the most modern tier.*** Even the best force in the world has a mix of state-of-the-art (Tier 1) systems, as well as mature (Tier 2), and somewhat dated (Tier 3) legacy systems. Many of the latter systems have been upgraded to some degree, but may exhibit limitations from their original state of technology. Even modern systems recently purchased may be considerably less than state-of-the-art, due to budget constraints and limited user training and maintenance capabilities. Thus, even new systems may not exhibit Tier 1 or Tier 2 capabilities. As later forces field systems with emerging technologies, legacy systems may be employed to be more suitable, may be upgraded, and continue to be competitive. ***Adversaries with lower tier systems can use adaptive technologies and tactics, or obtain niche technology systems to challenge advantages of a modern force.***

A major emphasis in COE is flexibility in use of forces and in doctrine. This also means OPFOR having flexibility, given rational and justifiable force development methodology, to adapt the systems mix to support doctrine and plans. The tiers provide the baseline list for determining the force mix, based on scenario criteria. The OPFOR compensates for capability limitations by using innovative and adaptive tactics, techniques, and procedures (TTP). Some of these limitations may be caused by the lack of sophisticated equipment or integration capability, or by insufficient numbers. Forces can be tailored in accordance with OPFOR guidance to form tactical groups.

An OPFOR force developer has the option to make selective adjustments such as use of niche technology upgrades such as in tanks, cruise missiles, or rotary-wing aircraft, to offset U.S. advantages (see WEG Chapter 9, Equipment Upgrades). Forces may include systems from outside of the overall force capability level. A Tier 3 force might have a few systems from Tier 1 or 2. The authors will always be ready to assist a developer in selecting niche systems and upgrades for use in OPFOR portrayal. Scenario developers should be able to justify changes and systems selected. With savvy use of TTP and systems, all tiers may offer challenging OPFOR capabilities for training. The Equipment Substitution Matrices (starting at pg 1-6) can help force designers find weapons to substitute, to reflect those best suited for specific training scenarios.

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	Tier 1	Tier 2	Tier 3	Tier 4
Fixed Wing Aircraft				
Fighter/Interceptor	Su-35	Su-27SM	Mirage III, MiG-23M	J-7/FISHBED
High Altitude Interceptor	MiG-31BS	MiG-25PD	MiG-25	--
Ground Attack	Su-39	Su-25TM	Su-25	Su-17
Multi-Role Aircraft	Su-30MKK	Su-30, Mirage 2000, Tornado IDS	Mirage F1, SU-24	MiG-21M
Bomber Aircraft	Tu-22M3/BACKFIRE-C	Tu-22M3/BACKFIRE-C	Tu-95MS6/BEAR-H	Tu-95S/BEAR-A
Command & Control	IL-76/MAINSTAY	IL-76/MAINSTAY	IL-22/COOT-B	IL-22/COOT-B
Heavy Transport	IL-76	IL-76	IL-18	IL-18
Medium Transport	AN-12	AN-12	AN-12	AN-12
Short Haul Transport	AN-26	AN-26	AN-26	AN-26
RW Aircraft				
Attack Helicopter	AH-1W/Supercobra	Mi-35M2	HIND-F	HIND-D
Multi-role Helicopter	Z-9/WZ-9	Battlefield Lynx	Lynx AH.Mk 1	Mi-2/HOPLITE
Light Helicopter	GAZELLE/SA 342M	GAZELLE/SA 342M	BO-105	MD-500M
Medium Helicopter	Mi-17-V7	Mi-171V/Mi-171Sh	Mi-8(Trans/HIP-E Aslt)	Mi-8T/HIP-C
Transport Helicopter	Mi-26	Mi-26	Mi-6	Mi-6
Other Aircraft				
Wide Area Recon Helicopter	Horizon (Cougar heli)	Horizon (Cougar heli)		
NBC Recon Heli	HIND-G1	HIND-G1	HIND-G1	--
Jamming Helicopter	HIP-J/K	HIP-J/K	HIP-J/K	HIP-J/K
Naval Helicopter	Z-9C	Ka-27/HELIX	Ka-27/HELIX	--
Op-Tactical Recon FW	Su-24MR/FENCER-E	Su-24MR/FENCER-E	IL-20M/COOT	--
EW Intel/Jam FM	Su-24MP/FENCER-E	Su-24MP/FENCER-E	IL-20RT and M/COOT	--
Long Range Recon	Tu-22MR/BACKFIRE	Tu-95MR/BEAR-E	Tu-95MR/BEAR-E	IL-20M/COOT
Long Range EW	Tu-22MP/BACKFIRE	Tu-95KM/BEAR-C	Tu-95KM/BEAR-C	--

	Tier 1	Tier 2	Tier 3	Tier 4
Air Defense				
Operational-Strategic Systems				
Long-Range SAM/ABM	Triumf/SA-21, SA-24	SA-20a w/SA-18	SA-5b w/SA-16	SA-5a w/S-60
LR Tracked SAM/ABM	Antey-2500, SA-24	SA-12a/SA-12b	SA-12a/SA-12b	SA-4b w/S-60
LR Wheeled SAM/ABM	Favorit/SA-20b, SA-24	SA-20a w/SA-18	SA-10c w/SA-16	SA-5a w/S-60
Mobile Tracked SAM	Buk-M1-2 (SA-11 FO)	Buk-M1-2(SA-11 FO)	SA-6b w/ZSU-23-4	SA-6a w/ZSU-23-4
Towed Gun/Missile System	Skyguard III/Aspide2000	Skyguard II/Aspide2000	SA-3, S-60 w/radar	SA-3, S-60 w/radar
Tactical Short-Range Systems				
SR Tracked System (Div)	Pantsir S-1-0	SA-15b w/SA-18	SA-6b w/Gepard B2L	SA-6a w/ZSU-23-4
SR Wheeled System (Div)	Crotale-NG w/SA-24	FM-90 w/SA-18	SA-8b w/ZSU-23-4	SA-8a w/ZSU-23-4
SR Gun/Missile System (Bde)	2S6M1	2S6M1	SA-13b w/ZSU-23-4	SA-9 w/ZSU-23-4
Man-portable SAM Launcher	SA-24 (Igla-S)	SA-24 (Igla-S)	SA-16	SA-14, SA-7b
Airborne/Amphibious AA Gun	BTR-ZD Imp (w/-23M1)	BTR-ZD with ZU-23M	BTR-ZD/SA-16	BTR-D/SA-16, ZPU-4
Air Defense/Antitank				
Inf ADAT Vehicle-IFV	BMP-2M Berezhok/SA-24	BMP-2M w/SA-24	AMX-10 w/SA-16	VTT-323 w/SA-14
Inf ADAT Vehicle-APC	BTR-3E1/AT-5B/SA-24	BTR-80A w/SA-24	WZ-551 w/SA-16	BTR-60PB w/SA-14
ADAT Missile/Rocket Lchr	Starstreak II	Starstreak	C-5K	RPG-7V
Air Defense ATGM	9P157-2/AT-15 and AD missile	9P149/Ataka and AD missile	9P149/AT-6	9P148/AT
Anti-Aircraft Guns				
Medium-Heavy Towed Gun	Skyguard III	S-60 with radar/1L15-1	S-60 with radar/1L15-1	KS-19
Medium Towed Gun	Skyguard III	GDF-005 in Skyguard II	GDF-003/Skyguard	Type 65
Light Towed Gun	ZU-23-2M1/SA-24	ZU-23-2M	ZU-23	ZPU-4
Anti-Helicopter Mine	Temp-20	Helkir	MON-200	MON-100

	Tier 1	Tier 2	Tier 3	Tier 4
AD Spt (C2/Recon/EW)				
EW/TA Radar Strategic	Protivnik-GE and 96L6E	64N6E and 96L6E	TALL KING-C	SPOON REST
EW/TA Rdr Anti-stealth	Nebo-SVU	Nebo-SVU	Nebo-SV	BOX SPRING
EW/TA Radar Op/Tac	Kasta-2E2/Giraffe-AMB	Kasta-2E2/Giraffe AMB	Giraffe 50	LONG TRACK
Radar/C2 for SHORAD	Sborka PPRU-M1	Sborka-M1/ PPRU-M1	PPRU-1 (DOG EAR)	PU-12
ELINT System	Orion/85V6E	Orion/85V6E	Tamara	Romona
Unmanned Aerial Vehicles				
High Altitude Long Range	Hermes 900	Hermes 900	Tu-143	Tu-141
Med Altitude Long Range	ASN-207	ASN-207 / Hermes 450	--	--
Tactical	Skylark III/Mohadjer 4B	Skylark II/Mohadjer 4	Shmel-I	FOX AT2
Vertical Take Off/ Landing	Camcopter S-100	Camcopter S-100	--	--
Vehicle/Man-Portable	Spylite	Spylite/Skylite-B	Skylite-A	--
Man-Portable	Skylark-IV	Skylark	--	--
Hand-Launch	Zala 421-12	Zala 421-08/421-21/Hexarotor VTOL		--
Artillery Launch	R-90 rocket	R-90 rocket		
Attack UAVs/UCAVs	Hermes 450	Hermes 450	Mirach-150	--
Theater Missiles				
Medium Range (MRBM)	Shahab-3B	Shahab-3A	Nodong-1	SS-1C/SCUD-B
Short-Range (SRBM)	SS-26 Iskander-M	SS-26 Iskander-E	M-9	SS-1C/SCUD-B
SRBM/Hvy Rkt < 300 km	Lynx w/EXTRA missile	Tochka-U/SS-21 Mod 3	M-7/CSS-8	FROG-7
Cruise Missile	Delilah ground, air, sea	Harpy programmed/piloted	Mirach-150 programmed	--
Anti-ship CM	BrahMos ground, air, sea	Harpy programmed/radar	Exocet	Styx
Anti-radiation	Harpy programmed/ARM	Harpy programmed/ARM	--	--

SYSTEMS SUBSTITUTION MATRIX

This table provides a list of Vol 1 systems for users to substitute other systems versus OPFOR systems listed in guidance documents. Systems in italics are Tier 2 baseline systems used in the OPFOR Organization Guide. Systems are listed by type in tier order, and can substitute to fit a scenario. Some systems span between the tiers (e.g., 3-4). Also, systems can be used at more than one tier (e.g., 3-4).

	Tier
1. ROTARY-WING AIRCRAFT	
Light Helicopters	
SA-342M Gazelle	1-2
BO-105	3
MD-500MD/Defender	4
Attack Helicopters	
Ka-50/HOKUM and Ka-52	1
Mi-28/HAVOC	1
AH-1W/Supercobra	1
Mi-35M2	2
AH-1F/Cobra	2
Mi-24/HIND D/F	3-4
Medium Multi-role Helicopters	
Z-9/Haitun and WZ-9 Gunship	1
Battlefield Lynx	2-3
Mi-2/HOPLIGHT	4
Utility Helicopters	
Mi-17/Mi-171V	1-2
Mi-8/HIP-C	3-4
AS-532/Cougar	2-4
Ka-27/HELIX	3
Transport Helicopters	
Mi-26/HALO	1-2
Mi-6/HOOK	3-4
Reconnaissance Helicopters	
Horizon	1-2



2. FIXED-WING AIRCRAFT

Fighter/Interceptor Aircraft	
MiG-31/FOXHOUND	1
Su-27/FLANKER-B and FLANKER-C	2
MiG-25/FOXBAT-B	2
Tier	
F-5/Freedom Fighter (Tiger)	3
Mirage III/5/50	3
J-7/FISHBED	3-4
J-8/FINBACK	3-4
J-6/F-6	4
Jaguar	4
J-6 (Jian-6)/F-6	4
Ground Attack Aircraft	
Su-39/FROGFOOT	1
Su-25TM/FROGFOOT	2
L-39/Albatros	4
Su-17/FITTER	4
Multi-role Aircraft	
EF-2000/Eurofighter	1
JAS39/Gripen	1
Rafale	1
Su-30M and Su-30MKK	1
Su-35/Su-27BM	1
MiG-29/FULCRUM	1-2
Mirage 2000	2
Tornado IDS	2
AJ37/Viggen	2-3
KFIR (Lion Cub)	2-3
F-4/Phantom	3
MiG-23/MiG-27 FLOGGER	3
Mirage F1	3
Su-24/FENCER	3
Q-5/FANTAN	3-4
MiG-21/FISHBED	4

Transport Aircraft

An-12/CUB	1-2
An-2/COLT	3-4
An-26/CURL	1-4
IL-76/CANDID	1-2
IL-18/COOT	3-4

Bomber Aircraft

H-5/Hongzhaji-5	4
H-6/Hongzhaji-6	4
Tu-22M3/BACKFIRE-C	1-2
Tu-95MS-6 and Tu-95S/BEAR	3-4

Command and Control Aircraft

A-50E/MAINSTAY	1-2

3. UNMANNED AERIAL VEHICLES

Skylark IV	1
Skylite-B	1
ASN-207	1
Vulture	1
Hermes 450S	1
Hermes 900	1
Skylark II	1-2
Zala 421-08	1-2
Zala 421-12	1-2
Camcopter S-100	1-2
Skylark	2
Skylite-A	2
Hermes 450	2
Pustelga	3
AT1	3
AT2 (200)	3
ASN-105 (D-4)	3
Shmel-1 and Pchela-1K	3

4. AVIATION COUNTERMEASURES, UPGRADES, EMERGING TECHNOLOGY

No Substitution Platforms

5. UNCONVENTIONAL AND SPF ARIAL SYSTEMS

No Substitution Platforms

6. THEATER MISSILES

Ballistic Missiles

Iskander-E, -M/SS-26	1-2
Shahab-3B	1
SS-21 Mod-3/Tochka-U	1-2
Shahab-3A	2
SCUD-B Mod 2/SS-1c Mod	2
M-11/DF-11/CSS-7	3
M-9/DF-15/CSS-6	3
M-7/CSS-8/B610	3
DF-3/CSS-2	3
SCUD-C/SS-1d	3-4
Nodong-1	3-4
SCUD-B/SS-1c	4

Cruise Missiles

BrahMos Supersonic Cruise Missile	1
Lynx Rocket/Missile System and Delilah	1
Iskander-E/-M/-K Cruise Missile Systems	1
Nimrod 3 Long-Range ATGM/Atk UAV	1
Harpy/CUTLASS ARM/Attack UAV	1-2
Nimrod Long-Range ATGM/Atk UAV	2
Mirach-150 Attack UAV/Cruise Missile	3

7. AIR DEFENSE

Air Defense Command Vehicles and Radars

Giraffe AMB Radar/Cmd Veh	1
Sborka AD ACV (w/DOG EAR Radar)	1-2
Giraffe 50AT Radar/Cmd Veh	2
PPRU-1/PU-12M ACV (DOG EAR Radar)	3-4
Long Track Mobile AD Radar Vehicle	3-4

Electronic Warfare Systems for Air Defense

Orion ELINT System	1-2
Avtobaza Ground ELINT System	1-2

Anti-helicopter Mines	
Helkir	2
Towed Antiaircraft (AA) Guns	
GDF-005 Retrofit (Skyguard) III 35-mm	1
ZU-23M1 23-mm	1
ZU-23M 23-mm	2
GDF-005 35-mm (Skyguard Mk2)	2
GDF-003 35-mm (Skyguard)	3
KS-19M2 100-mm	3-4
S-60 57-mm	3-4
Type 65 37-mm	3-4
ZU-23 23-mm	3-4
M1939 37-mm	4
ZPU-4 14.5-mm Heavy Machinegun	4
Self-Propelled AA Gun System	
BTR-ZD Imp 23-mm SP AA Gun	3
Gepard 35-mm SP AA Gun	3
BTR-ZD 23-mm SP AA Gun	3-4
ZSU-23-4 23-mm SP AA Gun	4
ZSU-57-2 57-mm SP AA Gun	4
Manportable Surface-to-Air Missiles (SAMs)	
SA-18S/Igla-Super	1-2
Starstreak II High Velocity Missile	1
Starstreak High Velocity Missile	1-2
Stinger	1-2
Albi MANPADS Launcher Vehicle/Mistral	1-2
SA-18/GROUSE and SA-24/Igla-S	2
SA-16/GIMLET	3
SA-7b/GRAIL	4
SA-14/GREMLIN	4
SHORAD SAM Systems	
Pantsir-S1-0/SA-22E Gun/Missile System	1
Crotale-New Generation	1
Tor-M2E (SA-15b Imp)	1
2S6M1 30-mm Gun/Missile System	1-2

FM-90 (Crotale Imp)	1-2
SA-15b/GAUNTLET	2
Crotale 5000	2
SA-8P/Osa-AKM-P1	2-3
SA-8b/GECKO Mod 1	3
SA-13b/GOPHER	3
SA-9/GASKIN	4

Medium Range Air Defense (MRAD)

Aspide 2000 with Skyguard III	1
SA-11 FO/Buk-M1-2	1 -2
Aspide 2000 (Skyguard Mk 2)	1 -2
SA-11/Buk-M1/GADFLY	2-3
Pechora-M (SA-3 Imp)	2-3
Pechora-2M (SA-3 Imp Mobile)	2-3
SA-2/GUIDELINE	3-4
SA-3/GOA	3-4
SA-4b/GANEF Mod 1	3-4
SA-6b/GAINFUL Mod 1	3-4
SA-6a/GAINFUL 4	

Long Range Air Defense (LRAD)

Antey 2500/SA-23, S-300V4	1
SA-21b/S-400/Triumf	1
SA-20b/Favorit/S-300PMU2	1
SA-20a/GARGOYLE/S-300PMU1	2
SA-12a/GLADIATOR, SA-12b/GIANT	2-3
SA-10C/GRUMBLE/S-300PMU	3
SA-10b/GRUMBLE/S-300PM	3-4
SA-5b/GAMMON	3
SA-5a/GAMMON	4

Dec
2016

Worldwide Equipment Guide

Chapter 1: Rotary Wing Aircraft





TRADOC G-2 ACE–Threats Integration
Ft. Leavenworth, KS

Distribution Statement: Approved for public release; distribution is unlimited.

Chapter 1: Rotary Wing Aircraft

This chapter provides the basic characteristics of selected rotary-wing aircraft readily available to the OPFOR. The sampling of systems was selected because of wide proliferation across numerous countries or because of extensive use in training scenarios. ***Rotary-wing aircraft*** covers systems classified as light, attack, multirole, transport, and reconnaissance aircraft. Rotary wing aircraft can be used for a variety of roles, including attack, transport, direct air support, escort, target designation, security, reconnaissance, ambulance, anti-submarine warfare (ASW), IW, airborne C2, search and rescue (SAR), and anti-ship.

Because of the increasingly large numbers of variants of each aircraft, only the most common variants produced in significant numbers were addressed. If older versions of helicopters have been upgraded in significant quantities to the standards of newer variants, older versions may not be addressed. Helicopters can be categorized into capability tiers. Upgrades may designate different configurations of the same aircraft in different tiers. Technology priorities include multirole capability, more lethal weapons with longer range, ability to operate in all terrains, survivability/countermeasures, and sensors for day/night all-weather capability.

Helicopters can be configured for various combat missions (attack, direct air support, escort, target designation, etc.). The best armed combat helicopters are ***attack helicopters***, which may be used for all combat missions (including attack, direct air support, escort, anti-ship, etc), and some non-combat missions (transport, reconnaissance, SAR, etc). ***Helicopter gunships*** (combat configurations of multirole helicopters) can be used for all combat and non-combat missions, but are less suitable for attack missions against well-defended targets. Some of these missions can be executed by armed multirole helicopters.

The weapon systems inherent to the airframe are listed under Armament. They use various weapon mounts, including fuselage or turret nose gun, external mounted pylons (or hardpoints), and cabin weapons, including door guns. Pylons can mount single munitions, launchers or pods, sensor pods, or fuel tanks.

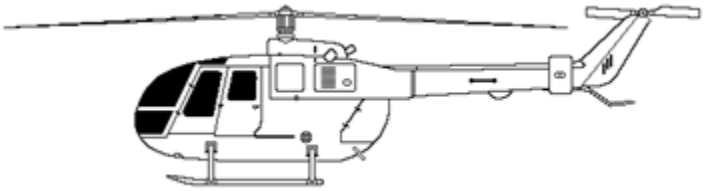
Munitions available to each aircraft are noted, but not all may be employed at the same time. Munition selection is based on mission and flight capability priorities. Munitions include bombs, missiles (ATGMs, air-to-surface missiles/ASMs, air-to-air missiles/AAMs), or rockets (single or in pods), mine pods, and automatic grenade launchers. For helicopter missions, other weapons and more ammunition can be carried in the passenger compartment. The most probable weapon loading options are also given, but assigned mission dictates actual weapon configuration.

Tables on aircraft weapons and aircraft-delivered munitions (ADMs) are at the end of this chapter.

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EUROPEAN LIGHT HELICOPTER BO-105





BO-105AT1 National War College Photo

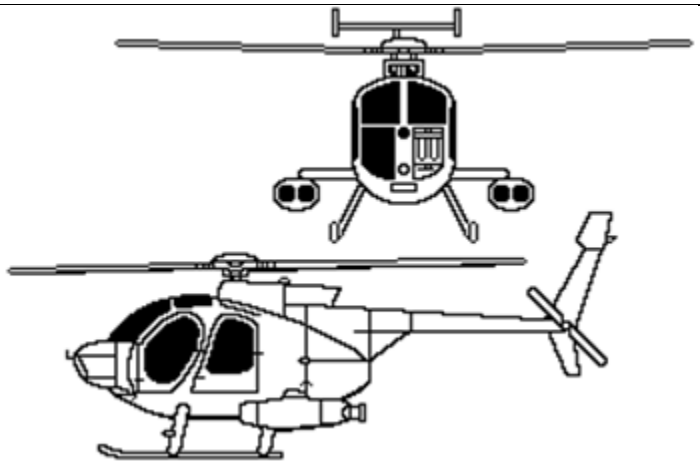
SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations:	INA	Speed (km/h) Max (level):	242
Date of Introduction:	1972	Cruise:	205
Proliferation:	At least 40 countries	Ceiling: Service:	3050
Description:	Variants in "( )"	Hover (out of ground effect):	457
Crew:	1 or 2 (pilots)	Hover (in ground effect):	1,525
Transports	3 troops or 2 litters, or cargo.	Vertical Climb Rate (m/s):	7.5
Main rotor:	4	Fuel (Liters) Internal:	570
Tail rotor:	2	Cargo Compartment Dimensions (m): Floor Length:	1.9
Engines	2x 420-shp Allison 250-C20B turboshaft	Width: 1.4	1.4
Weight (kg) Maximum Gross:	2,500	Height: 1.3	1.3
Normal Takeoff:	2,000	Standard Payload (kg): Internal load: 690	690
Empty:	1,301, 1,913 (PAH1)	External on sling only: 1,200	1,200
Speed (km/h) Max (level):	242	Fuel (Liters) Internal:	570
Internal Aux Tank:	200 ea. (max 2x)		
Range(km): Normal Load:	555		
With Aux Fuel:	961		
Dimensions (m): Length (rotors turning):	11.9		
Length (fuselage):	8.8		
Width: (m)	2.5		
Height:	3.0		
AMMUNITION	**SPECIFICATIONS**	**AMMUNITION**	**SPECIFICATIONS**
7.62-mm or 12.7-mm MG pods	2	HOT ATGM	6
2.75-in rocket pods (7 or 12)	2	AS-12 ASM pods (2 ea pod)	4
8-mm SNEB rocket pods (12)	2	Stinger AAM pod (4 ea pod)	4
50-mm SNIA rocket pods (28)	2	BO-105P/PAH-1	6x HOT AT missiles, or rocket pods
TOW ATGM (4 ea pod)	8	AT Guided Missiles: HOT 3 Missile Weight (kg):	32 (in tube)
Rate of fire (missiles/min):	3-4, depending	Rate of fire (missiles/min):	3-4, depending
VARTIANTS	**SPECIFICATIONS**	**VARIANTS**	**SPECIFICATIONS**

BO-105CB:	**The standard civilian production variant.**	**BO-105LS:**	**Upgraded to 2x 550-shp Allison 250-C28 turboshaft engines for extended capabilities in high altitudes and temperatures. Produced only in Canada.**
BO-105CBS:	**VIP version with a slightly longer fuselage to accommodate 6 passengers, some used in a SAR role.**	**BO-105M VBH:**	**Standard reconnaissance (light observation) version. Others are built in Chile, the Philippines, Indonesia (NBO-105), and Spain.**
BO-105P:	**German military variant**	**BO-105/ATH:**	**Spanish CASA assembled variant rigidly mounts 1x Rh 202 20-mm cannon under the fuselage.**
BO-105 PAH-1:	**Standard antitank version**	**BO-105M VBH:**	**Standard reconnaissance (light observation) version. Others are built in Chile, the Philippines, Indonesia (NBO-105), and Spain.**
BO-105AT1:	**Variant with 6 x HOT ATGMs**		

NOTES

EXTERNAL STORES ARE MOUNTED ON WEAPONS "OUTRIGGERS" OR RACKS ON EACH SIDE OF THE FUSELAGE. EACH RACK HAS ONE HARDPOINT. THIS HELICOPTER IS PRODUCED BY THE EUROCOPTER COMPANY. IT WAS FORMED AS A JOINT VENTURE BETWEEN AEROSPATIALE OF FRANCE, AND DAIMLER-BENZ AEROSPACE OF GERMANY. OTHER MISSIONS INCLUDE: DIRECT AIR SUPPORT, ANTITANK, RECONNAISSANCE, SEARCH AND RESCUE, AND TRANSPORT. CLAMSHELL DOORS AT REAR OF CABIN AREA OPEN TO ACCESS CARGO AREA. CARGO FLOOR HAS TIE-DOWN RINGS THROUGHOUT.

UNITED STATES LIGHT HELICOPTER MD-500MD/DEFENDER



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations:	Hughes model 369, Cayuse, Loach	Ceiling: Service:	4,635 (500), 4,875 (530)
Date of Introduction:	1977 (MD-500 MD)	Hover (out of ground effect):	1,830 (500), 3,660 (530)
Proliferation:	At least 22 countries	Hover (in ground effect):	2,590 (500), 4,360 (530)
Crew:	1 or 2 (pilots)	Vertical Climb Rate (m/s):	8.4 (500), 10.5 (530)
Transports	2 or 3 troops/cargo, or 6 on external platforms in lieu of weapons.	Fuel (Liters) Internal:	240
Main rotor:	4 or 5 (see VARIANTS)	Internal Aux Tank:	80
Tail rotor:	2 or 4 (see VARIANTS)	Range(km): Normal Load:	485 (500), 430 (530)
Engines	2x 420-shp Allison 250-C20B turboshaft	With Aux Fuel:	961
Weight (kg) Maximum Gross:	1,361 (500), 1,610 (530)	Dimensions (m): Length (rotors turning):	9.4 (500), 9.8 (530)
Normal Takeoff:	1,090	Length (fuselage):	7.6 (500), 7.3 (530)
Empty:	896	Width: (m)	1.9
Speed (km/h) Maximum (level):	241 (500), 282 (530)	Height:	2.6 (500), 3.4 (530 over mast sight)
Cruise:	221 (500), 250 (530)		
AMMUNITION	**SPECIFICATIONS**	**AMMUNITION**	**SPECIFICATIONS**
BO-105P/PAH1	6x HOT AT missiles, or rocket pods	Rate of fire (missiles/min):	3-4, depending
AT Guided Missiles: HOT 3 Missile Weight (kg):	32 (in tube)	Other Missile Types:	HOT 2 multi-purpose (HEAT and Frag warheads)
Armor Penetration (mm):	1250	AVIONICS/SENSOR/OPTICS	Roof-mounted direct-view, daylight-only sight to allow firing of HOT ATGMs. .
VARTIANTS	**SPECIFICATIONS**	**VARIANTS**	**SPECIFICATIONS**
MD-500D:	Civilian version. North Korea	OH-6A/Cayuse:	Light observation variant in mid-1960s for US Army. It was fitted with 1x 253-

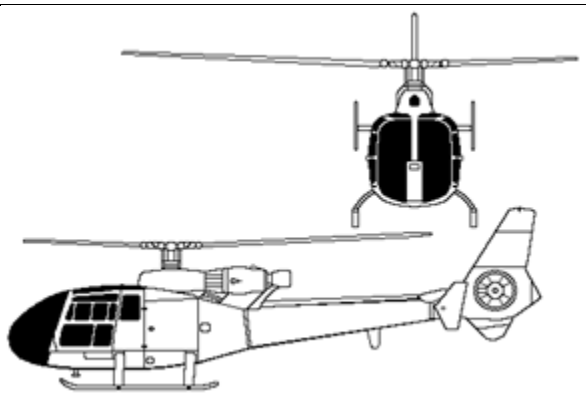
	acquired 80+ aircraft and converted them into gunships.		shp turboshaft, 4 bladed main rotor, and offset “V” tail. Options include M134 7.62-mm mini-gun or M129 40-mm auto-grenade launcher.
NK MD-500D Gunship:	This version has rockets and 7.62-mm MGs, or ATGMs.	OH-6A/MD-530F Super Cayuse/Lifter:	Upgraded engine (to a 425-shp), and avionics in 1988 for US Army
Hughes 500M:	Military export OH-6, in mid-1970s with upgrade 278-shp Allison 250-C18 turboshaft engine, and “V” tail.	MH-6B:	Army Special Ops variant "Little Bird" carries 6 for insertion/extraction.
MD-500MD/Scout and TOW Defender:	Improved military version of the model 500M with 5 main rotor blades, 375-shp Allison 250-C20B turboshaft engine, and T-tail.	AH-6C:	"Little Bird" armed variant.
MD-500E/MD-500MG/Defender II:	Has more elongated streamlined nose, optional 4x blade tail rotor for reduced acoustic signature. Possible mast-mount sight.	AH-6J:	"Little Bird" Attack variant with M134, .50-cal mini-gun, MK19 AGL, HELLFIRE ATGM or 2.75 in rockets, etc.
MD-530MG/Defender aka - 500MD/MMS TOW:	Has a mast-mount sight, and incorporates upgrades of previous variants.		

NOTES

EXTERNAL STORES ARE MOUNTED ON WEAPONS RACKS ON EACH SIDE OF THE FUSELAGE. EACH RACK HAS ONE HARDPOINT. OTHER MISSIONS INCLUDE: DIRECT AIR SUPPORT, RECONNAISSANCE, SECURITY AND ESCORT. NIGHT/WEATHER CAPABILITIES:

AVAILABLE AVIONICS INCLUDE WEATHER RADAR, DOPPLER AND GPS NAVIGATION, AND AN AUTO-PILOT. IT IS CAPABLE OF OPERATION IN DAY, NIGHT, AND WITH INSTRUMENTS UNDER ADVERSE METEOROLOGICAL CONDITIONS.

FRENCH LIGHT HELICOPTER SA-341/342 GAZELLE



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations:	See Variants	Ceiling (m):	
Date of Introduction:	1961 SA-341, 1973 SA-342	Service:	Service: 4,100 (SA 341), 5,000 (SA 342)
Proliferation:	At least 23 countries	Hover (out of ground effect):	2,000 (SA 341)
Crew:	1 or 2 (pilots)		2,370 (SA 342)
Transports	3 troops or 1 litter, or cargo.	Hover (in ground effect):	2,850 (SA 341)
Blades - Main rotor:	3		3,040 (SA 342)
Tail rotor:	13 (fenestron in tail)	Vertical Climb Rate (m/s):	12.2
Engines:	1x 590-shp Turbomeca	Fuel (liters):	
	Astazou IIIB turboshaft	Internal:	445
Weight (kg):		Internal Aux Tank:	90
Maximum Gross:	1,800 (SA 341), 1,900 (SA 342K), 2,000 (SA 342L/M)	Additional Internal Aux Tank:	200
Normal Takeoff:	1,800	Length (fuselage):	9.5
Empty:	998	Width:	2.0
Speed (km/h): Max (level):	310	Height:	3.1
Cruise:	270	Main Rotor Diameter:	10.5
Tail Rotor Diameter:	0.7	Height:	1.2
Cargo Compartment Dimensions (m):		Standard Payload (kg):	
Floor Length:	2.2	Internal load:	750
Width:	1.3	External on sling only:	700
AMMUNITION	**SPECIFICATIONS**	**AMMUNITION**	**SPECIFICATIONS**
SA 341H:	Can carry 4x AT-3 ATGMs, and 2x SA-7, or 128-mm or 57-mm rockets, and 7.62-mm machinegun in cabin.	SA 342M:	Armed version with 4 x HOT
SA 342L:	Export light attack variant with either rocket pods or Machine guns.	ATGMs	2x Mistral AAM, 7.62-mm MG.
SA 342K:	Armed antitank version with 4-6x HOT ATGMs and 7.62-mm MG.	HOT 3	Missile Weight (kg): 32 (in tube)
Missile Weight (kg):	32 (in tube)	Warhead:	Tandem shaped Charge

7.62-mm Mini-TAT MG or 20-mm GIAT M.621 cannon or 2x 7.62-mm AA-52 FN MG pods	100 1,000	Armor Penetration (mm CE):	1250
2.75-in rocket pods (7 ea.)	2	Maximum Range (m):	75/4,000
68-mm SNEB rocket pods (12 ea.)	2	Rate of fire (missiles/min):	3-4, depending on range
57-mm rocket pods (18 ea.)	2		
AT-3 SAGGER ATGM	4		
AS-12 ASM	4 or 2		
SA-7 GRAIL AAM	2		
MISTRAL AAM	2		

VARIANTS
SA 341 GAZELLE: Developed by Aerospatiale in France. Others were built in the UK by Westland, and in Yugoslavia.
SA 341B/C/D/E: Production versions for British military. Used in communications and training and roles.
SA 341F: Production version for French Army. A GIAT M.621 20-mm cannon is installed on right side of some aircraft. Rate of fire is either 300 or 740 rpm. Upgraded engine to Astazou IIIC.
SA 341H: Export variant.
SA 342L: Export light attack variant with Astazou XIVM engine.
SA 342K: Armed SA 341F with Upgraded 870-shp Astazou XIVH engine, mostly exported to the Middle East
SA 342M: Improved ground attack variant for French Army, with 4-6 HOT ATGMs, possibly fitted with Mistral air- to-air missiles. Similar to SA 342L, but with improved instrument panel, engine exhaust baffles to reduce IR signature, navigational systems, Doppler radar, and other night flying equipment. Fitted with Viviane FCS with thermal sight for night attack. This the OPFOR Tier 1 baseline light helicopter.

NOTES
MISSIONS INCLUDE: DIRECT AIR SUPPORT, ANTI-HELICOPTER, RECONNAISSANCE, ESCORT, SECURITY, TRANSPORT, AND TRAINING. EXTERNAL STORES ARE MOUNTED ON WEAPONS "OUTRIGGERS" OR RACKS ON EACH SIDE OF THE FUSELAGE. EACH RACK HAS ONE HARDPOINT. THE BENCH SEAT IN THE CABIN AREA CAN BE FOLDED DOWN TO LEAVE A COMPLETELY OPEN CARGO AREA. CARGO FLOOR HAS TIE DOWN RINGS THROUGHOUT.

UNITED STATES ATTACK HELICOPTER AH-1F/COBRA



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations:	Bell 209	Max "G" Force:	+2.5 to -0.5 g
Date of Introduction:	1986	Ceiling (m):	
Proliferation:	At least 3 countries	Service:	5,703
Crew:	2 (pilots in tandem seats)	Hover (out of ground effect):	915
Transports	N/A	Hover (in ground effect):	4,270
Blades – Main rotor:	2	Vertical Climb Rate (m/s):	4.0
Tail rotor:	2	Fuel (liters):	
Engines:	2 x 1,775-shp GE	Internal:	1,1,50
	T-700-GE-401 turboshaft	Range:	590 Normal Load Aux Fuel
Weight (kg):		Length (rotors turning):	17.7
Maximum Gross:	6,700	Length (fuselage):	14.7
Normal Takeoff:	6,700	Width (including wing):	3.3
Empty:	4,670	Height:	4.2
Speed (km/h):		Main Rotor Diameter:	14.7
Max (level):	350	Tail Rotor Diameter:	3.0
Cruise:	270	Standard Payload (kg):	1,740
AMMUNITION	**SPECIFICATIONS**	**AMMUNITION**	**SPECIFICATIONS**
ARMAMENT:	3x barrel 20-mm Gatling gun in chin turret. On 4 under wing hard points, it can mount 8 x TOW or Hellfire ATGMs (or four each), and 2 x 2.75-in FFAR rocket pods. AIM-9L/ Side winder provides air-to-air capability.	MOST PROBABLE ARMAMENT:	AH-1W: A representative mix when targeting armor formations is eight Hellfire missiles, two2.75-in rocket pods and 750x 20-mm rounds. Gun is centered before firing under wing stores.
Range:	(practical) 1,500 m	Antitank Guided Missiles:	TOW 2
Elevation:	21° up to 50° down	Warhead Type:	Tandem Shaped Charge
Traverse:	220°	Armor Penetration (mm CE):	900+ estimated
Ammo Type:	AP, HE	Maximum Range (m):	3,750
Rate of Fire:	Burst 16±4, continuous 730±50	Rate of fire (missiles/min):	3-4 based on range
Antitank Guided Missiles:	HELLFIRE II		
Warhead Type:	Tandem Shaped Charge		
Armor Penetration (mm CE):	1,000+		
Maximum Range (m):	8,000+		

Rate of fire (missiles/min):	2-3		
VARIANTS	**SPECIFICATIONS**	**VARIANTS**	**SPECIFICATIONS**
AH-1J:	Initial USMC twin engine AH-1 variant fielded in the early 1970s.	AH-1RO (Romania):	Construction of a variant, possibly called "Dracula", may occur in the near future.
AH-1T:	AH-1 variant with upgraded engines and powertrain for improved performance. This minimally expanded rotor system and overall dimensions of the AH-1J. Most older AH-1J Seacobra and AH-1Ts are still in operation, having been upgraded to the AH-1W standard.	AH-1Z/AH-1(4B)W:	Four-bladed variant called the "King Cobra" or "Viper", with better flight performance. It contains an integrated digital tandem cockpit and digital map display. Improved FCS includes helmet-mount sight system.

NOTES

AVIONICS/SENSOR/OPTICS: THE MISSILE TARGETING SYSTEM USES A TELESCOPIC SIGHT UNIT (TRAVERSE 110º, ELEVATION –60º/+30º) WITH TWO MAGNIFICATIONS/FIELDS OF VIEW, A LASER AUGMENTED TRACKING CAPABILITY, TV, AND VIDEO.

ADDITIONAL MISSIONS INCLUDE: DIRECT AIR SUPPORT, ESCORT, TARGET DESIGNATION, SECURITY, RECONNAISSANCE, AIR TO AIR COMBAT, AND ANTI-SHIP. THIS AIRCRAFT COSTS APPROXIMATELY $10.7 MILLION, INEXPENSIVE COMPARED TO OTHER MODERN ATTACK HELICOPTERS; BUT ITS PERFORMANCE IS SIMILAR. THUS MANY NATIONS CONSIDER THIS AIRCRAFT AS A GOOD CANDIDATE FOR FIELDING IN ATTACK HELICOPTER SQUADRONS. THIS IS THE OPFOR TIER 1 REPRESENTATIVE HELICOPTER SYSTEM.

UNITED STATES ATTACK HELICOPTER AH-1W/SUPERCOBRA



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations:	Bell 209	Ceiling (m):	
Date of Introduction:	By 1986	Service:	5,703
Proliferation:	At least 3 countries	Hover (out of ground effect):	915
Crew:	2 (pilots in tandem seats)		Hover (in ground effect): 4,270
Transports	N/A	Hover (in ground effect):	4,270
Blades – Main rotor:	2	Vertical Climb Rate (m/s):	4.0
Tail rotor:	2	Fuel (liters):	
Engines:	2 x 1,775-shp GE	Internal:	1,1,50
	T-700-GE-401 turboshaft	Range:	590 Normal LoadAux Fuel
Weight (kg):		Length (rotors turning):	17.7
Maximum Gross:	Maximum Gross: 6,700	Length (fuselage):	14.7
Normal Takeoff:	Normal Takeoff: 6,700	Width (including wing):	3.3
Empty:	Empty: 4,670	Height:	4.2
Speed (km/h): Max (level):	350	Main Rotor Diameter:	14.7
Cruise:	270	Tail Rotor Diameter:	3.0
Max "G" Force:	+2.5 to -0.5 g	Standard Payload (kg):	1,740
AMMUNITION	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
ARMAMENT	M197, 3x barrel 20-mm Gatling gun in chin turret. On 4 under wing hard points, it can mount 8 x TOW or Hellfire ATGMs (or four each), and 2 x 2.75-in FFAR rocket pods. AIM-9L/Sidewinder provides air-to-air capability.	MOST PROBABLE ARMAMENT: AH-1W:	A representative mix when targeting armor formations is eight Hellfire missiles, two2.75-in rocket pods and 750x 20-mm rounds. Gun is centered before firing under wing stores.
20-mm 3x barrel Gatling gun, M197:		Antitank Guided Missiles:	TOW 2
Range:	(practical) 1,500 m	Warhead Type:	Tandem Shaped Charge
Elevation:	21° up to 50° down	Armor Penetration (mm CE):	900+ estimated
Traverse:	220o	Maximum Range (m):	3,750
Ammo Type:	AP, HE	Rate of fire (missiles/min):	3-4 based on range
Rate of Fire:	Burst 16+4, continuous 730+50	Antitank Guided Missiles:	HELLFIRE II
		Warhead Type:	Tandem Shaped Charge
		Armor Penetration (mm CE):	1,000+
		Maximum Range (m):	8,000+

		Rate of fire (missiles/min):	2-3
VARIANTS	**SPECIFICATIONS**	**VARIANTS**	**SPECIFICATIONS**
AH-1J:	Initial USMC twin engine AH-1 variant fielded in the early 1970s.	AH-1RO (Romania):	Construction of a variant, possibly called "Dracula", may occur in the near future.
AH-1T:	AH-1 variant with upgraded engines and powertrain for improved performance. This minimally expanded rotor system and overall dimensions of the AH-1J. Most older AH-1J Seacobra and AH-1Ts are still in operation, having been upgraded to the AH-1W standard.	AH-1Z/AH-1(4B)W:	Four-bladed variant called the "King Cobra" or "Viper", with better flight performance. It contains an integrated digital tandem cockpit and digital map display. Improved FCS includes helmet-mount sight system.

NOTES

AVIONICS/SENSOR/OPTICS: THE MISSILE TARGETING SYSTEM USES A TELESCOPIC SIGHT UNIT (TRAVERSE 110º, ELEVATION –60º/+30º) WITH TWO MAGNIFICATIONS/FIELDS OF VIEW, A LASER AUGMENTED TRACKING CAPABILITY, TV, AND VIDEO.

ADDITIONAL MISSIONS INCLUDE: DIRECT AIR SUPPORT, ESCORT, TARGET DESIGNATION, SECURITY, RECONNAISSANCE, AIR TO AIR COMBAT, AND ANTI-SHIP. THIS AIRCRAFT COSTS APPROXIMATELY $10.7 MILLION, INEXPENSIVE COMPARED TO OTHER MODERN ATTACK HELICOPTERS; BUT ITS PERFORMANCE IS SIMILAR. THUS MANY NATIONS CONSIDER THIS AIRCRAFT AS A GOOD CANDIDATE FOR FIELDING IN ATTACK HELICOPTER SQUADRONS. THIS IS THE OPFOR TIER 1 REPRESENTATIVE HELICOPTER SYSTEM.

RUSSIAN ATTACK HELICOPTER KA-50/HOKUM AND KA-52/HOKUM-B



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations:	Black Shark, Werewolf , HOKUM-A	Ceiling (m):	
Date of Introduction:	Limited fielding by 1995. Ka-52 fielding starts in 2011.	Service:	5,500
Proliferation:	2 countries	Hover (out of ground effect):	4,000
Blades – Main rotor:	6 (2 heads, 3 blades each)	Hover (in ground effect):	Hover (in ground effect): 5,500
Tail rotor:	None	Vertical Climb Rate (m/s):	10
Engines:	2x 2,200-shp Klimov	Fuel (liters):	
Weight (kg):		Internal:	INA
Maximum Gross:	10,800	Range:	500 ea. (max 4 x)
Normal Takeoff:	9,800	Length (rotors turning):	16
Empty:	7,692	Length (fuselage):	15.0
Speed (km/h): Max (level):	310, 390 diving	Width (including wing):	7.34
Cruise:	270	Height:	(gear extended): 4.93 (gear retracted): 4
Sideward:	100+, Rearward: 100+	Main Rotor Diameter:	14.5 Cargo
Turn Rate:	Unlimited	Tail Rotor Diameter:	None
Max "G" Force: Survivability Countermeasures:	+3 to +3.5 g Main rotors and engines electrically deiced. Infrared signature suppressors can mount on engine exhausts. Pastel/L-150 radar warning receiver, laser warning receiver, IFF, chaff and flares. Armored cockpit. Self-sealing fuel tanks. Pilot ejection system.	External weapons load:	2,500 kg on 4 under-wing hard points.
AMMUNITION		**AMMUNITION**	**SPECIFICATIONS**
Most probable armament: HOKUM A/B/N:	Fuselage-mounted 30-mm cannon on right side, 40 x 80-mm rockets,12 x Vikhr-M ATGMs, 2 x SA-	Armor Penetration (mm):	1,200

	24AAMs(ATGM pod can launch SA-24AAMs).		
Guided Missiles:	AT-16/Vikhr-M antitank missile	Rate of fire (missiles/min):	2-3 per range
Guidance:	Laser-beam rider, prox on/off	Range (m):	1,000- 10,000
Warhead:	Tandem shaped Chge (HEAT)	Other Missile Types:	AT-16 HE, Ataka 9M120-1 HEAT, HE

VARIANTS

Ka-50A/HOKUM A:
Original Hokum. Due to poor performance, it will not be fielded.

Ka-50N/HOKUM N:
Night attack variant fitted with a nose-mounted FLIR from Thomson-CSF. The cockpit is fitted with an additional TV display, and is NVG compatible. These replace the Saturn pod on HOKUM-A. ATGM pods hold 6 AT-16/Vikhr missiles. Later, dual-seat versions were developed. Dual-seat arrangement can significantly improve effectiveness of a combat aircraft, because it frees up the pilot for precision flying, and provides a weapons officer who can give full attention to the combat mission.

Ka-52/Alligator/HOKUM-B:
Tandem, dual-seat cockpit variant of Ka-50, with 85% of its parts in commonality. Although performance is slightly inferior to Ka-50 in some areas (Max g 3.0, 3,600 m hover ceiling), it out-performs its predecessor in other areas (such as 310 km/h max speed), and has an equal service ceiling and range. An upgrade to the more powerful VK-2500 engine has begun.
Ka-52 can be used as an air and ground attack. The fire control system employs a mast-mounted FH-01/Arbalet millimeter wave radar covering the front quadrant. The fire control system has a chin-mounted TV, FLIR, and laser in the UOMZ DOES stabilized ball mounted behind the cockpit. Also included is a Prichal laser range-finder/laser target designator (LTD), with a range of 18+ km. It can acquire, auto-track, and engage moving targets at a range of 15 km. Stationary targets can be engaged to 18+ km. The Ka-52 can launch AT-16/Vikhr ATGMs, with LBR guidance.
However, there have been issues with that missile. A version of AT-9/Ataka, 9M120-1 now has added LBR guidance to its RF; so it could be used on the Ka-52, and supplement or replace Vikhr missile loads. Another option to replace or supplement Vikhr is Hermes-A. The aircraft has been displayed with 2 pods (12 multi-role missiles), and has been successfully tested. It is a 2-stage supersonic missile with a 170-mm booster stage and 130-mm sustainer. The aircraft can use its own LTD for guidance, or launch but defer to a remote LTD (man-portable, vehicle mounted, or UAV-mounted) for terminal phase, and shift to its next target. These multi-mode guided ASMs have a range of 18 (15-20) km, and a 28-kg HE warhead large enough to kill any Armored vehicle, and a wide variety of other air or ground targets.
This helicopter is also equipped with a Hermes-A multi-role missile with a Weight (kg): 32 (in tube)
Guidance: Inertial/ MMW radar ACLOS or SAL-H with auto-tracker lock-on
Warhead: HE, 28 kg
Armor Penetration (mm): 1,30 0+
Rate of fire (missiles/min): 2
Range (m): 18,000 maximum
A 40-km version of Hermes was tested and is due in the Near Term. A 100-km version (with a 210 mm booster, for 4 missiles per pylon) is featured at the KBP Tula site, and will be an option. Future versions will have an IR or radar-homing option. The Ka-52 adds workstation equipment for air battle management. It has 2 workstations with aircraft controls for mission hand-off. Russian forces have demonstrated operations with Ka-52s controlling flights of Ka-50N helicopters. It can also be used as a trainer for the Ka-50N.

Ka-50-2/Erdogan:
Russian/Israeli cooperative effort competing for the Turkey helicopter contract. The variant has Israeli avionics and a tandem dual seat cockpit similar to the Apache.

NOTES

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RUSSIAN ATTACK HELICOPTER MI-24/35 HIND





SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations:	Mi-25 or Mi-35 for exports	Hover (out of ground effect):	1,500
Date of Introduction:	1976 (HIND D)	Hover (in ground effect):	2,200
Proliferation:	At least 34 countries	Vertical Climb Rate (m/s):	15
Crew:	2 pilots in tandem cockpits	Fuel (liters):	
	8 troops/4 litters	Internal:	1,840
Blades – Main rotor:	5	Internal Aux Tank (in cabin):	1,227
Tail rotor:	3	External Fuel Tank:	500 ea. x 2

Engines:	2x 2,200-shp Klimov TV3-117VMA turboshaft	Range (km):	
Weight (kg):		Normal Load:	450
Maximum Gross:	11,500	With Aux Fuel:	950
Normal Takeoff:	11,100	Dimensions (m):	
Empty:	8,500	Length (rotors turning):	21.6
Speed (km/h): Max (level):	335	Cargo Compartment Dimensions (m):	
Cruise:	295	Floor Length:	2.5
Max "G" Force:	1.75 g	Width:	1.5
Ceiling (m):		Height:	1.2
Service:	4,500	External weapons load:	1,500 kg (no weapons): 2,500 kg
AMMUNITION	**SPECIFICATIONS**	**AMMUNITION**	**SPECIFICATIONS**
Fuselage/nose mount gun/MG:	1	57-mm S-5 rocket pods (32 ea.)	2-4
7.62/12.7-mm door MG:	1	122-mm S-13 rocket pods (5 ea.)	2-4
AT-2/-6/-9 ATGMs:	2	240-mm S-24 rocket pods (1 ea)	2-4
80-mm S-8 rocket pods (20 ea.):	2-4	250-kg bombs, including FAE	4
500-kg bombs, including FAE:	2	Protection/Survivability/Countermeasures: Armored cockpit and titanium rotor head defeat 20-mm rds. Overpressure system is used for NBC environment. Infrared signature suppressors on engine exhausts. Radar warning receivers, IFF. Infrared jammer, rotor brake. Armored cockpit. ASO-4 Chaff/flare dispenser.	
KMGU or K-29 Mine pods:	2-4		
Gun/MG/AGL pods (See below):	2-4		
AA-8/R-90 or SA-24AAM:	2-4		
ARMAMENT: Mi-24 has a fuselage or turret nose gun, and at least one door machinegun. It also has 6 pylons (hardpoints), on which it can mount bombs, missiles (ATGMs, ASMs, AAMs), rockets, and gun or grenade or mine pods. Mission dictates weapon configuration. Available munitions are shown above; not all may be employed at one time. As ammunition/payload weight is expended, more passengers can fit aboard the aircraft.		Most Probable Armament: HIND D: Nose turret-mounted 4-barrel 12.7-mm Gatling type minigun, 1,470 rds, 4 pods of 57-mm rockets, and 4 x AT-2C/ SWATTER ATGMs. HIND E: Nose turret-mounted 4-barrel 12.7-mm Gatling type minigun, 40 x 80-mm rockets and 8 x AT-6C/SPIRAL ATGMs. HIND F: GSh-30K gun on fuselage, 40 x 80-mm rockets, 8 x AT-6C ATGMs, and 2x SA-24AAMs. Mi-35M2: Nose turret 23-mm twin gun 470 rds, 40 x 80-mm (or 10 x 122-mm) rockets, 8 AT-6c (or 8 AT-9), and 2 x SA-24 AAMs. For tank destroyer role, exchange rocket pods for 8 more ATGMs.	
Fuselage-Mounted Guns/Machineguns: Guns vary widely with different variants (see below). Some are fixed, providing accurate fires along the flight path. Nose turret guns offer more responsive fires against targets to sides, but may lack accuracy, range and ammo capacity of fixed guns. The gun is		AVIONICS/SENSOR/OPTICS: The ATGM targeting system uses a low-level light TV, a laser target designator, PKV Gun sight for pilot, air data sensor, and a missile guidance transmitter. Some versions and specific forces have upgraded FCS.	

assisted by rear and side mount guns and arms operated by passengers. Onboard combat troops can fire personal weapons through cabin windows. For gunship missions, usually the only troop is a door gunner, thus permitting more ammo in the cabin. Also, to complement main gun fires, crews can add gun pods		
Guided Missiles: AT-6b or AT-9/Ataka-M Guidance: Radio-guided Warhead: Tandem shaped Chge (HEAT) Armor Penetration (mm): 1,100, 800+ERA Rate of fire (missiles/min): 3-4 Range (m): 400-7,000 (6,000 AT-9) Other Missile Types: AT- 6/Ataka HE, 9A2200 anti-helicopter w/prox fuze		
VARIANTS		
Mi-24A/HIND A/B/C: The original -A helicopter had side-by-side seats, single-barrel 12.7-mm MG, 57-mm rocket pods, and AT-2a/b/SWATTER-A/B ATGMs. The export HIND A launched AT-3/SAGGER ATGMs. All of these missiles were manually controlled (MCLOS). The HIND B never entered production. HIND C was a trainer, without a gun pod. Nearly all of the older HIND A, B and C variants have been upgraded or modified to the HIND D or E standard.		
Mi-24D/HIND D: This represents an OPFOR Tier 4 helicopter capability. This gunship has a more powerful engine and improved fire control system. Other upgrades include a 4-barrel 12.7-mm Gatling type gun. Rocket pods can be mounted on the inner 4 pylons, and AT-2c/ SWATTER-C ATGMs can be mounted on wing pylons. These SACLOS missiles offer superior range and operational precision over earlier versions. There are NVGs and II sights, which permit night flying but virtually no night engagement capability, except in illuminated areas. Mi-25 is the export version.		
Mi-24V/HIND E: The most proliferated version. This variant represents OPFOR Tier 3 helicopter capability. It has the 4-barrel mini-gun and up to 8 AT-6/ Shturm-V series ATGMs (most recent is AT-6C). It can also launch Ataka/AT-9 series ATGMs. With its heads-up-display (HUD) fire control system, the aircraft can also launch AA-8 AAMs. Mi-35 is an export version of HIND E. Mi-35O night attack upgrade with an Agema FLIR ball.		
Mi-24P/HIND F: This gunship variant has A 30-mm twin gun affixed to right side. ATGMs are the AT-6 and AT-9 series. Mi-35P is an export version of the HIND F.		
Mi-24PS: Ministry of Internal Affairs version, with wingtip ATGM launchers, sensor ball with FLIR night sights and loud speakers.		
Mi-24R/HIND G-1: Mi-24V variant for NBC sampling. It has mechanisms for soil and air samples, filter air, and place marker flares.		
Mi-24K/HIND G-2: Photo-reconnaissance and artillery fire direction variant. It has a camera in the cabin, gun, and rocket pods, but no targeting system. Upgrades to the Mi-35M standard are the Mi-24VK-1 and Mi-24PK-2.		
Mi-24PN/Mi-35PN: Russian upgrade of Mi-24P/35P with Zarevo FLIR FCS.		
Mi-24VP: Mi-24VP is a Russian response to lack of satisfaction with the 30-mm gun. This variant replaces the gun with a twin 23-mm nose turret gun and 470-mm rounds. It has been fielded in limited numbers.		
Mi-24VM/Mi-35M: The program integrates a suite of compatible upgrades. It has main and tail rotors from Mi-28, and a new engine		

and transmission, with improved capability for nap-of-the-earth (NOE) flight. It includes: hardpoints reduced to 4, hover rise to 3,000 m, fiberglass rotor blades, fixed landing gear, scissors tail rotor, new nav, and stabilized all-weather FLIR ball FCS. Export Mi-24VP with FLIR sights is Mi-35M1 (NFI). Mi-35-PM is a Mi-35P upgraded to -M standard. Indian Mi-35s are upgrading to -M standard.
Mi-24VK-1 and Mi-24PK-2: Upgrades for earlier helicopters to the Mi-35M standard.
The Mi-35M2: This is the latest export version, and the most robust version of the Mi-24/35 HIND helicopter. This variant represents OPFOR Tier 2 helicopter capability. It has new 2,400- shp VK-2500 engines. Ceiling is increased to 5,700 m (4,000 hover). The French based FCS pod has a Chlio FLIR night sight. Armament is: twin barrel 23-mm nose turret gun, 12.7-mm NSV MG (at the cargo door), 16 x AT-6c (or AT-9) ATGMs, and 2 rocket pods. Other options include AA-8, AA-11, or SA-24 AAMs. A 30-mm nose gun is available. For tank destroyer role, exchange rocket pods for pods with 8 more ATGMs.
Mi-35D: Export private venture upgrade with weapons systems from the Ka-50/Hokum helicopter. Changes include the Shkval FCS, Saturn FLIR, and up to 16 AT-16/Vikhr ATGMs. For AAM, the AA-18 would be replaced with AA-18S (SA-18S/Igla-Super).
Tamam Mi-24 HMSOP/ Mission 24: Israeli upgrade program. It includes a TV FCS with FLIR, autotracker, and GPS. Contrary to other HINDs, The pilot sits in front, with the gunner in the rear. ATGM is the NLOS Spike-ER. The launcher can also launch Skylite UAVs, then hand them off to ground controllers.
Mi-24 Mk III: South African upgrade. It has a 20-mm Gatling-type gun, and ZT-35/ Ingwe ATGM. The Ukrainian Super HIND Mk II would be similar, with Mokopa.

NOTES
ADDITIONAL MISSIONS INCLUDE: DIRECT AIR SUPPORT, ESCORT, TARGET DESIGNATION, SECURITY, RECONNAISSANCE, AIR TO AIR COMBAT, AND ANTI-SHIP. OPTIONAL UPGRADES INCLUDE THE MI-28'S AT-9/ATAKA 8-MISSILE LAUNCHER (16 TOTAL), OR ISRAELI SPIKE-LR ATGM LAUNCHER. A NEW UPGRADE IS ADDITION OF A LASER TARGET DESIGNATOR IN THE FCS, WHICH CAN GUIDE SEMI-ACTIVE LASER-HOMING BOMBS, AND LASER-GUIDED 57/80/122-MM ROCKETS FROM PODS.

RUSSIAN ATTACK HELICOPTER MI-28N/HAVOC





SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations:	N/A	Hover (out of ground effect):	3.600
Date of Introduction:	N/A	Hover (in ground effect):	INA
Proliferation:	Algeria, Kenya, Iraq, Venezuela	Vertical Climb Rate (m/s):	INA
Crew:	2	Fuel (liters):	
Blades – Main rotor:	5	Internal:	1,900
Tail rotor:	4	Internal Aux Tank (in cabin):	INA
Engines:	2x 2,200-shp Klimov TV3-117VMA turboshaft	External Fuel Tank:	INA
Weight (kg):		Range (km):	
Maximum Gross:	11,500	Normal Load:	475
Normal Takeoff:	10,400	With Aux Fuel:	1,100
Empty:	7,000	Dimensions (m):	
Speed (km/h): Max (level):	300	Length (rotors turning):	21.2
Cruise:	260	Cargo Compartment Dimensions:	Negligible
Sideward\Rearward:	100/100	Standard Payload:	3,640 kg on 4 under wing stores points.
Max "G" Force:	-.5 to +3.7 g	Width (including wing):	4.9
Ceiling (m):		Height:	4.7
Service:	6,000	Tail Rotor Diameter:	3.8

Survivability/Countermeasures:
Armored cockpit frame is made of titanium, steel and ceramic. It can withstand hits of 20-mm shells at a minimum. The cockpit glass is bulletproof to 12.7-mm rounds, and resistant to fragmentation from 20-mm shells. The HAVOC has a high altitude ejection system that jettisons wings and cockpit doors when the crew jumps to safety with parachutes. It has a "technical compartment" accommodating two persons, to evacuate the crew from downed aircraft. Main rotors and engines are electrically deiced. Self-sealing fuel tanks. Infrared signature suppressors mounted on engine exhausts. Radar warning receivers, pressurized cockpit, IFF, chaff, decoys

AMMUNITION	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
1x 2A42 30-mm cannon	250 Rds.	250/500-kg bombs	2-4
AT-6c or AT-9/Ataka pods (4 ea pod)	2-4	SA-24 AAM pod (2-4 ea)	2

S-8 80-mm rocket pod (20 ea) or S-13 122-mm rocket pod (5 ea) Preferred type S-8Cor laser-guided	2-4	KMGU scatterable mine pod	2-4
AS-12/KEGLER ASM	2	Mission dictates weapons configuration. Not all will be employed at the same time.	
23-mm gun pods (250 rds) Most Probable Armament:	2		
Mi-28A/N:	Chin turret-mounted 2A42 30-mm auto-cannon, 40 x 80-mm (or 10 x 122-mm) unguided or semi-active laser-homing rockets, 14 x AT-6c/Kokon-M ATGMs, and 2 x SA-24 AAMs. Note. The ATGM pods can launch other ATGMs and selected AAMs.	SENSOR/OPTICS:	The HAVOC has optical magnification, a HUD, 2 FLIR sights, targeting radar, and a laser designator for target engagement. A helmet sighting system turns the cannon in the direction the pilot is looking. Rotor blade-tip pitot tubes give speed/drift data for targeting at low airspeed.

VARIANTS
Mi-28A: The original version, and is primarily a daylight only aircraft.
Mi-28N: The Mi-28N has avionics upgrades. Use of night-vision goggles gives day/night, all-weather mission capability. The "Night version."
Mi-28NE(for export): This aircraft features an integrated rotor-hub radar for targeting and navigation, autopilot, an inertial nav system, thermal night sight, and low-light level TV helmet targeting system for target engagement. It is probable that changes for the Mi-28M (below) will be applied to Mi-28N, and in fact, to all Mi-28s.
Mi-28M: Next upgrade version currently in development. It includes 2x 2,400-shp Klimov VK-2500 (TV3-117SB3) turboshaft engines, improved transmission, and more efficient rotor blades. These compensate for added avionics weight, and increases in armament basic load. The aircraft's upgraded avionics offer better coordination of group combat actions through datalinks. A likely ATGM change will be to the Krizantema/AT-15, with 6,000-m range and 1,500+ mm penetration. A version of AT-9/Ataka, 9M120-1 now has RF and laser beam rider guidance as on Krizantema. Thus Ataka can be used to supplement AT-15missile loads.

NOTES
ADDITIONAL MISSIONS INCLUDE: DIRECT AIR SUPPORT, ESCORT, TARGET DESIGNATION, SECURITY, RECONNAISSANCE, AIR TO AIR COMBAT, AND ANTI-SHIP. ALTHOUGH THIS AIRCRAFT IS ROUTINELY COMPARED TO THE U.S. AH-64 APACHE, IT IS MUCH LARGER AND LESS MANEUVERABLE THAN ITS U.S. COUNTERPART.

BRITISH MEDIUM MULTIROLE HELICOPTER LYNX



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations:	AH. Mk-1, 7, 9	Hover (out of ground effect):	3,230, 5,126
Date of Introduction:	1977	Hover (in ground effect):	3,660
Proliferation:	At least 11 countries	Vertical Climb Rate (m/s):	7
Crew:	2 pilots. Transports 9 troops, 6 litters, or cargo.	Fuel (liters):	
Blades – Main rotor:	4	Internal:	985
Tail rotor:	4	Internal Aux Tank (in cabin):	696
Engines:	2x 900-shp Rolls Royce Gem 42-1 turboshaft, 2x 1,260 LHTEC CTS800-4N turboshaft (Mk 9)	Range (km):	
Weight (kg):		Normal Load:	630
Maximum Gross:	4,535, 5,126 (Mk 9)	With Aux Fuel:	1,342
Normal Takeoff:	2,658, 3,496 (Mk 9)	Main Rotor Diameter:	12.8
Empty:	2,578	Tail Rotor Diameter:	2.2, 2.4 (Mk 9) Cargo
Speed (km/h): Max (level):	289	Floor Length:	2.1
Cruise:	259, 285 (Mk 9)	Width:	1.8
Sideward/Rearward:	Sideward:130/ Rearward:INA	Height:	1.4
Max "G" Force:	+2.3 to -0.5	Standard Payload (kg):	
Ceiling (m):		Internal load:	907
Service:	INA	External on sling only:	1,360, 2,000 (Mk 9)
SURVIVABILITY/COUNTERMEASURES: Engine exhaust suppressors, infrared jammer, and flare/chaff dispensers are available. Rotor brake and self-sealing fuel tanks are used.			
ARMAMENT: The Lynx employed by ground forces can be equipped with two 20-mm cannons mounted externally to permit 7.62-mm machineguns to be fired from the cabin. Two fuselage pylons allow for external stores.			
AVIONICS/SENSOR/OPTICS: Army variants equipped for TOW missiles have a roof-mounted sight (over the left-hand pilot's seat) with IR and thermal capabilities for firing. Optional equipment allows for target magnification, LLLTV, cameras, and IR searchlight. Safire or other FLIR for night capability.			
NIGHT/WEATHER CAPABILITIES:			

The aircraft is NVG compatible, and through instruments, avionics, autopilot, and Doppler navigation system, is capable of operations day and night, and is instrumented for adverse meteorological conditions.
VARIANTS
Developed under a partnership between predominantly Westland of the United Kingdom and Aerospatiale of France. Listed below are primary and most proliferated variants used by ground forces. Many others exist in small numbers for ground and naval forces.
Lynx AH. Mk 1: **The basic army multirole and gunship version. This aircraft has skid-type landing gear. Most have been converted to Mk 7 format.**
Lynx AH. Mk 7: **Also known as AH 1. Upgraded British army version, some with improved main rotor blades. Reverse-direction tail rotor to reduce noise signatures and improve performance. Aircraft has skid-type landing gear.**
Lynx AH. Mk 9: **Aka Super Lynx or Light Battlefield Helicopter. Implemented tricycle-type landing gear, improved rotor blades, and upgraded engines to increase performance.** **Mostly used in tactical transport role, with no ATGM launch capability.**
Battlefield Lynx: **Export version of Lynx AH. Mk 9 that can be armed with ATGMs.**

NOTES
THIS AIRCRAFT WAS DESIGNED TO BE BOTH A TRANSPORT AND AN ATTACK AIRCRAFT. MISSIONS INCLUDE: DIRECT AIR SUPPORT, ANTI- HELICOPTER, RECONNAISSANCE, ESCORT, SECURITY, TRANSPORT, AND TRAINING. EACH FUSELAGE SIDE HAS ONE PYLON ALLOWING FOR A SINGLE GUN POD OR MISSILE RACK. LYNX IS CAPABLE OF SINGLE-ENGINE FLIGHT IN THE EVENT OF LOSS OF POWER BY ONE ENGINE (DEPENDING ON AIRCRAFT MISSION WEIGHT) WITH ITS ENGINE LOAD SHARING SYSTEM. IF AN ENGINE FAILS, THE OTHER'S OUTPUT INCREASES.

RUSSIAN MEDIUM MULTIROLE HELICOPTER MI-2/HOPLITE





SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations:	INA	Hover (out of ground effect):	1,000
Date of Introduction:	1965	Hover (in ground effect):	2,000
Proliferation:	Widespread	Vertical Climb Rate (m/s):	4.5
Crew:	1 (pilot)	Fuel (liters):	
Blades – Main rotor:	3	Internal:	600
Tail rotor:	2	External Fuel Tank:	238 ea.
Engines:	2x 400-shp PZL GTD-350 (series III and IV) turboshaft	Range Max Load (km):	170
Weight (kg):		Internal Fuel Load:	440
Maximum Gross:	3,700	With Aux Fuel:	790
Normal Takeoff:	3,550	Main Rotor Diameter:	14.6
Empty:	2,372	Tail Rotor Diameter:	2.7
Speed (km/h): Max (level):	220	Dimensions (m):	
Cruise:	194	Length (rotors turning):	17.4
Sideward/Rearward:	INA	Length (fuselage):	11.9
Max "G" Force:	INA	Width:	3.2
Ceiling (m):		Height:	3.7
Service:	4,000		

SURVIVABILITY/COUNTERMEASURES:
Main and tail rotor blades electrically deiced.

ARMAMENT:
The Lynx employed by ground forces can be equipped with two 20-mm cannons mounted externally to permit 7.62-mm machineguns to be fired from the cabin. Two fuselage pylons allow for external stores.

AVIONICS/SENSOR/OPTICS:
The cannon is pilot sighted, and fire is adjusted by controlling attitude of the aircraft.

NIGHT/WEATHER CAPABILITIES:
The Mi-2 is primarily a daylight only aircraft.

ARMAMENT:
23-mm Automatic Cannon, NS-23KM:
Range: (practical) 2,500 m
Elevation/Traverse: None (rigidly-mounted)
Ammo type: HEFI, HEI, APT, APE, CC
Rate of Fire (rpm): (practical) 550
7.62-mm or Pintle-mounted Machinegun: (may be mounted in left-side cabin door)
Range: (practical) 1,000 m
Ammo type: HEFI, HEI, APT, APE, CC

Rate of Fire (rpm): (practical) 250 OR 12.7-mm or Pintle-mounted Machinegun: (may be mounted in left-side cabin door) Range: (practical) 1,500 m Ammo type: API, API-T, IT, HEI Rate of Fire (rpm): (practical) 100
VARIANTS
Mi-2B: Upgrade with improved navigation and electrical systems
Mi-2R: Ambulance version that carries 4x litter patients.
Mi-2T: Transport version that carries 8 personnel.
Mi-2URN: Armed reconnaissance variant, employs 57-mm unguided rockets, and mounts a gun sight in the cockpit for aiming all weapons.
Mi-2URP: The antitank variant. Carries 4x AT-3C Sagger ATGMs on external weapons racks, and 4x additional missiles in the cargo compartment.
Mi-2US: The gunship variant, employs an airframe modification that mounts a 23-mm NS-23KM cannon to the portside fuselage. It also employs 2x 7.62-mm gun pods on external racks, and 2x 7.62-mm pintle-mounted machineguns in the cabin.
PZL Swidnik: A Polish-produced variant under license from Russia. It features minor design changes, but same performance, characteristics, and missions. Polish MOD officials will upgrade the gunship version with a new ATGM. Likely choice is between the Israeli 6 km FOG-M Spike-ER missile, and the 4 km HOT-3. The 4-missile launcher will also have a thermal night sight.

NOTES
EXTERNAL STORES ARE MOUNTED ON WEAPONS RACKS ON EACH SIDE OF THE FUSELAGE. EACH RACK HAS TWO HARDPOINTS FOR A TOTAL OF FOUR STATIONS. ADDITIONAL MISSIONS INCLUDE; DIRECT AIR SUPPORT, RECONNAISSANCE, TRANSPORT, MEDEVAC, AIRBORNE COMMAND POST, SMOKE GENERATING, MINELAYING, AND TRAINING. THE CABIN DOOR IS HINGED RATHER THAN SLIDING, WHICH MAY LIMIT OPERATIONS. THERE IS NO ARMOR PROTECTION FOR THE COCKPIT OR CABIN. AMMO STORAGE IS IN THE AIRCRAFT CABIN, SO COMBAT LOAD VARIES BY MISSION. SOME MI-2USS CURRENTLY EMPLOY FUSELAGE-MOUNTED WEAPON RACKS RATHER THAN THE 23-MM FUSELAGE-MOUNTED CANNON, WHICH IS REMOVED. SOME VARIANTS HOWEVER, STILL EMPLOY THE CANNON.

CHINESE MEDIUM MULTI-ROLE Z-9/HAITUN AND WZ-9 GUN SHIP





SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations:	50	Hover (out of ground effect):	1,020 Z-9A 1,600 Z-9B
Date of Introduction:	1994	Hover (in ground effect):	1,950 Z-9A 2,600 Z-9B
Proliferation:	At least 3 countries.	Vertical Climb Rate (m/s):	246
Crew:	1 for Z-9, 2 for WZ-9. Transports 9-12 troops, 4-8 litters or cargo.	Fuel (liters):	
Blades – Main rotor:	4	Internal:	1,140
Tail rotor:	13 Z-9A, 11 Z-9B/WZ-9	External Fuel Tank:	180
Weight (kg):		Normal Fuel Load:	860
Maximum Gross:	4100	With Aux Fuel:	1,000
Empty:	2050	Dimensions (m):	
Speed (km/h): Max (level):	315	Length (rotors turning):	13.7
Cruise:	280	Length (fuselage):	12.1 without rotors
Max "G" Force:	INA	Compartment Dimensions: (m)	
Ceiling (m):		Floor Length:	2.2
Service:	4,500 Z-9A, 6,000 Z-9B/WZ-9	Width:	1.9
		Standard Payload (kg):	
		Internal load:	INA
		External on sling only	1,600
		Max:	2,038

SURVIVABILITY/COUNTERMEASURES:
Light armor panels. All composite rotors and fenestron, and composite body structure reduce signature. Nomex honeycomb
in structure. Limited countermeasure capability.

ARMAMENT:
Two fixed 23-mm guns or 12.7-mm MGs.
Two pylons permit mounting up to 8
ATGMs, or 4 plus 2 rocket pods.

MOST PROBABLE ARMAMENT:
Combat versions (WZ-9 and Z-9G) have Twin 23-mm gun, four Red Arrow-8F ATGMs, 2x 7-round 90-mm rocket pods, and 2 TY
90 IR-homing AAMs.

ROCKETS AND MISSILES:
Name: Red Arrow-8F
Type: ATGM
Warhead: Tandem Shaped Charge
Armor Penetration (mm CE): 1,100
Min/Max Range (m): 100/4,000
Rate of fire (missiles/min): 3-4, depending on range.

Name: Type 90-1 **Type: Air-to-surface rocket** **Warhead: Frag-HE** **Max Range (m): 7,000**
AVIONICS/SENSOR/OPTICS: **WZ-9 has a day/night all-weather capability with gyro-stabilized TV/IRST FLIR chin pod gunsight, and SFIM autopilot. Transponder and weather radar is optional. Datalink for naval observation supports over-the-horizon attack**
NIGHT/WEATHER CAPABILITIES: **The aircraft is NVG compatible, and through instruments, avionics, autopilot, and Doppler navigation system, is capable of operations day and night, and is instrumented for adverse meteorological conditions.**
VARIANTS
Z-9A: **Military production version with some upgrades, such as Arriel 1C2 engine, upgrade instrument panel, and 150-kg payload increase.**
Z-9A 100: **Indigenously produced version.**
Z-9B: **Current production version for multi-role use, based on Dauphin 2 designs. Changes include 11-blade tail rotor.**
Z-9C: **Naval version for ASW and SSM, with Sinatra HS-12 dipping sonar and torpedo. It has a datalink to support targeting for YJ-82 SSM. An expected near-term upgrade is the C-701 TV guided air-to-surface missile.**
WZ-9: **Light attack version of Z-9B (see ARMAMENT, left). Poss aka Z-9W. Export version is Z-9G.**
Z-9Z: **Reconnaissance prototype.**

NOTES
DESPITE STATEMENTS FROM SOME SOURCES, WZ-9 IS TOO LIGHTLY PROTECTED TO BE AN "ATTACK HELICOPTER". THE Z-9 WAS DESIGNED TO BE ADAPTABLE FOR A VARIETY OF ROLES, INCLUDING TRANSPORT, DIRECT AIR SUPPORT, ESCORT, SECURITY, RECONNAISSANCE, AMBULANCE, ANTI-SUBMARINE WARFARE, IW, AIRBORNE C2, SEARCH AND RESCUE, ANTI-SHIP, AND ANTI-SUBMARINE WARFARE. EACH FUSELAGE SIDE HAS ONE PYLON ALLOWING FOR A SINGLE POD OR MISSILE RACK. AN EXPECTED UPGRADE FOR WZ-9/Z-9G IS THE RED ARROW 9 LASER-BEAM RIDER/MMW GUIDED ATGM, WITH 1,200 MM PENETRATION AND 5 KM RANGE.

EUROPEAN MULTIROLE HELICOPTER AS-532/COUGAR



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations:	AS 332 Super Puma, SA 330 Puma	Fuel (liters):	
Date of Introduction:	1981	Internal:	1,497 (UC/AC), 2,000 (UL/AL), 2,020 (U2/A2)
Proliferation:	At least 38 countries	External Fuel Tank:	
Crew:	2 (pilots) Transports: 20-29 troops or 6-12 litters (variant dependent), or cargo.	With Aux Fuel:	1,017 (UC/AC), 1, 245 (UL/AL), 1,176 (U2/A2)
Blades – Main rotor:	4	Dimensions (m):	
Tail rotor:	5, 4 (U2/A2)	Length (rotors turning):	18.7-19.5 (U2/A2)
Weight (kg): Normal Takeoff:	8,600 (Mk I), 9,300 (Mk II)	Length (fuselage):	15.5 (UC/AC),
Maximum Gross:	9,000 (Mk I), 9,750 (Mk II)	Floor Length:	16.3 (UL/AL), 16.8 (U2/A2)
Empty:	4,330 (UC/AC), 4,460 (UL/AL), 4,760 (U2/A2)	Width:	3.6-3.8 (U2/A2)
Speed (km/h): Max (level):	275 (Mk I), 325 (Mk II)	Main Rotor Diameter	15.6-16.2 (U2/A2)
		Tail Rotor Diameter:	3.1-3.2 (U2/A2)
Ceiling (m):	270	Cargo Compartment Dimensions (m):	
Service:	4,100	Floor Length:	6.5 (AC/UC), 6.8 (UL/AL), 7.9 (U2/A2)
Hover (out of ground effect):	1,650 (Mk I) 1,900 (Mk II)	Width/Height:	1.8/1.5
Hover (in ground effect):	2,800 (Mk I), 2,540 (Mk II)	Standard Payload (kg):	
Vertical Climb Rate (m/s):	7	Internal load:	3,000
		External on sling only:	4,500
SURVIVABILITY/COUNTERMEASURES: Main and tail rotor blades electrically deiced. A radar warning receiver is standard, while a laser warning receiver, missile launch detector, missile approach detector, infrared jammer, decoy launcher, and flare/chaff dispensers are optionally available.			
WEAPONS 7.65-mm MG (2) Other Loading Options			

20-mm twin gun pods (2), 68-mm rocket pods (22 each), (2), 2.75-in rocket pods (19 each), (2), External fuel tanks (600 liters). Mission dictates weapons configuration. Not all will be employed at the same time.
ARMAMENT: The Mk I variants may employ 2x 7.65-mm machine guns on pintle-mounts in the cabin doors when employed in a transport role.
MOST PROBABLE ARMAMENT: The armed versions have side-mounted 20-mm machineguns and/or axial pods fitted with 68-mm rocket launchers.
AVIONICS/SENSOR/OPTICS: Night/Weather Capabilities: The aircraft is NVG compatible, and through its instruments, avionics, full autopilot, and navcomputer, is capable of operation in day, night, and instrument meteorological conditions.

VARIANTS	SPECIFICATIONS
SA 330 Puma:	Developed in the late 1960s by Aerospatiale in France. Others were built in the UK, Indonesia, and Romania.
AS 332 Super Puma:	Differs from the SA 330 Puma through an improved rotor system, upgraded engines, stretched fuselage, and a modified nose shape.
The Cougar name was adopted for all military variants. In 1990, all Super Puma designations were changed from AS 332 to AS 532 to distinguish between civil and military variants. The "5" denotes military, "A" is armed, "C" is armed-antitank, and "U" is utility. The second letter represents the level of "upgrading".	
AS-532 Cougar UC/AC Mk I:	The basic version with a short fuselage to carry 20 troops.
AS-532 Cougar UL/AL Mk I:	This version has an extended fuselage, which allows it to carry 25 troops and more fuel. It is also capable of carrying an external load of 4,500 kg.
AS-532 Cougar U2/A2 Mk II:	This 1992 version is the longest variant of the Cougar line. It has an improved Spheriflex rotor system with only 4x tail rotor blades, and 2x 2,100-shp Turbomeca Makila 1A2 turboshaft engines that allow an increased cargo carrying capability. It can transport 29 troops or 12 litters, or an external load of 5,000 kg. Primarily used for combat search and rescue, and as an armed version. It may be armed additionally with a 20-mm cannon or pintle-mounted .50 caliber machine guns.

NOTES
THIS HELICOPTER IS PRODUCED BY THE EUROCOPTER COMPANY. IT WAS FORMED AS A JOINT VENTURE BETWEEN AEROSPATIALE OF FRANCE, AND DAIMLER-BENZ AEROSPACE OF GERMANY. ADDITIONAL MISSIONS INCLUDE: VIP TRANSPORT, ELECTRONIC WARFARE, AND ANTI-SUBMARINE WARFARE.

RUSSIAN PATROL/ANTI-SUBMARINE HELICOPTER KA-27/HELIX



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations:	N/A	Fuel (liters):	
Date of Introduction:	1980	Internal:	4,720
Proliferation:	At least 6 countries	Range (km):	800
Crew:	2 (pilot, navigator) , 1-3 sensor operators	Dimensions (m):	
Blades – Main rotor:	6 (2heads, 3 blades each)	Length (rotors turning):	31.8
Tail rotor:	None	Length (fuselage):	11.3
Normal Takeoff:	11,000	Width:	5.65
Maximum Gross:	10,700	Height:	5.4
Empty:	6,400	Main Rotor Diameter:	15.9
Speed (km/h): Max (level):	250	Cabin Dimensions (m):	
Cruise:	230	Length:	4.52
Ceiling (m):		Width:	1.3
Service:	6,000	Height:	1.32
Hover:	3,500	Main Rotor Diameter:	15.9
Vertical Climb Rate (m/s):	12.5	Cabin Dimensions (m):	
Standard Payload (kg):		Length:	4.52
Internal load:	4,000	Width:	1.3
External load:	5,000	Height:	1.32

SURVIVABILITY/COUNTERMEASURES:
Lower fuselage sealed for flotation. Leading-edge electro-thermal de-icing. IFF, RWRs, Infrared jammer, chaff and flare dispensers, and color coded identification flares.

WEAPONS:
7.62 mm machine gun (1)
PLAB 250-120 bombs (2)(rarely used)
AT-1MV 400 mm Torpedoes (2)
Mission dictates weapons configuration. Not all will be employed at the same time.

MOST PROBABLE ARMAMENT:
Torpedoes

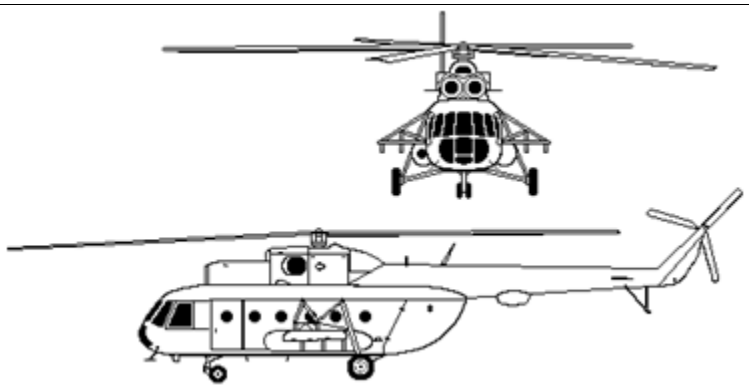
AVIONICS/SENSOR/OPTICS:

Auto-hovering, automatic flight control system, 360 degree search radar, directional ESM, Doppler, dipping sonar, magnetic anomaly detector (MAD), sonobuoys stored internally.	
Night/Weather Capabilities: Designed to operate day and night in adverse weather.	
VARIANTS	**SPECIFICATIONS**
Ka-27PL Helix-A:	ASW version.
Ka-27PS Helix-D:	Ka-27PS Helix-D: SAR version. Fitted with 300 kg rescue hoist. Hooks under fuselage for loads up to 5,000 kg
Ka-28:	Export version of Helix-A. Max takeoff weight increased to 12,000 kg. Max fuel and range also increased.
Ka-29TB Helix-B:	Armored assault troop version operated from amphibious landing ships or aircraft carriers. Armed with single four-barrel 7.62 mm machine gun, can also fit a 30 mm Type 2A42 cannon. Four stores pylons for 80 mm rocket pods, 57 mm rocket pods, 23 mm gun pods, incendiary tanks, or anti-tank missiles.
Ka-31 AEW:	Airborne early warning version of Ka-29 fitted with rotating radar antenna underneath the aircraft.
Ka-32A2:	Ka-32A2: Paramilitary transport version used by police. Pintle mounted guns in window, hydraulic hoist, loudspeakers, and searchlights. Can carry 11 passengers.
Ka-32A7:	Armed version of Ka-27PS. 13-passenger capacity. Two GSh-3L 23mm cannons, B-8V-20 rocket pods, two AS-20 Kayak anti-ship missiles or AS-10 Karen air-to-air missiles.

NOTES

THE HELIX IS PRIMARILY A NAVAL HELICOPTER, FOR MISSIONS SUCH AS SHIP-BASED ANTI-SUBMARINE WARFARE, DIRECT AIR SUPPORT, TRANSPORT, RESCUE, EW, ANTI-SHIP, AND AIR-TO-AIR. THE HELIX HAS THE DISTINCTIVE CONTRA-ROTATING MAIN ROTOR SYSTEM FAVORED BY THE KAMOV BUREAU. THE CONTRA-ROTATING DESIGN ELIMINATES THE NEED FOR A TAIL ROTOR.

RUSSIAN MULTIROLE HELICOPTER MI-8/HIP-C AND VARIANTS



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations:	Rana in India	Vertical Climb Rate (m/s):	9
Date of Introduction:	1967	Fuel (liters):	1,870 total, 3,700 max
Proliferation:	At least 54 countries	Internal:	445
Crew:	3 (2x pilots, 1x flight engineer) Transports: 24-26 troops (HIP-C, HIP-E)	Internal Aux Tank:	915 ea., up to 2
Blades – Main rotor:	5	Auxiliary Cabin Tank:	915 each, 1 or 2
Tail rotor:	3 right side, left on upgrades	Range (km):	
Engines:	2x 1,700-shp Isotov TV2-117A turboshaft. Upgrades use Mi-17 engines.	Maximum Load:	INA
Weight (kg):		Normal Load	690
Maximum Gross:	12,000	With Aux Fuel:	950
Normal Takeoff:	11,100	Dimensions (m):	
Empty:	6,990	Length (rotors turning):	25.4
Speed (km/h):		Length (fuselage):	18.2
Maximum (level):	250	Width:	2.5
Cruise:	240	Height:	5.6
Ceiling (m):		Main Rotor Diameter:	21.3
Service:	4,500	Tail Rotor Diameter:	3.9
Hover (out of ground effect):	850	Height	1.8
Hover (in ground effect):	1,760		

CARGO COMPARTMENT DIMENSIONS (M):
Floor Length: 5.3
Width: 2.3
Height: 1.8

STANDARD PAYLOAD:
HIP C: 24-26 troops or 3,000 kg internal or external loads on 4x hardpoints.
HIP E: troops or 4,000 kg internal or 3,000 kg external on 6x hardpoints.

SURVIVABILITY/COUNTERMEASURES:
Can be fitted with armor. Main and tail rotor blades electrically deiced. Infrared jammer, chaff and flares. Armor on some variants.

ARMAMENT:

HIP C has four external hardpoints. HIP E -F have six; other variants have none. Weapons include fuselage/nose MGs, rockets, ATGMs, bombs, mines, and AAMs. Only a selected mix of munitions will fit. Mission dictates weapon configuration. Troops can fire their personal weapons from pintles and windows and doors. Assault versions may have fewer onboard troops to carry more ammunition. The K-29 dispenser can hold POM-2S or PTM-3 mines.
AVIONICS/SENSOR/OPTICS: Night/Weather Capabilities: The Mi-8 is equipped with instruments and avionics allowing operation in day, night, and is instrumented for bad weather conditions.
VARIANTS
The original civilian version produced at Kazan is called Mi-8. A civilian version produced at Ulan-Ude is called Mi-8T.
Mi-8T/HIP C: Initial fielded version for medium assault/transport, with 4 external hard points and noted engines and rotor. Probable assault armament mix is 7.62-mm MGs, 4x 57-mm or 2x 80-mm rocket pods.
Mi-8PS: Military VIP transport variant of civilian HIP-C deluxe Mi-8 Salon.
Mi-8TVK/HIP E: Assault or transport helicopter. Assault probable armament with 6x hard points: 12.7-mm nose turret MG, 4x AT-2 type ATGMs, and 2 x rocket pods or bombs.
Mi-8TV/HIP-F: Export version uses AT-3 type ATGMs.
Mi-8SMV/HIP J: Airborne electronic countermeasures (ECM) platform. R-949 jammer, and up to 32 dispensable jammers.
Mi-8PPA/HIP K: Airborne IW comms intercept/jam platform characterized by 6x "X"-shaped antennas on the aft fuselage.
Mi-8VP/HIP D: Comes in two variants. Mi-8VPK is an airborne communications platform with rectangular comms canisters mounted on weapons racks. Mi-8VzPU is an airborne reserve command post. Mi-9/HIP G: Airborne command relay post characterized by antennas, and Doppler radar on tailboom.
Mi-14/HAZE: Naval HIP upgrade variant.
Mi-17/Mi-171/HIP H: Mi-17/Mi-171/HIP H: Upgrade helicopters produced after 1977, with more powerful engines, left-side tail rotor, and a five blade rotor. Many Mi- 8 helicopters have been upgraded to the Mi-17/HIP-H standard.

NOTES
MORE THAN 12,000 HIP HELICOPTERS HAVE BEEN PRODUCED. MISSIONS INCLUDE DIRECT AIR SUPPORT, TRANSPORT, RECONNAISSANCE, EW, MEDEVAC, SEARCH AND RESCUE, SMOKE GENERATING, AND MINELAYING. THERE ARE DOZENS OF VARIANTS AND A MORE THAN A DOZEN UPGRADES AND UPGRADE PACKAGES. INTERIOR SEATS ARE REMOVABLE FOR CARGO CARRYING. RESCUE HOIST CAN LIFT 150 KG. CARGO SLING SYSTEM CAPACITY IS 3,000 KG. THE MI-8 IS CAPABLE OF SINGLE-ENGINE FLIGHT IN THE EVENT OF LOSS OF POWER BY ONE ENGINE (DEPENDING ON AIRCRAFT MISSION WEIGHT) BECAUSE OF AN ENGINE LOAD SHARING SYSTEM.

RUSSIAN MULTIROLE MI-17/HIP-H AND MI-171SH GUNSHIP



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations:	Mi-8M for home use, Mi-17 for export. Nomenclatures vary.	Vertical Climb Rate (m/s):	9
Date of Introduction:	1977, 1981 as Mi-17	Fuel (liters):	1,870 total, 3,700 max
Proliferation:	At least 23 countries, with 5,000+ in service worldwide.	Internal:	445
Crew:	3 (2x pilots, 1x flight engineer). Transports up to 26, 36 troops military seating, or 12 casualties.	Internal Aux Tank:	915 ea., up to 2
Blades – Main rotor:	5	Auxiliary Cabin Tank:	915 each, 1 or 2
Tail rotor:	3	Range (km):	
Engines:	2x 2,200-shp Isotov TV3-117VM	Maximum Load:	INA
Weight (kg):	13,000	Normal Load	Up to 580, 675 Mi-17-V5
Maximum Gross:	11,100	With Aux Fuel:	1,065
Normal Takeoff:	7100-7370 (variant dependent)	Dimensions (m):	See Mi-8/HIP-C
Empty:		CARGO COMPARTMENT DIMENSIONS (M):	
Speed (km/h):			
Maximum (level):	300	Width: 2.3, Height: 5.5 Others see Mi-8	
Cruise:	200	Standard Payload (kg):	
Ceiling (m):		Internal load: 4,000	
Service:	6,000	External sling: 4,000 (5,000 Mi-17-V5)	
Hover (out of ground effect):	1,670		
Hover (in ground effect):	1930-3,980		

SURVIVABILITY/COUNTERMEASURES:
Armor plating (military versions), main and tail rotor blades electrically deiced. Infrared jammer, chaff and flares, exhaust diffusers. Missile warners include LIP. Shear-cutters. Like Mi-8 it has single-engine flight ability.

ARMAMENT:
Assault versions have six (sometimes four) external hardpoints. Weapons options include fuselage/nose MGs, rockets, ATGMs, bombs, mines, AAMs, and ASMs. Only a selected mix will fit, dictated by mission. Troops can fire personal weapons with pads at windows, plus doors. Assault versions may have fewer onboard troops to carry more ammunition.

WEAPONS AND AMMUNITION TYPES:
Same as Mi-8/HIP except:

2x 7.62-mm MG (1 fore, 1 aft)	700
Mi-171Sh Max Loads	2
AT-6c/AT-9Ataka ATGM pod (4 per pod)	4
80-mm rocket pods (20 each)	4
SA-24 AAM (SAM)	4
250-kg bombs	4
500-kg bombs	2
VSM-1 (4 x K-29 mine pods)	1
23-mm gun pods (250 rds/pod)	2

MOST PROBABLE ARMAMENT:
HIP H: Fitted with 1x 12.7mm MG or AG-17 30-mm AGL, aft 7.62-mm MG, 4x AT-2C/SWATTER and 40x 80-mm rockets.

AVIONICS/SENSOR/OPTICS:
Night/Weather Capabilities: The Mi-17 is equipped with instruments, GPS nav, avionics, Doppler radar, autopilot for operation in day and night, map display screen, and instruments for meteorological conditions.

VARIANTS

Mi-17/HIP-H:
Original production HIP-H had 2x 1,950-shp Isotov TV3-117MT engines from Mi-14/HAZE, a new main rotor, and left-side tail rotor (distinguishing it from HIP-C). The reconfigured cab has rear clamshell doors. Many early HIP models are modified to the Mi-17 standard. Counterpart export and Russian-use variant weapons, sensors, and other features may differ to fit requirements

Mi-17T/Mi-8M:
Military variant added crew armor plating. The assault version has 1x 12.7mm MG or 30-mm AG-17 AGL, aft 7.62-mm MG, and 40x 80-mm rockets.

Mi-17P:
Descendent of the HIP K airborne jamming platform characterized by large rectangular antennas along aft fuselage.

Mi-17PG:
Variant with H/I-band pulse and continuous wave jamming system.

Mi-17PI:
Variant with D-band jammer, able to jam up to 8 sources simultaneously.

Mi-8MT:
Early "Hot and high" upgrade, with 2x 2,070-shp Klimov TV3- 117VMA engines for greater rate of climb, higher hover ceiling Mi-19: Airborne CP on Mi-17 chassis. Mi-19R: Abn rocket artillery regiment CP. Many common versions now use 2,200-shp engines as noted at left. Kazan makes the Mi-17-1V export/Mi-8MTV multi-role, the Mi-17-V5/Mi-8MTV-5 multi-role (with APU and increased sling load), and Mi-172 passenger version. Ulan-Ude produces the Mi-171 export/Mi-8AMT multi-role, and the Mi-171Sh combat helicopter. Mi-171A is a civilian version.

Mi-17N/Mi-8MTO/Mi-8N:
Upgrade night assault variant tested in Chechnya, with FLIR sights. It led to the helicopter noted below.

MI-171-SH/MI-8AMTSH TERMINATOR (RUS):
Better armored 2001 gunship, with upgrades, e.g., 2x 2,200-shp engines. The FCS includes Raduga-Sh ATGM day sight from Mi-35M, FLIR night sight.

MOST PROBABLE ARMAMENT:
2 x 7.62-mm MGs, 8x AT-6c/AT-9 ATGMs, and 40 x 80-mm rockets. Frangible rod AT-9 missiles can be used for air-to-air combat. Also, AA-18S/SA-18S AAMs (SAMs) can be used. The ATGM pod can also launch AAMs. IR warner and flares. For export, they can fit other sensors and/or munitions.

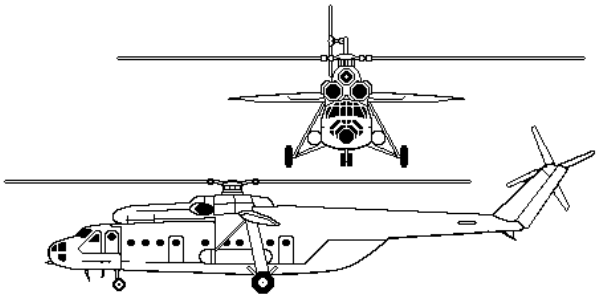
Newest variant is the Mi-17-V7 multi-role from Kazan, with VK-2500 engines
rated at 2,500 shp. It can operate at high altitude, and offers 14,000 max take-off weight, 5,000 kg internal payload, and 6,000
kg max external sling load. Gunship has a laser designator for semi-active laser-homing munitions (bombs, 80/ 122-mm rockets or ATGMs).

Israeli Peak-17 gunship upgrade for India has FLIR/CCD day/night FCS, either Spike-ER (8 km) or LAHAT ATGM (13 km,

below), and can launch Skylite UAVs.

NOTES
MISSION DICTATES WEAPONS CONFIGURATION. NOT ALL WILL BE EMPLOYED AT THE SAME TIME.

RUSSIAN TRANSPORT HELICOPTER MI-6/HOOK



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations:	INA	External Fuel Tank:	3,490
Date of Introduction:	1961	Range (km):	
Proliferation:	At least 15 countries	Max Load:	620
Crew:	5 (2 pilots, 1x navigator, 1x flt engineer, 1x radio operator)	With Aux Fuel:	1,000 km
Blades – Main rotor:	5	Dimensions (m):	
Tail rotor:	4	Length (rotors turning):	41.7
Engines:	2x 5,500-shp Soloviev D-25V (TV-2BM) turboshaft	Length (fuselage):	33.2
Weight (kg):		Width (including wing):	15.3
Maximum Gross:	42,500-46,800	Height:	9.9
Normal Takeoff:	40,500	Main Rotor Diameter:	35.0
Empty:	27,240	Cargo Compartment Dimensions (m): Floor Length: 12 Width: 2.65 Height: Variable from 2.0 to 2.5 Standard Payload: Internal: 12,000 kg with rolling takeoff External: 8,000 kg at hover Transports over 65 troops, or 41 litters, or 1x BRDM-2 scout car, or 1x BMD, or 1x GAZ truck, or 1x 7,500 liter POL truck or 12,000 liters in soft bladders.	
Speed (km/h):			
Maximum (level):	300		
Cruise:	250		
Ceiling (m):	4,500		
Fuel (liters):			
Internal:	6,315		
Internal Aux Tank:	INA		

SURVIVABILITY/COUNTERMEASURES:
Main rotor blades electrically deiced. Tail rotor blades have internal anti-icing fluid.

AVIONICS/SENSOR/OPTICS:
Night/Weather Capabilities:
The avionics and navigational package, and a fully functioning autopilot allow for day/night all-weather operation.

VARIANTS	SPECIFICATIONS
Mi-6A/-6T/HOOK A:	Basic civil and military transport version.
Mi-6VKP/HOOK B:	Airborne command post variant.
Mi-6VUS/HOOK C:	Developed airborne command post. Also known as Mi-22.
Mi-6AYaSh/HOOK D:	Airborne command post with possible side-looking airborne radar fairing.

Mi-6S:	**MEDEVAC variant.**
Mi-6TZ:	**Tanker variant.**

NOTES

REMOVABLE STUB WINGS, WHEN INSTALLED, ARE FIXED AT A 15° INCIDENCE RELATIVE TO THE LONGITUDINAL AXIS. THEY PROVIDE 20% OF THE TOTAL LIFT IN FORWARD FLIGHT. AIRCRAFT PRODUCTION ENDED IN 1981. AIRCRAFT HAS HYDRAULICALLY ACTUATED REAR CLAMSHELL DOORS AND RAMP, PROVISIONS FOR INTERNAL CARGO TIE-DOWN RINGS, AN 800 KG CAPACITY INTERNAL WINCH SYSTEM IN CARGO COMPARTMENT, FLOOR CAPACITY IS 2,000 KG/M^2, AND A CENTRAL HATCH IN THE CABIN FLOOR FOR SLING LOADS

RUSSIAN TRANSPORT HELICOPTER MI-26/HALO



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designations:	INA	Range (km):	
Date of Introduction:	1983	Max Load:	800
Proliferation:	At least 5 countries	With Aux Fuel:	1200
Crew:	5 (2x pilots, 1x navigator, 1x flt engineer, 1x loadmaster)	Dimensions (m):	
Blades – Main rotor:	8	Length (rotors turning):	40
Tail rotor:	5	Length (fuselage):	33.5
Engines:	2x 11,400-shp Lotarev D-136 turboshaft	Width:	8.2
Weight (kg):	56,000	Height	8.1
Maximum Gross:	49,500	Main Rotor Diameter:	32
Normal Takeoff:	28,240	Tail Rotor Diameter: 7.6	7.6
Empty:	28,240	Cargo Compartment Dimensions (m): Floor Length: 12 Width: 3.3 Height: variable from 2.9 to 3.2	
Speed (km/h):			
Maximum (level):	295		
Cruise:	255		
Ceiling (m):	4,500 Hover (out of ground effect): 1,800 Hover (in ground effect): 4,500	Standard Payload: Internal or external load: 20,000 kg Transports over 80 troops, 60 litters, or 2x BRDM-2 scout cars, or 2x BMDs, or 1x BMP or, 1x BTR-60/70/80 or, 1x MT-LB.	
Fuel (liters):			
Internal:	11,900		

SURVIVABILITY/COUNTERMEASURES:
Main and tail rotor blades electrically deiced. Infrared signature suppressors on engines. Infrared jammers and decoys; flares.
Self-sealing fuel tanks.

AVIONICS/SENSOR/OPTICS:

Night/Weather Capabilities:
The avionics and navigational package, Doppler weather radar, and a fully functioning autopilot allow for day/night all-weather operation.

VARIANTS	SPECIFICATIONS
Mi-26MS:	Medical evacuation version.

Mi-26T:	**Freight transport.**
Mi-26TZ:	**Fuel tanker with an additional 14,040 liters of fuel in 4x internal tanks and 1,040 liters of lubricants, pumped through 4x 60-meter long refueling nozzles for refueling aircraft, and 10x 20-meter long hoses for refueling ground vehicles. Fuel transfer rate is 300 liters/minute for aviation fuel, and 75-150 liters/minute for diesel fuel. The refueling system can easily be removed to allow the aircraft to perform transport missions.**

NOTES

THE HALO A HAS NO ARMAMENT. THE LOAD AND LIFT CAPABILITIES OF THE AIRCRAFT ARE COMPARABLE TO THE U.S. C-130 HERCULES TRANSPORT AIRCRAFT. THE LENGTH OF THE LANDING GEAR STRUTS CAN BE HYDRAULICALLY ADJUSTED TO FACILITATE LOADING THROUGH THE REAR DOORS. THE TAILSKID IS RETRACTABLE TO ALLOW UNRESTRICTED APPROACH TO THE REAR CLAMSHELL DOORS AND LOADING RAMP. THE CARGO COMPARTMENT HAS TWO ELECTRIC WINCHES (EACH WITH 2,500 KG CAPACITY) ON OVERHEAD RAILS CAN MOVE LOADS ALONG THE LENGTH OF THE CABIN. THE CABIN FLOOR HAS ROLLERS AND TIE-DOWN RINGS THROUGHOUT. THE HALO HAS A CLOSED-CIRCUIT TELEVISION SYSTEM TO OBSERVE POSITIONING OVER A SLING LOAD, AND LOAD OPERATIONS. THE MI-26 IS CAPABLE OF SINGLE-ENGINE FLIGHT IN THE EVENT OF LOSS OF POWER BY ONE ENGINE (DEPENDING ON AIRCRAFT MISSION WEIGHT) BECAUSE OF AN ENGINE LOAD SHARING SYSTEM. IF ONE ENGINE FAILS, THE OTHER ENGINE'S OUTPUT IS AUTOMATICALLY INCREASED TO ALLOW CONTINUED FLIGHT.

FRENCH HELIBORNE BATTLEFIELD SURVEILLANCE RADAR SYSTEM HORIZON



SYSTEM	SPECIFICATIONS
Alternative Designations:	Helicoptere d Observation Radar et d'Investigation sur zone
Date of Introduction:	1994
Proliferation:	At least one country
Crew:	4
Platform:	Mounted on AS-32UL/Cougar helicopter
Combat Weight (mt):	11.5
Antenna size (m):	3.5 x 5
Radio:	INA
RADAR	See Below

ANTENNA:

Mount: Vertical post mount pointing downward from left rear. Radar stows under helicopter tail on take-off and landings, then lowers hydraulically during operation.
Antenna Type: Doppler, with MTI
Mode: Search
Scan Method: Antenna rotates horizontally for azimuth scan. Radar rotates 10°/sec, for a low pulse repetition frequency (PRF). Electronic for elevation.

SYSTEM

TRANSMITTER:

Transmitter Type: Traveling Wave Tube fully coherent, agile frequency and adaptive burst mode.
Frequency band: I/J
RF maximum (GHz): 12.0
Power (kw): 50
Mode: Doppler MTI radar

Receiver and Processing Requirements:

Aircraft has onboard processing system. The processor is designed for a low false alarm rate. Ground station is mounted in a 7-mt truck. Each ground station holds 2 workstations. System receives 60° and 90° sector scans, independent of aircraft flight dynamics. Real-time digital data link can be integrated into French RITA communications net. Each moving target is automatically detected, located, analyzed, and classified. System can operate separately or as part of an intelligence network.

Protection and Electronic Counter-countermeasures:

Radar snapshot mode reduces vulnerability to anti-radiation missiles.

Very low side lobes reduce ECM effects.

The aircraft carries flares and decoys.

VARIANTS

System derived from the Orchidee system used in Desert Storm. Orchidee was compatible with the British Astor and US JSTARS systems.

PERFORMANCE

Surveillance range (km): 200 / 150 in rain clutter
Surveillance rate: 20,000 km2every 10 sec
Target location accuracy (m): 40
Datalink range: 120 km, Agatha data link
Surveillance targets: Wheeled or tracked vehicles, moving or hovering rotary wing aircraft, slow-flying FW aircraft, watercraft.



Target speed (km/hr): 4-400, including nap-of-the-earth (NOE)
Flight speed (km/hr): 130
Surveillance altitude (m): 2,000-4,000
Endurance (hrs): 4

NOTES

THE SYSTEM WAS DESIGNED TO OPERATE UNDER ARMY CONTROL AT DIVISION LEVEL. HORIZON SET CONSISTS OF 2 AIRCRAFT, ONE GROUND STATION, NAVIGATION EQUIPMENT, AND AGATHA DATA LINK.

ROTARY WING AIRCRAFT WEAPONS AND AIRCRAFT-DELIVERED MUNITIONS (ADM)

A wide variety of weapons and munitions can be employed on rotary-wing aircraft for use against aerial, ground, and waterborne targets. Weapons can be generally categorized as guns, launchers, and dispensers. Munitions are primarily rounds, rockets, missiles, bombs, grenades, mines, and torpedoes (see the tables below). However, new technologies continue to emerge, and are expanding the ability of aircraft to deliver lethality and execute other missions for and against military forces.

Technology trends for more lethal air attack include abilities to: launch reconnaissance UAVs to support their missions in roles such as target selection and designation, launch attack UAVs, and add new weapons and munitions for long-range precision attack. The following weapons and munitions apply to RW systems in this chapter. Fixed-wing aircraft can use these munitions and a variety of heavier ones.

GUNS

Mount/Gun Name	Producing Country	Caliber or mm/Type	Barrels (if 2+)	Mount, Fixed or Turret/ Pod (Fixed)	# of Rounds/ Rds per Min	Munition Types (Other Than Ball-T, API-T, HEI-T)	Munition Range (m)/ Lethality (penetration-mm)
AA-52	France	7.62 MG *1	1	Pod	500+/900		1,200 heavy barrel
M134	U.S.	7.62 Mini-gun	6	M27or Mini-TAT turret, M18 pod	1500/2,000, 4,000		1,500 m
PKM	Russia	7.62 MG		Cabin, rear	Varies/250practical		1,000/ 8 at 500 m
PKT	Russia	7.62 MG		Nose fixed, rear, pod	3,800/250 practical		2,000/ 8 at 500 m
AN/M2	U.S./Others	.50-cal MG	1	Door pintle, or fixed, pod	/750-850	APFSDS-T, SLAP	1,800
NSV-T	Russia	12.7 MG	1	Door pintle or fixed, pod	/800	Incendiary, Duplex-T *2	2,000/20 at 500, 13.2 at 1,000
YakB-12.7	Russia	12.7 Gatling	4	USPU-24 chin turret GUV-8700 pod	1,470/4,500 750/4,500	Incendiary, Duplex-T *2	2,000
M197	U.S.	20 Gatling	3	Nose turret	/750		1,500
M 621	France	20 Cannon	1	THL-20 turret, pod, right side fixed *3	100+/650	APDS	1,500-2,000 m
9A669 GUV 9A624 9A622	Russia	23 Cannon 7.62 Mini-gun	2 4	Pod with 3 guns, the 23-mm, and 2 x 7.62 mini-guns	750/300 or 3,400 2200/	Frangible, APFSDS-T	2,500+/16 at 1,000 m for Frangible 2,000/ 8 at 500 m
GSh-23L Type 23-3	Russia China	23 Cannon	2	USPU-24 chin turret NPPU-24 right side *3 UPK-23-250 pod fixed *3	470/3,400 470/4,300 250/300 or 3,400	Frangible, APFSDS-T	
NS-23KM	Russia	23 Cannon	2	Right side fixed	550 practical	Frangible, Frag-HE, CC*4 APFSDS-T	2,500/19 @ 1000 m API-T
2A42	Russia	30 Cannon	1	NPPU-280 chin turret	460/250/200 or 600	Frangible, Frag-HE, CC*4 APFSDS-T	4,000/45 at 2,000 m for APFSDS-T
GSh-30K	Russia	30 Cannon	2	Right side fixed	250/varies to 2,600	Frangible, Frag-HE, CC*4 APFSDS-T	4,000/45 at 2,000 m for APFSDS-T

*1 Early versions of AA-52 were in 7.5 x 54 mm.

*2 Duplex round has 2 cartridges, to double fire saturation in the beaten zone.

*3 Gun (on fuselage or in a pod) has a fixed base mount, but can flex in elevation. An example is the UPK-23-250 flexible gun pod, which can depress guns to 30 degrees.

*4 CC is a 30mm canister round with 28 sub-projectiles for use against soft targets and personnel with increased fire saturation in the beaten zone.

AERIAL ROCKETS

Name	Producing Country	Caliber (mm)	Guidance No/Yes	Pod Name (# per pod)	Munition Nomenclature	Lethal Munition Type	Munition Range (m)/ Lethality (penetration-mm)	Comments
SNIA	France	50	No	/28				
S-5	Russia Others	57	No/SAL-H	UB-9 UB-16-57 UB-32	S-5K, KO, KP, KPB S-5, S-5M, S-5OM S-5Cor	HEAT-Frag, Frag-HE Frag-HE HEAT SAL-H	2,000/200 4,000 4,500 7,000/200	SAL-H: Semi-active Laser-Homing, on aircraft equipped with a laser target designator.
SNEB	France	68	No/SAL-H	Heli TDA 68-12C/12 Heli TDA 68-22C/22	Type 253 Type 26P Type 24, 26	HEAT-MP Frag-HE APERS	1,600/INA 1,600	There are reports of SAL-H capability - see above
S-8	Russia Others	80	No/SAL-H	B-8V7/7 B-8V20A/20 B-8M1/20	S-8KOM S-8T S-8DM S-8BM S-8ASM S-8Cor	HEAT-Frag Tandem HEAT Frag HE APHE Flechette HEAT SAL-H	4,000/400 antitank 4,000/600+ antitank 4,000/HE fuel-air 2,200/2 m concrete + HE INA 8,000/ 400	SAL-H see above. Other assets, such as aircraft or ground forces with LTD can laze rockets to target. S-8PM with jammer
Hydra-70/ 2.75 inch rkt	U.S. Others	70	No	M260/7, M261/19	M151 and M229 M261 M255A1	HE HE-MPSM Flechette	8.8/M151 10-lb Warhead, M229 17-lb 7,000/9 DP submunitions	MPSM is multipurpose, programmable time fuze. SAL-H in R&D.
S-13	Russia Others	122	No/SAL-H	B-13R/5 B-13L/5	S-13 S-13-OF S-13DF S-13T S-13Cor	HEAT Frag-HE HE thermobaric APHE HEAT SAL-H	4,000/3 m soil, 1 m concrete +HE 3,000/Frag-HE 6,000/equal to 40 kg of TNT 4,000/6 m soil, 1 m concrete + HE 9,000/700	SAL-H see above
S-24B	Russia	240	No/SAL-H Inertial	/1	V-24APD RV-24 S-24BMZ	Frag-HE PD fuze Frag-HE prox fuze Frag-HE	2,000/23.5 kg warhead	SAL-H option see above Fuze conversion kit with fins
S-25	Russia	340	No/SAL-H	O-25/1	S-25-OFME S-25L S-25LD	Frag-HE prox fuze HE SAL-H HE SAL-H	2-4,000/190 kg warhead 7,000/150 kg HE warhead 10,000/150 kg HE, 8 m CEP	SAL-H see above S-25LD can also use TV or IR-homing
Type 90-1	China	90	No	/7	Type 90-1	Frag-HE	7,000	Chinese

* Aerial rockets are also referred to as air-to-surface rockets (ASRs), or as fin-folding aerial rockets (FFARs).

ANTITANK GUIDED MISSILES (ATGMS)

Name	Producing Country	Rate of Fire (#/min, based on range)	Guidance	#/Pod	Munition Nomenclature (If different)	Munition Type	Munition Range (m)/ Penetration (mm)	Comments
AT-2c	Russia	3-4	RF SACLOS	2		HEAT, HE	4,000/650	
AT-3c and AT-3e	Russia Others	2-3	Wire SACLOS	1 or 3	AT-3c, AT-3E	HEAT (comments), HE	3,000/520, 800 AT-3e	AT-3e has Tandem HEAT. Other Countries make copies/variants.
AT-6/Shturm-V	Russia	3-4	RF SACLOS	4 *1,2		HEAT, HE	5,000/650	
AT-6b/Shturm-V1	Russia	3-4	RF SACLOS	4 *1,2		Tandem HEAT, HE	6,000/1,000	
AT-6c/Shturm-V2	Russia	3-4	RF SACLOS	4 *1,2		Tandem HEAT, HE	7,000/1,000	
AT-9/Ataka	Russia	3-4	RF SACLOS	4 *1,2		Tandem HEAT, HE, AA frangible rod	6,000/1,100	Expected upgrades include 8-km range, IR/radar homing. See *1.
Krizantema/AT-15	Russia	4-6	RF ACLOS/LBR	4		Tandem HEAT	6,000/1,250+ERA (1,500+)	2 simultaneous, separate targets
AT-16/Vikhr-M	Russia	2-3	Laser-beam rider	8 *2, 3		Tandem HEAT/HE *2	10,000 /1,200 *3	Proximity fuze on/off per target.
Hellfire	U.S./UK	2-3	SAL-H *5	4 *3	Hellfire, Hellfire II	Tandem HEAT + HE *2	Hellfire II 8000/1300+ equiv	
Hermes-A	Russia	2-2	Inertial/RF/SAL-H *5	6		Tandem HEAT + HE *2	18,000/1300+ equiv	28 kg warhead, 40 km version due
HOT	Europe	3-4	Wire SACLOS	2, 3, 4	HOT-2, HOT-3	Tandem HEAT	HOT 3 4000/1250+	
LAHAT	Israel	2-4 *4	SAL-H *5	4		Tandem HEAT	13,000/1,000+ Dive attack	
Mokopa	South Africa	2-4 *4	SAL-H *5			Tandem HEAT	10,000/1,350+	Variant of Hellfire
Red Arrow-8F	China	3-4	Wire SACLOS	2 or 4		Tandem HEAT	4,000/1,100	
Spike-ER	Israel	2-3	Fiber-Optic *5 and IIR homing	2 or 4		Tandem HEAT	8,000/1,000+ Dive attack	AKA: NTD, Dandy. ER stands for Extended Range
TOW/BGM-71	U.S./Others	3-4	Wire SACLOS	2 or 4	TOW-2	Tandem HEAT	TOW 2 3750/900+	2-missile pod on MD-500.

								Other countries make copies/variants .

*1. AT-6 and variants, and AT-9 and variants, are interchangeable in launchers for each other.

*2. Launcher pods can also launch AA-16, AA-18, or AA-18S air-to-air missiles, decreasing the number of ATGMs in the pod for a given mission.

*3. AT-16 and Hellfire II have combined HEAT and HE warheads for multi-role use. The AT-16 also has proximity fuse that can be engaged in-flight for aircraft and materiel targets.

*4. With semi-active laser homing (SAL-H) guidance, launcher craft can hand off missile control to another designator, and launch other missiles without delays from missile flight time.

*5. Guidance modes such as SAL-H and fiber-optic can be categorized as non-line-of-sight, whereby the launcher craft can be outside of view of the target, and can avoid return fires.

6. For additional information on antitank and anti-armor missiles, see Vol 1 Chapter 6.

AIR-TO-AIR MISSILES (AAMS)

Name	Producing Country	Also SAM or ATGM *1	Guidance	Pod Name (# per pod)	Munition Type	Munition Range (km)/Warhead (kg)	Comments
AA-2C or D/ATOLL/R-13M	Russia		IR-homing	/1, 2	Frag-HE	8/7.4	AIM-9L upgrade phasing out
AA-8/APHID/R-60M	Russia		IR-homing	/1	HE Continuous rod prox	8 low altitude/3.5	Upgrade missile with DU rod
AA-11/ARCHER/R-73 RMD1	Russia		IR-homing	/1	HE Continuous rod prox	30/7.4	
AA-11/ARCHER/R-73 RMD2	Russia		IR-homing	/1	HE Continuous rod prox	40/7.4	
SA-7b/Strela-2M	Russia/Others	MANPADS SAM	IR-homing	/1	Frag-HE	5/1.15	
SA-14/Strela-3	Russia/Others	MANPADS SAM	IR-homing	/1, 2, 4	Frag-HE	6/1.0	
SA-16/Igla-1	Russia/Others	MANPADS SAM	IR-homing	/1, 2, 4	Frag-HE	5.2+/1.27	
SA-18/Igla	Russia/Others	MANPADS SAM	IR-homing	/1, 2, 4	Frag-HE	6/1.27	
SA-24 (SA-18S)	Russia	MANPADS SAM	IR-homing	/1, 2, 4	Continuous rod, prox fuze	6+/2.5	Aka: Igla-S/Igla-Super
AIM-9L/Sidewinder	U.S./Others	Veh/towed SAM	IR-homing		Frag-HE	17.7/9.5	
AT-6c and AT-9/Ataka	Russia	Veh ATGM	RFSACLOS	/4, 8 *1 *2	Tandem HEAT	7/7.4, 6/7.4 Ataka	Penetration 1,000-1,100 mm
Ataka 9A2200 Missile	Russia	Veh ATGM	RFSACLOS	4, 8 *1 *2	Continuous rod, prox fuze	6/	Also fit AT-6 launchers
AT-16/Vikhr-M	Russia	RW ATGM	Laser-beam rider	/8 *1 *2	HEAT/HE with prox on/off	10,000 /INA	Penetration 1,300+ mm
Mistral 2	France	Veh/pedestal SAM	IR-homing	ATAM/1, 2	Frag-HE, prox	6/3	On Gazelle
Spike-ER	Israel	Veh/man-port ATGM	FOG_M, IIR-homing	/4 *1 *2	Tandem HEAT	8.0/INA	Penetration 1,000+ mm
Starstreak	UK	AD/AT or multi-role	Laser-beam rider	ATAS/4 *1	3 x Sabots with Frag-HE	7/.9 kg per submissile	3 x high-velocity submissiles
Stinger	U.S./Others	Veh/MANPADS SAM	IR-homing	ATAS/4, 2	HE	4.5+/1.0	
TY-90/Yitian	China	Veh-launch SAM	IR-homing	/2, 1	HE, frangible rod	6/3	Too large for MANPADS use

***1. All ATGMs can be used to engage helicopters hovering or flying low and slow, esp. nap-of-the-earth mode (35 km/hr or less). These ATGMs can engage RW aircraft at all times.**

2. ATGM launcher can substitute 1 or more SAMs.

AIR-TO-SURFACE MISSILES (ASMS)

Name	Producing Country	Mission	Guidance	#/Pod	Warhead Type	Munition Range (km)/ Penetration (mm)	Comments
AS-10/KAREN/Kh-25ML **Kh-25-MR** **Kh-25-MT** **Kh-25MTP**	Russia	Tactical Tactical, AT Tactical, AT Tactical, AT	SAL-H RF-Guided TV-Guided Thermal-Guided	1	Frag-HE/90 kg Frag-HE/90 kg Frag-HE/90 kg Frag-HE/90 kg	20/ 10/ 20/ 20/	
AS-12/KEGLER/Kh-25MP	Russia	Anti-radar	Passive-homing	1	90 kg	40/	
AS-12/AS.12	France	Tactical, AT, Anti-ship	Wire SACLOS	2	SAPHE, 28 kg	7/	
AS-17/KRYPTON/Kh-31P	Russia	Anti-radar	Passive homing	1	90 kg	100/	
AS-17/KRYPTON/Kh-31A	Russia	Anti-ship	Active radar	1	90 kg	50/	
C-701	China	Anti-ship, land attack	TV, IR-homing	4	SAPHE, 29 kg	20/	MMW-homing tested
Hermes-A	Russia	Tactical, AT	Inertial/RF/SAL-H	6-8	Frag-HE, 28 kg	40/1300+	100 km version due
Sea Skua	UK	Anti-ship	Semi-active Radar	1	SAPHE, 28 kg	25/	
Guided Rockets **see pg 2-23**	Russia		SAL-H				

*** Systems designed for use with laser guidance are generally called missiles. However, some rockets can be adapted with SAL-H modifications for near-ASM range and precision.**

BOMBS

Name	Weight (kg)	Guidance (if any)	Type	Nomenclature Specific Bomb	Warhead or Submunition/# if more than 1/Nomenclature/Type	Munition Range (m)/ Lethality (penetration-mm)	Comments
GBU-100	120		ASW Depth Bomb		HE 100 kg		
SZV	94	Underwater Acoustic	ASW Depth Bomb		HEAT 19 kg	600 m in depth	Steers on glide fins
FAB-100	117		General Purpose	M80	HE 39 kg		
OFAB-100	100		Blast-Frag		Frag-HE 60 kg		
FAB-250	250		General Purpose	M79	HE 105 kg	30 radius	
OFAB-250	250		Blast-Frag		Frag-HE 210 kg		
RBK-250 Glide bomb (Dispenser)	273		Cluster Cluster	RBK-250-275AO- RBK-250AD-1	150 AO-1sch bomblets /60 AO-2.5 RT AP bomblets /30 PTAB-2.5KO HEAT bomblets Chemical bomblets	4,800 m^2 destructive area	Like MK-118
ZAB-250	250		Incendiary		200 kg Napalm		
KhB-250			Chemical		200 kg Sarin, VX, mustard, etc		
FAB-500/M62	500		General Purpose		HE 450 kg		
OFAB-500	515		General Purpose		Frag-HE 155 kg		
OFZAB-500	500		General Purpose		Frag-HE Incendiary 250 kg		
ODAB-500PM	520		Fuel-Air Explosive		193 kg		
KAB-500Kr	560	TV guided	Precision Attack		Concrete-piercing 380 kg, 200 kg chg	1500 m^2 destructive area	
KAB-500L	534	SAL-H	Precision Attack		HE 400 kg with 195 kg of charge	1500 m^2 destructive area	
RBK-500U Glide bomb (Dispenser)	504 500 520 427 334 525 525 525 500 467		Cluster	RBK-500AO OAB-2.5RT PTAB PTAB-1M ShOAB-0.5 BETAB-500ShP OFAB ZAB PPM SPBE-D	108/ AO-2.5 APAM ICM/bomblets 126/ 5RTM APAM 352/ PTAB HEAT bomblets 60/ PTAB-2.5KO HEAT bomblets 268/ PTAB-1M HEAT bomblets 565/ 0.5 ShOAB-0.5 AP bomblets 10/ BETAB-M concrete piercing bomblets 10/ OFAB APAM bomblets 168/ ZAB incendiary bomblets	6,400 m^2 destructive area 210 m^2 destructive area 210 mm penetration top-atk 300 m x 400 m/210 mm top atk 300 m x 400 m Runway penetrators	Improvement over the RBK-500

					48/ PPM mines 15 IR sensor-fuzed 14.5 kg bomblets Chemical bomblets	EFP top-attack[2]	
ZAB-500	500		Incendiary		480 kg Napalm		

Only Russian RW aircraft in this chapter employ bombs. Thus, all bombs listed are Russian.
EFP - Explosively-formed penetrator

Other ordnance includes sub munition and mine dispensers, minelayer ramps, automatic grenade launchers, anti-ship torpedoes, anti-submarine mines, and torpedoes. Selected RW aircraft can launch UAVs; therefore a near-term capability will be the ability to launch attack UAVs or UCAVs and guide them to engage targets.

Dec
2016

Worldwide Equipment Guide

Chapter 2: Fixed Wing Aircraft



TRADOC G-2 ACE–Threats Integration
Ft. Leavenworth, KS

Distribution Statement: Approved for public release; distribution is unlimited.

Chapter 2: Fixed Wing Aircraft

This chapter provides the basic characteristics of selected fixed-wing aircraft readily available to COE OPFOR across the spectrum of joint operations. This sampling of systems was selected because of wide proliferation across numerous countries or because of already extensive use in training scenarios. Additional data sheets addressing other widely proliferated aircraft will be sent with further supplements to this guide. Many foreign militaries are leveraging advances in automated technologies in order to use increasing amounts of data across all warfighting capabilities. Increases in processing power and broadband technologies through commercial research and development make real time situational awareness and communications on the move a tangible objective for many foreign forces. The emergence of rudimentary Integrated Battlefield Management Systems (IBMS) in tier three forces represents this global trend. Net Centric operations are viewed worldwide as a key element of modern military operations, an IBMS is a system that integrates multiple command and control formats as well as sensor data into one display that improves situational awareness through multiple sources.

Because of the increasingly large numbers of variants of each aircraft, only the most common variants produced in significant numbers were addressed. If older versions of airplanes have been upgraded in significant quantities to the standards of newer variants, the older versions were not addressed.

Fixed-Wing Aircraft generally covers the systems that will affect the planning and actions of the ground maneuver force, aircraft commonly employed by the OPFOR when in close proximity to enemy ground forces, as well as strategic aircraft. This chapter classifies aircraft as fighter/interceptor, strike, ground-attack, multi-role, bombers, special-role, and transport aircraft. Multi-role aircraft are able to support missions across each of the categories. This chapter encompasses many aircraft which may have a dual civil/military application. It does not include, however, aircraft designed and used primarily for civil aviation.

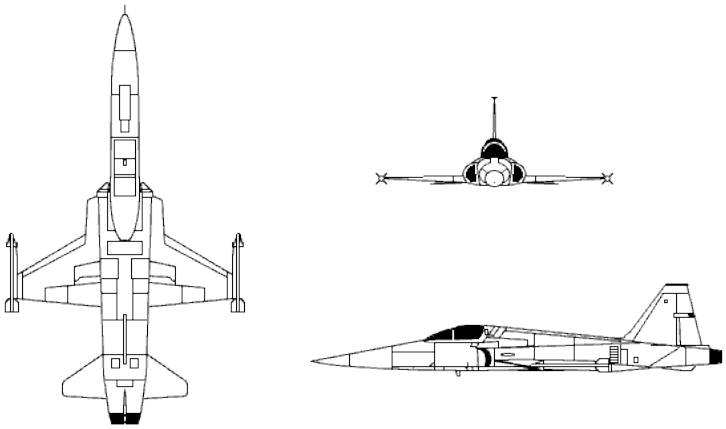
The munitions available to each aircraft are mentioned, but not all may be employed at the same time. The weapon systems inherent to the airframe are listed under armament. The most probable weapon loading options are also given, but assigned mission dictates actual weapon configuration. Therefore, any combination of the available munitions may be encountered.

A wide variety of upgrade programs are underway. The FW aircraft variants noted are only a small representation of those available. For instance, application of GPS and commercial GPS map display units permits even the oldest aircraft to have precision location. Night vision systems coupled with the high level of night illumination existing in most areas of the world permit night use of older aircraft. Even though some weapons require linked effective night sights, many weapons, such as bombs (including sensor-fuzed), standoff GPS programmed cruise missiles, and munitions using remote guidance (such as semi-active laser-homing munitions guided by laser target designators) permit older aircraft to launch the munitions and rely on others to guide them to target. Other aerial systems can substitute for FW aircraft to execute what were FW missions. These include rotary-wing aircraft, unmanned aerial vehicles (including attack UAVs and UCAVs), improvised systems such as airships, and cruise missiles.

Questions and comments on data listed in this chapter should be addressed to:

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FIGHTER AIRCRAFT F-5 FREEDOM FIGHTER/TIGER



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types		Vertical Climb Rate (m/s):	146
2 x M239A2 20-mm Qty:	280	Vertical Climb Rate (m/s) (A/E):	175
Other Loading Options		Fuel (liters):	
AAMs:		Internal:	2,207
AIM-9 Sidewinders on wingtip launchers	2	Internal (A/E):	2,555
Pylons:		Range (km):	
Fuselage:	1	Ferry :	2,519
Underwing:	4	Ferry (A/E):	2,861
Max weapons:(kg):		Dimensions (m):	
F-5A	2,812	Length:	14.4
F-5E	3,175	Length (A/E):	14.6
900 kg	1	Wingspan:	7.7
227 kg	9	Wingspan (A/E):	8.1
AGM-65 submunitions dispensers rocket pods	1	Height:	4.1
GPU-5 30-mm gun pods	3	Standard Payload (kg):	
568-L or 1,041-L drop tanks	3	External (A):	2,812
Alternative Designations:	F-5A initial	External (E):	3,175
Date of Introduction:	1964	Hardpoints:	
Number of Countries Proliferated:	> 30	Centerline:	1
Description:		Wing Pylons:	4
Crew:		Survivability/Countermeasures:	
F-5A	1	Martin-Baker Mk10 F-5Es ejection seats:	Yes
F-5B/F	2	ECM systems:	Option
Engines:		RWR:	Option
5,000 lbs. thrust General Electric J85-21A turbojets w/afterburner (F-5E)	2	Chaff and Flare:	Option
Weight (kg):		ARMAMENT:	

Empty:	3,667	M239A2 20-mm cannon:	2
Empty (A/E):	4,410	AVIONICS/SENSOR/OPTICS	
Max Takeoff:	9,333	F-5A radar gun sight	Yes
Max Takeoff (A/E):	11,214	Pulse Doppler Radar (F-5E):	Yes
Speed (km/h):		Communications and Navigation (F-5E):	Yes
Maximum (at altitude):	1,489	Lead-Computing Optical Sight:	Yes
Maximum (at altitude) (A/E):	1,733	Central Air Data Compute:	Yes
Cruise:	904	Attitude and Heading reference system:	Yes
Max "G" Force (g):	INA	FLIR:	Yes
Ceiling (m):	15,789	Night/Weather Capabilities:	Yes

NOTES

THE F-5 IS A LIGHTWEIGHT, EASY-TO-FLY, SIMPLE-TO-MAINTAIN, AND RELATIVELY CHEAP SUPERSONIC FIGHTER. IT WAS ORIGINALLY OFFERED AS A CANDIDATE FOR THE U.S. LIGHTWEIGHT FIGHTER, BUT FOUND VIRTUALLY ALL ITS MARKET OVERSEAS.

APPEARANCE: WINGS: SMALL, THIN MOUNTED LOW ON THE FUSELAGE WELL AFT OF THE COCKPIT

ENGINES: TWO TURBOJETS ARE BURIED SIDE-BY-SIDE IN THE AFT FUSELAGE

FUSELAGE: LONG POINTED NOSE THAT SLOPES UP TO THE CANOPY, BEHIND THE CANOPY, A THICK DORSAL SPINE SLOPES DOWN TO THE TAIL

TAIL: DOUBLE-TAPER FIN HAS TO-SECTION INSET RUDDER. CROPPED DELTA TAIL PLANES ARE MOUNTED AT THE BOTTOM OF THE FUSELAGE IN LINE WITH THE FIN.

VARIANTS

F-5B FREEDOM FIGHTER: TWO-SEAT VERSION. FIRST EXPORT PRODUCTION VARIANT FLEW IN MAY 1964.

CF-5A/D: CANADIAN-BUILT VARIANT. POWERED BY 4,300 LBS. THRUST J85-CAN-15 TURBOJETS. CF-5AS ARE SINGLE SEAT FIGHTERS, AND CF-5DS ARE TWO-SEATERS.

NF-5A/D: CANADAIR BUILT AIRCRAFT FOR NETHERLANDS WITH MODIFIED WING INCLUDING LEADING-EDGE MANEUVERING SLATS AND LARGER DROP TANKS.

NORWEGIAN F-5A/B UPGRADE: PERFORMED ON 30 AIRCRAFT (17 A, 13 B). AS WERE FITTED WITH ALE-40 CHAFF/FLARE DISPENSERS. BS RECEIVED ALR-46 RWR, ALE-38 CHAFF/FLARE DISPENSERS, NEW RADIO, TACAN, IFF, AND LIS-600D ALTITUDE AND HEADING REFERENCE SYSTEM (AHRS).

F-5E TIGER II: SECOND GENERATION F-5 FIGHTER VERSION THAT REPLACED F-5A/B IN PRODUCTION.

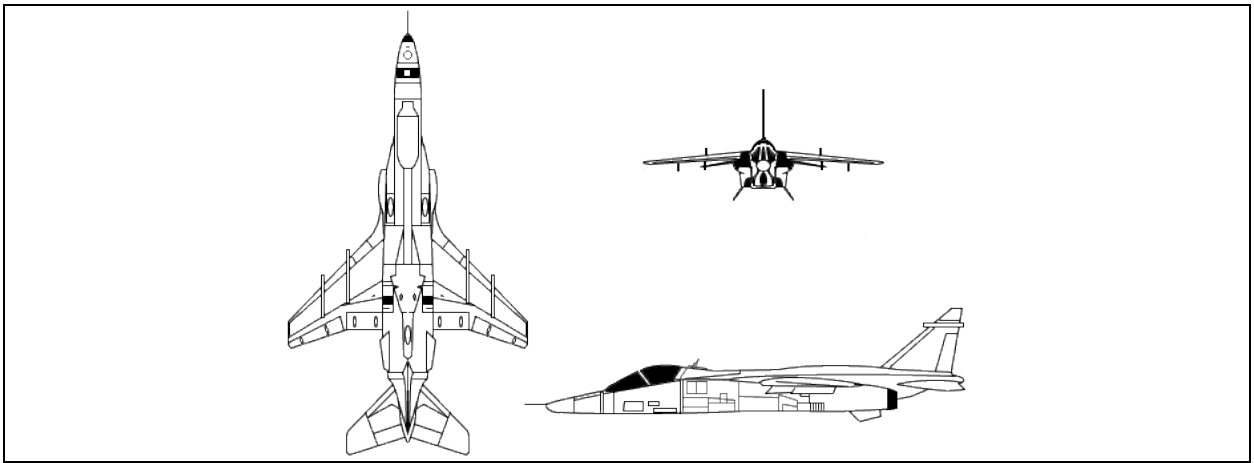
F-5F: TWO-SEAT TRAINER RETAINS ONE CANNON WITH 140 ROUNDS, WEAPONS PYLONS, TIP RAILS; CAN BE FITTED WITH AVQ-27 LASER TARGET DESIGNATOR.

CHEGOONG-HO (AIR MASTER): SOUTH KOREAN NAME FOR F-5ES AND F-5FS ASSEMBLED BY KOREAN AIR.

CHUNG CHENG: TAIWANESE NAME GIVEN TO F-5ES AND F-5FS ASSEMBLED BY AIDC IN TAIWAN.

RF-5E TIGEREYE: PHOTO-RECONNAISSANCE VERSION WITH MODIFIED NOSE THAT ACCEPTS A VARIETY OF CAMERA-CARRYING PALLETS AND MOUNTING AN OBLIQUE FRAME CAMERA.

BRITISH/FRENCH LIGHT ATTACK AIRCRAFT JAGUAR



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types		Range (km):	
Two 30 mm Aden or DEFA 533 guns:	150	Combat Radius (km):	
Other Loading Options		Internal Fuel:	I537 - 852
400 kg or 445 kg:	8	External Fuel:	917 - 1,408
227 kg or 250 kg:	11	Dimensions (m):	
113 kg or 125 kg:	15	Length:	16.9
Rocket pods:	4-6	Wingspan:	8.7
Munitions dispensers:			
ECM pods:	4	Height:	4.9
Fuel drop tanks:	3	Standard Payload (kg):	
ATLIS laser designating pod (French):	1	Hardpoints:	5
Missiles:		Centerline:	1
AIM-9 Sidewinder/Matra/Magic R55:	2	Wing:	4
AS30L AGM:	2	Survivability/Countermeasures:	
Engines 8,040 lbs. thrust Rolls-Royce Turbomeca Adour Mk 104/804 turbofan with afterburner:	2	Martin-Baker zero/zero ejection seats:	Yes
Weight (kg):		ECM systems:	Yes
Maximum Gross:	15,700	Night Vision Goggles:	Yes
Normal Takeoff:	10,954	Bulletproof windscreen:	Yes
Empty:	7,000	ARMAMENT:	
Speed (km/h):		30 mm Aden or DEFA 533 guns:	2
Maximum (at altitude):	1,699, Mach 1.6	AVIONICS/SENSOR/OPTICS	
Maximum (sea level):	1,350, Mach 1.1	DARIN (display attack and ranging inertial navigation):	Yes
Landing Speed:	213	Nav/attack system:	Yes
Max “G” Force (g):	+8.6 g	ADF:	Yes

Ceiling (m):	14,000	Radar altimeter:	Yes
Vertical Climb Rate (m/s):	72	Central Air Data Compute:	Yes
Fuel (liters):	Fuel (liters):	Attitude and Heading reference system:	Yes
Internal:4,200	Internal:4,200	HUDWAC (head-up display and weapon aiming computer):	Yes
External:3,600	External:3,600	Night/Weather Capabilities:	Yes

NOTES

PRODUCED TO MEET A JOINT ANGLO-FRENCH REQUIREMENT IN 1965 FOR A DUAL-ROLE ADVANCED/OPERATIONAL TRAINER AND TACTICAL SUPPORT AIRCRAFT, THE JAGUAR HAS BEEN TRANSFORMED INTO A POTENT FIGHTER-BOMBER. THE RAF ORIGINALLY INTENDED TO USE THE AIRCRAFT PURELY AS AN ADVANCED TRAINER, BUT THIS WAS LATER CHANGED TO THE OFFENSIVE SUPPORT ROLE ON COST GROUNDS

APPEARANCE: WINGS: SHORT-SPAN, SWEPT SHOULDER-MOUNTED, ENGINES: TWO TURBOFANS IN REAR FUSELAGE, FUSELAGE: LONG AND SLEEK WITH LONG, POINTED, CHISELED NOSE, WIDENED AT AIR INTAKES.

NIGHT/WEATHER CAPABILITIES:

DAY/VFR MEDIUM AND LOW-LEVEL GROUND ATTACK/ RECONNAISSANCE AIRCRAFT. THE NIGHT VISION GOGGLES PROGRAM WILL ALLOW LIMITED NIGHT CAPABILITY.

VARIANTS

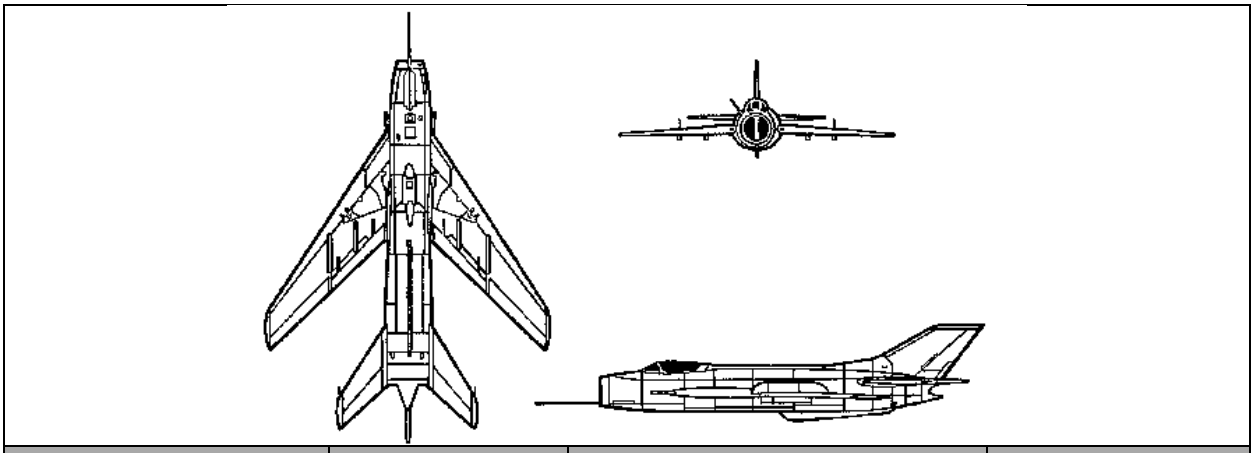
JAGUAR S/JAGUAR GR1: SINGLE-SEAT ATTACK VERSION DESIGNATED GR1 IN BRITISH SERVICE. FIRST EQUIPPED WITH ADOUR MK 102 ENGINES DEVELOPING 7,305 LBS. THRUST WITH AFTERBURNER.

JAGUAR A: FRENCH AIRCRAFT WITH TWIN-GYRO PLATFORM AND DOPPLER NAVIGATION, WEAPON-AIMING COMPUTER, MISSILE FIRE CONTROL FOR ANTI-RADAR MISSILE, FIRE CONTROL SIGHTING UNIT, AND LASER RANGER AND DESIGNATOR POD.

JAGUAR T2/JAGUAR E: TWIN-SEAT COMBAT-CAPABLE TRAINER VERSION: 35 AIRCRAFT DESIGNATED T2 IN BRITISH SERVICE AND E IN FRANCE AND OTHER NATIONS.JAGUAR INTERNATIONAL: EXPORT VARIANT, OFTEN WITH MORE EXTENSIVE AVIONICS FITS THAN BRITISH OR FRENCH AIRCRAFT.

SHAMSHER: JAGUAR INTERNATIONAL VARIANT SELECTED BY INDIA OVER THE MIRAGE F1 AND THE SAAB AJ37 VIGGEN AS THE DEEP PENETRATION STRIKE AIRCRAFT (DSPA).

CHINESE FIGHTER AIRCRAFT J-6 (JIAN-6)/F-6



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
30 mm guns		Vertical Climb Rate (m/s):	152+
250 kg Bombs, or	2	Fuel (liters):	
400-L drop tanks, or	2	Internal:	2,170
760-L drop tanks, or	2	External (2 drop tanks):	800 or 1,520
CAA-1B AAM	2	Range (km):	
Inboard Stations:		Normal:	1,390
8 x 57-mm rockets, or	4	With 2 x 760 L drop tanks:	2,200
16 x 57-mm rockets, or	4	Dimensions (m):	
7 x 90-mm rockets, or	4	Length:	
Gun pods, or	4	Fuselage:	12.6
Practice bomb	4	With Nose Probe:	14.9
Alternative Designations:	see variants	Wingspan:	9.2
Date of Introduction:	1962	Height:	3.9
Proliferation:	10 countries	Hardpoints:	
Description:		Underwing:	6
Crew:	1 (pilot)	Survivability/Countermeasures:	
5,732 lbs. thrust Shenyang Wopen-6 turbojets (7,165 lbs. thrust with afterburner)	2	Martin-Baker zero/zero ejection seats:	Yes
Weight (kg):		Cockpit is pressurized:	Yes
Takeoff:		Fluid anti-icing system for windscreen:	Yes
Clean:	7,545	Tail warning system:	Yes
Typical:		ARMAMENT:	
with 2 AAMs and 760-L drop tanks:	8,965		
Max:	10,000	30-mm automatic cannons:	3
Empty:	5,760	AVIONICS/SENSOR/OPTICS	
Speed (km/h):		Airborne interception radar:	Yes
Maximum Clean:		VHF transceiver:	Yes
(at 11,000 m):	1,540, Mach 1.45	Blind-flying equipment,:	Yes
(at low level):	1,340, Mach 1.09	Radio compass:	Yes
Cruise:	950	Radio altimeter:	Yes
Max “G” Force (g):	+8	Night/Weather Capabilities:	No
Ceiling (m):	19,870		

NOTES

THE F-6 (JIAN-6 FIGHTER AIRCRAFT) IS THE CHINESE VERSION OF THE MIG-19, WHICH WAS STILL IN PRODUCTION IN CHINA IN THE MID-1990S.

APPEARANCE: WINGS: SHARPLY SWEPT, MOUNTED AT MID-FUSELAGE. ENGINES: TWO SMALL TURBOJETS ARE FITTED SIDE-BY-SIDE IN THE AFT FUSELAGE. FUSELAGE: RELATIVELY LONG AND SLENDER, SWELLING AFT FOR THE ENGINES WITH ENGINE NOSE INTAKE THAT HAS A CENTRAL SPLITTER PLATE. TAIL: THE SHARPLY SWEPT FIN HAS A SMALL DORSAL FILLET AND NEARLY FULL HEIGHT RUDDER.

VARIANTS

J-6: EQUIVALENT OF THE MIG-19S/SF DAYTIME FIGHTER WITH 3 X 30 MM GUNS, ONE AT EACH WING ROOT AND ONE ON THE FUSELAGE.

J-6A: EQUIVALENT OF THE MIG-19PF ALL-WEATHER FIGHTER. ARMED WITH STANDARD J-6 GUNS AND ROCKETS.

J-6B: EQUIVALENT OF THE MIG-19PM ALL-WEATHER FIGHTER. ARMED WITH THE AA-1 ALKALI RADAR HOMING MISSILES, NO GUNS.

J-6C: SIMILAR TO THE J-6, BUT WITH BRAKE CHUTE HOUSED IN BULLET-FARING AT THE BASE OF TAILFIN. SAME GUNS AS THE J-6A. EXPORT VARIANT WITH MARTIN-BAKER EJECTION SEATS AND AIM-9 SIDEWINDER MISSILES.

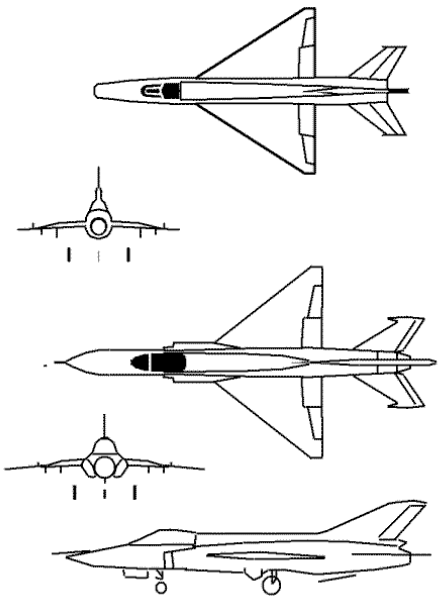
J-6XIN: SIMILAR TO J-6A, BUT WITH NOSE-MOUNTED INTERCEPTION RADAR. SAME GUNS AS THE J-6A.

JJ-6: TRAINER VERSION WITH TANDEM TWO-SEAT COCKPIT. EXPORT VERSIONS ARE FT-6. ARMED WITH ONLY THE FUSELAGE GUN.

JZ-6: A TACTICAL PHOTO-RECONNAISSANCE VERSION, ARMED WITH WING ROOT GUNS ONLY.

F-6: EXPORT VERSIONS.

CHINESE FIGHTER AIRCRAFT J-7 (JIAN-7)/FISHBED



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types		Landing Speed:	310-330
23mm type 23- twin barrel (F-7M):	INA	Ceiling (m):	18,800
30mm Type 30-1 Cannons:	2	Vertical Climb Rate (m/s):	
AAMs:		(F-7B):	150
PL 5B (F-7M):	2 - 4	(F-7M):	180
PL-2/2A/5B/7 (J-711):	2	Fuel (liters):	
Rockets:		Internal:	2,385
12 round 57mm (F-7M):	4	Range (km):	
7 round 90mm (F-7M):	4	Low Alt:	370
18 round 57mm (J-7111)):	4	F-7B with 2 Pl-2 AAM:	
7 round 90mm (J-7111):	4	Internal fuel:	1,200
Bombs:		1 800-L drop tank:	1,490
100 kg (F-7M):	10	F-7M with 2 PL-7 AAM:	
250 kg (F-7M):	4	3 500-L drop tanks:	1,740
500 kg (F-7M)	2	Dimensions (m):	
50 / 150 kg (J-7111):	4	Length:	14.9
250 / 500 kg (J-7111):	2	Wingspan:	7.2
Fuel Tanks:		Height:	4.1
500 L (F-7M):	2	Standard Payload (kg):	1,800
800 L (F-7M):	1	Hardpoints:	
500 L (J-711):	3	Wing Pylons:	2
Alternative Designations:	F-7B, F-7M	Survivability/Countermeasures:	
Date of Introduction:	1965	Zero/130-850 km/h ejection seat:	Yes
Proliferation:	> 11	ECM systems:	
Crew:	1	Jammer:	Yes

Engines 9,700 lbs. thrust Wopen-7B turbofan, 13,500 lbs. thrust w afterburner:	1	ARMAMENT:	
Weight (kg):		M239A2 20-mm cannon:	2
Empty:		30-mm type 30-1 cannons with 60 rounds each in farings under front fuselage	2
(F-7B):	5,145	AVIONICS/SENSOR/OPTICS	
(F-7M):	5,275	Skyranger or Super Skyranger radar:	Yes
Max takeoff:		Heads-Up-Display and Weapons Aiming Computer	Yes
(F-7B):	7,372	ECM pod:	Yes
(F-7M):	7,531	Night/Weather Capabilities:	
Speed (km/h):		J-7111	Yes
Max:	2,175		

NOTES

THE SOVIETS LICENSED THE MANUFACTURE OF THE MIG-21F AND ITS ENGINE TO CHINA IN 1961, AND ASSEMBLY OF THE FIRST J-7 USING CHINESE-MADE COMPONENTS BEGAN EARLY 1964. THE J-7 AIRCRAFT WAS THE MOST WIDELY PRODUCED CHINESE FIGHTER, REPLACING OLDER J-6 FIGHTERS, THE CHINESE VERSION OF THE MIG-19. IN 1995 IT WAS PROJECTED THAT J-7 PRODUCTION WOULD CONTINUE FOR AT LEAST ANOTHER DECADE, RESULTING IN A TOTAL INVENTORY OF NEARLY 1000 AIRCRAFT BY 2005, BUT THE PLAAF INVENTORY HAS REMAINED AT ABOUT 500 AIRCRAFT, SUGGESTING THAT PRODUCTION WAS EITHER SUSPENDED OR TERMINATED.

APPEARANCE: WINGS: MID-MOUNT, DELTA, CLIPPED TIP, ENGINES: ONE TURBOFAN IN FUSELAGE, FUSELAGE: CIRCULAR WITH DORSAL SPINE, TAIL: SWEPT-TAIL WITH LARGE VERTICAL SURFACES AND VENTRAL FIN

VARIANTS:

J-7 I/F-7: INITIAL PRODUCTION VERSION, SIMILAR TO MIG-21F FISHBED-C. THE 12,677-LBST WOPEN 7 ENGINE IS SAID TO BE MORE RELIABLE THAN THE TUMANSKY R-11 FROM WHICH IT WAS DERIVED. EXPORT MODELS ARE DESIGNATED F-7.

J-7 II/F-7B: UPRATED ENGINE, REDESIGNED INLET CENTER-BODY, INSTALLATION OF SECOND 30-MM CANNON, CENTERLINE DROP TANK HARDPOINT. ENTERED PRODUCTION IN EARLY 1980S.

JJ-7/FJ-7: TANDEM TWO-SEAT TRAINER VERSION DEVELOPED WELL AFTER THE SINGLE SEAT FIGHTERS. FIRST FLIGHT ON JULY 5, 1985.

F-7M AIRGUARD: CURRENT PRODUCTION VERSION AND EXPORT VERSION: RECOGNITION FEATURE IS RELOCATION OF THE PITOT TUBE FROM BELOW THE NOSE INTAKE TO ABOVE IT. FITTED WITH MARCONI SKYRANGER RADAR; GEC AVIONICS HEADS-UP-DISPLAY AND WEAPONS AIMING COMPUTER; INBOARD WING PYLONS FOR PL-2/2A/5B/7 OR MATRA MAGIC AAM, ROCKET PODS OR BOMBS UP TO 500 KG; ADDITIONAL OUTBOARD PYLONS WITH PLUMBING FOR 500-L DROP TANKS OR 50/150 KG BOMBS OR ROCKET PODS.

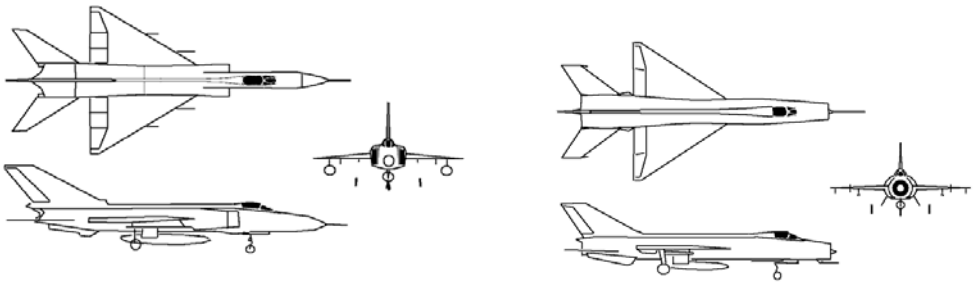
F-7P SKYBOLT: SIMILAR TO THE F-7M WITH SOME PAKISTANI EQUIPMENT: CANNON IS TWO NORINCO 30 MM CANNONS WITH 60 ROUNDS EACH. USUALLY CARRIES A 720-L CENTERLINE DROP TANK.

F-7M AIRGUARD: CURRENT PRODUCTION VERSION AND EXPORT VERSION: RECOGNITION FEATURE IS RELOCATION OF THE PITOT TUBE FROM BELOW THE NOSE INTAKE TO ABOVE IT. FITTED WITH MARCONI SKYRANGER RADAR; GEC AVIONICS HEADS-UP-DISPLAY AND WEAPONS AIMING COMPUTER; INBOARD WING

PYLONS FOR PL-2/2A/5B/7 OR MATRA MAGIC AAM, ROCKET PODS OR BOMBS UP TO 500 KG; ADDITIONAL OUTBOARD PYLONS WITH PLUMBING FOR 500-L DROP TANKS OR 50/150 KG BOMBS OR ROCKET PODS.

F-7P SKYBOLT: SIMILAR TO THE F-7M WITH SOME PAKISTANI EQUIPMENT: CANNON IS TWO NORINCO 30 MM CANNONS WITH 60 ROUNDS EACH. USUALLY CARRIES A 720-L CENTERLINE DROP TANK.

CHINESE FIGHTER AIRCRAFT J-8/FINBACK



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types		Fuel (liters):	
23mm type 23- twin barrel (rnds):	200	Internal:	5,400
AAMs:		External:	1,760
PL-2B IR:	6	Range (km):	2,200
PL-7 medium range semi-active homing (optional):	6	Combat Radius:	800
Rockets:		Takeoff Run/Landing Roll (m):	
Quingan HF-16B 57 mm:	6	670/1,000 (w/afterburner and drag chute)	
90 mm AS rockets:	6	Dimensions (m):	
Bombs:	3	Length:	21.6
Fuel Tanks:	3	Wingspan:	9.4
Alternative Designations:	F-8	Height:	5.4
Date of Introduction:	1980	Standard Payload (kg):	
Proliferation:	1	External:	7
Crew:	1	Hardpoints:	6 under wing, 1 centerline
Engines14,815 lbs. thrust Wopen 13A-II turbojets with afterburner :	1	Survivability/Countermeasures:	
Weight (kg):		Pressurized cockpit with ejection seat:	Yes
Max Gross:	17,800	Radar warning receiver:	Yes
Normal Takeoff:	14,300	chaff and flares	Yes
Empty:	9,820	ARMAMENT:	
Speed (km/h):		23-mm Type 23-3 twin-barrel cannon:	1
Max (at altitude):	2,340	AVIONICS/SENSOR/OPTICS	
Max (sea level):	1,300	VHF/UHF and HF/SSB radios	Yes
Limit “G” Force (g):	+4.83	‘Odd Rods’ type IFF	Yes
Ceiling (m):	20,000	Monopulse nose-radar	Yes

NOTES

THE BEST THAT CAN BE SAID FOR THE J-8 IS THAT ONCE UPGRADED IT WILL BE NO MORE THAN AN ADVANCED OBSOLETE AIRCRAFT, COMPARABLE IN CONFIGURATION AND AERODYNAMIC PERFORMANCE TO THE SU-

15/FLAGON. THE J-8 AND J-8-II AIRCRAFT ARE TROUBLE-PRONE AIRCRAFT WITH A POOR WEAPON SUITE AND AN INEFFICIENT ENGINE. AT BEST, THE J-8-II CAN BE COMPARED WITH AN EARLY MODEL (1960S) US F-4 PHANTOM. IN FACT, AFTER TWENTY-SIX YEARS THE J-8-II IS STILL IN THE DEVELOPMENT STAGE, HAS RESULTED IN ONLY ABOUT 100 FIGHTERS DEPLOYED, AND MEETS NONE OF THE REQUIREMENTS OF THE PLAN.

APPEARANCE: WINGS: SHARPLY SET DELTA WING, ENGINES: SIDE BY SIDE W OPEN TURBOJETS, FUSELAGE: SLENDER WITH NOSE ENGINE AIR INTAKE (J-8-I), SOLID CONICAL NOSE (J-8-II), TAIL: SWEPT WITH FULL-HEIGHT RUDDER.

VARIANTS

THIS AIRCRAFT IS AN ADAPTATION OF THE SOVIET MIG-21 FISHBED

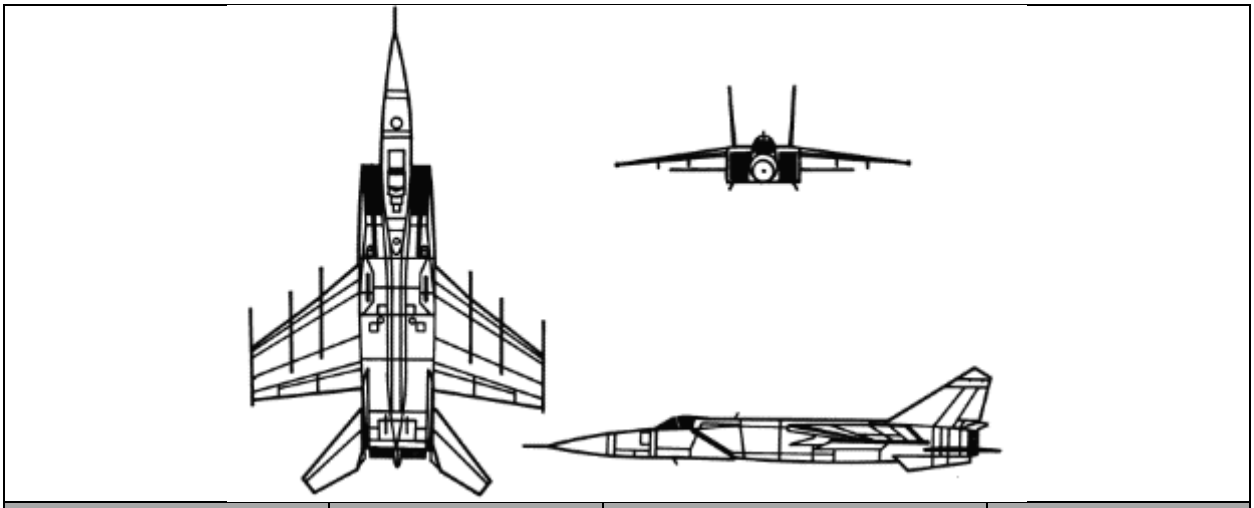
J-8/F-8-I FINBACK-A: INITIAL PRODUCTION VERSION WITH WP-7P ENGINES AND NOSE AIR INTAKES. J-8 IS DESIGNATION FOR AIRCRAFT IN CHINESE SERVICE; F-8/F-8M DENOTES EXPORT VERSION. MORE THAN 100 J-8/F-8-IS WERE PRODUCED

J-8-II FINBACK-B: RADAR TYPE IS UNIDENTIFIED MONOPULSE RADAR, BUT MAY BE THE LEIHUA TYPE 317A IN SOLID NOSE HOUSING. SEVEN PYLONS FOR INCREASED WEAPONS INVENTORY AND NEW SIDE AIR INTAKES. OTHER CHARACTERISTICS SIMILAR TO F-8-II.

F-8-II FINBACK-B: IMPROVED VERSION WITH NEW 14,815 WOPEN-13A ENGINES, WING ROOT INTAKES, AND ALL-FLYING HORIZONTAL STABILIZERS, FOLDING VENTRAL FIN, 80%-COMPOSITE MATERIAL VERTICAL FIN AND IMPROVED AVIONICS.

F-8 ILM FINBACK-B: DESIGNATION FOR RUSSIAN MODIFIED F-8-IIS. INCLUDES: RUSSIAN AA-12 AND AA-10 MISSILES, A HEADS-UP-DISPLAY, GLOBAL POSITIONING SYSTEM RECEIVER, MULTI-FUNCTION COCKPIT DISPLAYS AND INTEGRATED ELECTRONIC COUNTERMEASURES. ALSO RUSSIAN PHAZOTRON ZHUK 8 II MULTI-FUNCTION PULSE DOPPLER FIRE-CONTROL RADAR.

RUSSIAN INTERCEPTOR AIRCRAFT MIG-25/FOXBAT-B



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Air-to-Air Missiles:		Ceiling (m):	
AA-6 ACRID:	4	Service (clean):	
AA-7 APEX:	4	R Series:	23,000
AA-6 ACRID w/ AA-8 APHID/AA-11 ARCHER:	2/4	P Series:	20,700
AA-7 APEX w/ AA-8 APHID/AA-11 ARCHER:	2/4	With External Stores (R-Series):	20,700
Alternative Designations:	Mig-25 RB FOXBAT-B/ MiG-25PD FOXBAT-E	Vertical Climb Rate (m/s) (P Series):	208
Date of Introduction:	1967	Fuel (liters):	
Proliferation:	At least 10 countries	Internal:	17,470
Description:		External:	5,300
Crew:	1	Range (km):	
Engines 19,400 lbs. thrust Soyuz/ Tumansky R-15BD-300 turbojet (24,692 lbs. thrust with afterburner):	2	Dimensions (m):	
Weight (kg):		Length:	
Maximum Gross:		R Series:	21.6
R Series:	41,200	P Series:	23.8
P Series:	36,720	Wingspan:	
Clean Takeoff:	35,060 (R)	R Series:	13.4
Empty:	20,000 (P)	P Series:	14.0
Speed (km/h):		Height (gear extended):	
Maximum (at altitude):		R Series:	6.0
R Series:	3,000	P Series:	6.1
P Series:	3,390	Standard Payload (kg):	
Maximum (sea level):		External:	2,000 – 5,000
R Series:	1,200	Hardpoints (R Series):	
P Series:	1,050	Wing:	4
Cruise:		Fuselage:	6

R Series:	2,500	Hardpoints (P Series):	4
P Series:	3,000	Survivability/Countermeasures:	
Takeoff/Landing Speed:		pressurized cockpit with zero/130 – 1,250 km hour ejection seats	Yes
R Series:	360	Decoys:	Yes
P Series:	290	Radar jammer:	Yes
Max “G” Force (g):		radar and missile warning receivers:	Yes
P Series:	+4.5	ARMAMENT:	
Maximum with Max Internal fuel:	Supersonic:	Air-to-air missiles on four under-wing attachments:	Yes
With 5,300-litre Fuel Tank:	Supersonic:	AVIONICS/SENSOR/OPTICS:	
Subsonic (R Series):	2,400 (R)	Fire control radar in the nose Range (km):	
Takeoff Run/Landing Roll (m) (P Series):	1,250/800	Search:	100
		Tracking;	75

NOTES

THE FOXBAT IS A HIGH-PERFORMANCE, HIGH-ALTITUDE INTERCEPTOR. THIS FAST BUT MANEUVERABLE INTERCEPTOR HAS BEEN DEPLOYED AS A HIGH ALTITUDE RECONNAISSANCE PLATFORM. THOSE REMAINING IN RUSSIAN SERVICE ARE ALL RECONNAISSANCE VERSIONS. THE INTERCEPTORS PHASED OUT IN 1994.INTERCEPTOR VERSIONS REMAIN IN SERVICE WITH OTHER NATIONS.

APPEARANCE: WINGS: SHOULDER-MOUNTED, SWEPT-BACK, AND TAPERED WITH SQUARE TIPS, ENGINES: BURIED SIDE BY SIDE IN AFT FUSELAGE, FUSELAGE: LONG AND SLENDER WITH SOLID, POINTED NOSE. FLATS ARE MID- TO LOW MOUNTED ON FUSELAGE, SWEPT-BACK AND TAPERED WITH ANGULAR TIPS. TAIL: TWO SWEPTBACK, AND TAPERED VERTICAL FINS WITH ANGULAR TIPS

VARIANTS

MIG-25 FOXBAT-A: STANDARD INTERCEPTOR VERSION. WITHDRAWN FROM SERVICE IN RUSSIA IN THE 1990S.

MIG-25R FOXBAT-B: RECONNAISSANCE VERSION.

MIG-25RB FOXBAT-B: RECONNAISSANCE-BOMBER VERSION BUILT IN 1970.

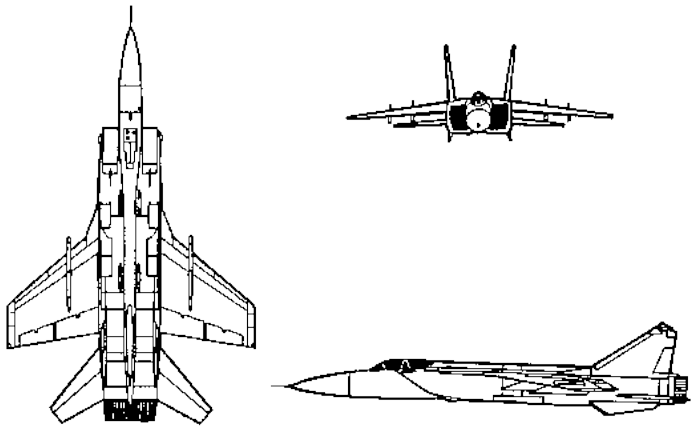
MIG-25U FOXBAT-C: TWO-SEAT TRAINER VERSION.

MIG-25RBK FOXBAT-D: RECONNAISSANCE-BOMBER VERSION WITH SLAR.

MIG-25P/PD FOXBAT-E: INTERCEPTOR WITH IMPROVED RADAR THAT HAS LIMITED LOOK-DOWN/SHOOT-DOWN CAPABILITY, IR SENSOR UNDER THE NOSE, AND UPGRADED ENGINE.

MIG-25BM FOXBAT-F: FIGHTER/ATTACK VERSION WITH AS-11 KILTER ANT-RADAR MISSILES AND FREE-FALL BOMBS TO ATTACK GROUND BASED AIR DEFENSE FROM HIGH ALTITUDES.

RUSSIAN INTERCEPTOR AIRCRAFT MIG-31/FOXHOUND



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types:		Range (km):	
GSh-23-6 23mm Gatling-type cannon (rnds):	260	Ferry without refueling:	3,300
Other Loading Options:		Combat Radius (km):	
Fuselage:		4 x AA-9 Amos, 2 x drop tanks, 1 in-flight refuel at Mach 0.8:	2,200
AA-9 AMOS AAMX:	4	4 x AA-9 Amos, 2 x drop tanks at Mach 0.85:	1,400
AA-6 ACRID:	2	4 x AA-9 Amos, no drop tanks at Mach 0.85:	1,200
AA-8 APHID:	4	4 x AA-9 Amos, no drop tanks at Mach 2.35:	720
AA-10 ALAMO (multirole):	8	Duration (hr.):	
AA-11 ARCHER (multirole):	8	internal and drop tanks only:	3.6
AA-12 ADDER (multirole):	8	drop tanks and in-flight refueling:	6 -7
Alternative Designations:		Takeoff Run/Landing Roll (m):	1,200/800
Date of Introduction:	1967	Dimensions (m):	
Proliferation:	< 1	Length:	20.6
Description:		Wingspan:	13.5
Crew:	2	Height:	6.2
Engines 0,944 lbs. thrust Aviadvigatel D-30F-6 turbofan, 34,172 lbs. thrust with afterburner):	2	Standard Payload (pylons):	8
Weight (kg):		Survivability/Countermeasures:	
Maximum Gross:	46,200	Pilot and weapons system operator in tandem under individual rearward hinged canopies:	Yes
Normal Takeoff:	41,000	Active infrared and electronic countermeasures:	Yes
Empty:	21,820	Radar warning receiver:	Yes
Speed (km/h):		Wingtip ECM/ECCM pod:	Yes
Maximum (at altitude):	2,500	ARMAMENT:	

Maximum (sea level):	1,500	GSh-23-6 23mm Gatling-type cannon:	1
Maximum Attack Speed:	3,000	AVIONICS/SENSOR/OPTICS:	
Cruise:	1,010	N-007/S-800 Zaslon (Flash Dance) electronically scanned phased array look-down shoot-down fire control radar:	Yes
Max "G" Force (g):	+5	Long range nav system:	Yes
Ceiling (m):	24,400	Infrared search/track system:	Yes
Vertical Climb Rate (m/s):	42	Night/Weather Capabilities::	Yes
Fuel (liters):			
Internal:	20,250		
External:	5,000		

NOTES

THE MIG-31 IS AN ALL-WEATHER, TWO-SEAT INTERCEPTOR WITH ADVANCED DIGITAL AVIONICS. IT WAS THE FIRST SOVIET FIGHTER TO HAVE A TRUE LOOK-DOWN, SHOOT-DOWN CAPABILITY.

APPEARANCE: WINGS: SHOULDER-MOUNTED, MODERATE-SWEPT WITH SQUARED TIPS. ENGINES: TWO TURBOFANS. FUSELAGE: RECTANGULAR FROM INTAKES TO EXHAUSTS WITH A LONG, POINTED NOSE. TAIL: TAIL FINS ARE BACK-TAPERED WITH ANGULAR TIPS AND CANTED OUTWARD. LOW-MOUNTED FLATS ARE SWEPT-BACK AND TAPERED.

VARIANTS

THE MIG-31 FOXHOUND IS A SUBSTANTIALLY IMPROVED DERIVATIVE OF THE MIG-25 FOXBAT.

MIG-31 FOXHOUND-A INTERCEPTOR: ORIGINAL PRODUCTION VERSION.

MIG-31B/BS/E FOXHOUND-A INTERCEPTOR:

THE MIG-31B HAS FLASH DANCE A RADAR AND IMPROVED AA-9 AMOS AAMS, IN-FLIGHT REFUELING PROBE, AND NEW NAVIGATION SYSTEM.

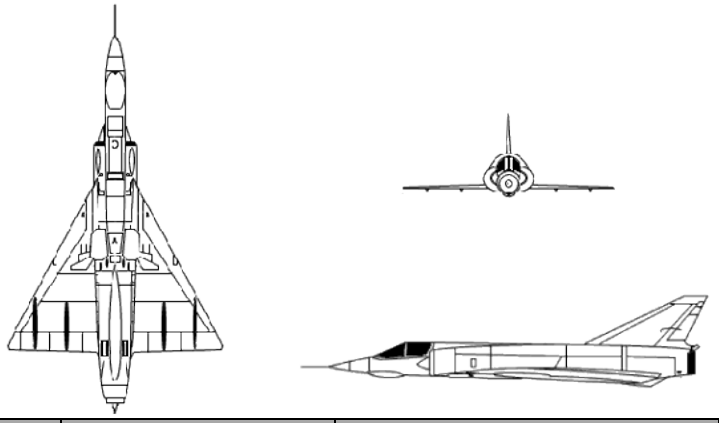
MIG-31BS: SIMILAR TO THE MIG-31B, WITH RADAR ENHANCEMENT AND A-723 NAVIGATION.

MIG-31E: EXPORT VARIANT OF MIG-31B AIMED AT CHINA, INDIA, AND IRAN. NONE WERE SOLD.

MIG-31BM/FE FOXHOUND-A MULTIROLE FIGHTER: MID-LIFE UPGRADE FOR INTERCEPTORS. FITTED WITH ASMS, UPGRADED RADAR AND AA-11 AND AA-12 AAMS.MIG-31FE IS EXPORT VARIANT.

MIG-31M FOXHOUND-B MULTIROLE FIGHTER: UPGRADED LONG RANGE NAVIGATION SYSTEM AND IMPROVED PHASED ARRAY RADAR.

FRENCH FIGHTER AIRCRAFT MIRAGE III/5/50



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types		Range (km):	
30-mm cannon:	125	Cruise:	
AAMs:		Mirage III:	1,670
Matra Magic 550:	2	Mirage 5:	1,930
AIM-9 Sidewinder:	2	Mirage 50:	2,133
Bombs:	12	Ferry:	4,000
125 kg /250 kg:	6	Takeoff Run/Landing Roll (m):	700-1,600/700
440 kg:	10	Dimensions (m):	
Rocket Pods:	1967	Length:	
68-mm or 100-mm:	2	Mirage III:	15.0
2 x 30-mm Cannon Pods (rnds ea.):	250	Mirage 5:	15.6
Alternative Designations:		Mirage 50:	15.6
Date of Introduction:	1959	Wingspan:	8.3
Proliferation:	>15	Height (gear extended):	4.3
Description:		Standard Payload (kg):	4,000
Crew:	1	Survivability/Countermeasures:	
Engines:		Martin-Baker zero/267 km/h ejection seat:	Yes
6,200 lbs. thrust SNECMA Atar 9C turbojet with afterburner (Mirage III/5):	1	Separate cockpit and avionics air conditioning systems:	Yes
7,200 lbs. thrust SNECMA Atar 9K50 turbojet, afterburner (Mirage 50):	1	Radar warning receiver:	Yes
Weight (kg):		ARMAMENT:	
Max Takeoff:	13,500	30-mm DEFA 552 (Mirage III):	2
Empty:	7,050	30-mm DEFA 553 (Mirage 5):	2
Speed (km/h):		30-mm DEFA 553 (Mirage 50):	2
Max (at altitude):	2,350; Mach 2.2	AVIONICS/SENSOR/OPTICS:	
Max (sea level):	1,390; Mach 1.1	Intercept or ground mapping radar:	Yes
Ceiling (m):		Fire-control radar in the nose:	Yes

Mirage III:	17,000	Navigation computer:	Yes
Mirage 5:	17,000	Automatic gun sight:	Yes
Mirage 50:	18,000	Night/Weather Capabilities:	
Vertical Climb Rate (m/s):	84	All-weather, day and night capable. (III/5)	
Fuel (liters):		Clear-weather day fighter. (50)	
Internal:	3,330		
External (III/5/50):	1,700/ 1,200/ 1,700		

NOTES

ONE OF THE MOST SUCCESSFUL AIRCRAFT PRODUCED FOR EXPORT TO BE PRODUCED OUTSIDE OF THE UNITED STATES AND THE FORMER SOVIET UNION. THE MIRAGE III/5/50 HAS PROVEN TO BE A COMPETENT GROUND ATTACK AIRCRAFT DESPITE ITS ORIGINAL DEVELOPMENT AS A HIGH ALTITUDE INTERCEPTOR. THE MIRAGE 5 AND 50 ARE SIMILAR TO THE III, BUT FITTED WITH SIMPLIFIED AVIONICS AND HAVE EXCLUSIVELY BEEN EXPORT VARIANTS.

APPEARANCE: WINGS: LOW-MOUNTED DELTA WINGS WITH POINTED TIPS. ENGINES: ONE TURBOJET INSIDE FUSELAGE. FUSELAGE: LONG, SLENDER, AND TUBULAR WITH A POINTED NOSE AND BUBBLE COCKPIT. TAIL: LARGE, SWEPT-BACK SQUARE TIP WITH A TAPERED FIN AND NO TAIL FLATS.

VARIANTS

MIRAGE IIIA: HIGH ALTITUDE INTERCEPTOR AND STRIKE AIRCRAFT FITTED WITH ROCKET MOTOR FOR TAKE-OFF.

MIRAGE IIIB: TWO-SEAT TRAINER VERSION OF IIIA WITH STRIKE CAPABILITY RETAINED NO INTERNAL CANNON.

MIRAGE IIIC: MAJOR PRODUCTION VARIANT OF IIIA. FITTED WITH ATAR 9B3 ENGINE, CYRANO II INTERCEPT AND GROUND-MAPPING RADAR.

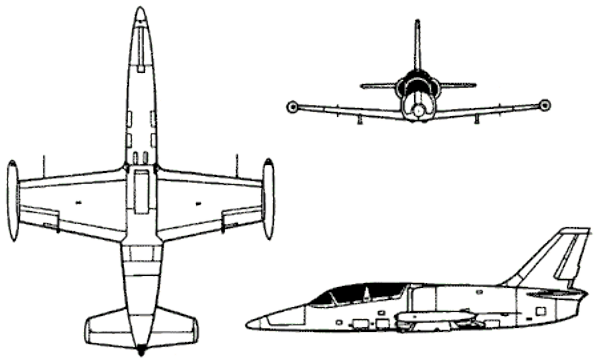
MIRAGE IIID: TWO-SEAT TRAINER/STRIKE AIRCRAFT. NO INTERNAL CANNON.

MIRAGE IIIE: MAJOR PRODUCTION VARIANT. FITTED WITH ATAR 9C ENGINE, CYRANIO IIBIS RADAR, AND EXTRA AVIONICS BAY.

MIRAGE IIIEA/EO: AUSTRALIAN LICENSE-BUILT AIRCRAFT. (52 ATTACK AND 48 INTERCEPTOR AIRCRAFT)

MIRAGE 5: GROUND ATTACK VARIANT ORIGINALLY DEVELOPED FOR THE ISRAELI AIR FORCE. FITTED WITH TWO EXTRA FUSELAGE STORES STATIONS, FIRE CONTROL RADAR DELETED OR REPLACED BY RANGING RADAR. PERFORMANCE IDENTICAL TO MIRAGE III EXCEPT FOR LONGER RANGE ON INTERNAL FUEL; SOME FITTED WITH CYRANO OR AGAVE RADAR.

CZECH REPUBLIC TRAINER/LIGHT GROUND ATTACK AIRCRAFT L39 ALBATROSS



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types	Combat Load	Ceiling (m):	11,500
23-mm twin barrel GSh-23 cannon	150	Vertical Climb Rate (m/s):	22
Other Loading Options		Fuel (liters):	
Rocket Pods:	4	Internal:	1,255
Rocket Pods and 350 L drop tanks:	2	External:	8,40
IR Missiles and 350 L drop tanks:	2	Range (km):	
227 kg bombs:	4	With Max Fuel:	1,750
454 kg bombs:	2	Takeoff Run/Landing Roll (m):	530/650
113 kg bombs:	6	Dimensions (m):	
Dispensers and 350 L drop tanks:	2	Length:	12.2
350 L drop tank and Photo Recon Pod:	1	Wingspan:	9.5
SYSTEM		Height:	4.8
Alternative Designations:		Standard Payload (kg):	
Date of Introduction:	1974	External:	1,500
Proliferation:	22	Hardpoints:	
Description:		Fuselage:	1
Crew:	2	Wings:	4
Engines 3,792 lbs. thrust Ivanchenko AI-25TL turbofan:	1	Survivability/Countermeasures:	
Weight (kg):		Zero/150 km/hr. ejection seats:	Yes
Max Takeoff:	4,700	pressurized, heated, and air conditioned cockpit:	Yes
Clean Takeoff:	4,525	ARMAMENT:	
Empty:	3,455	23-mm GSh-23 twin barreled cannon:	Yes
Speed (km/h):		AVIONICS/SENSOR/OPTICS:	
Maximum (at altitude):	750	Weapon delivery and navigation system with HUD and video camera	Yes

		in front cockpit and monitor in rear cockpit	
Maximum (sea level):	700	Gun/rocket/missile firing and weapon release controls in front cockpit only	Yes
Max "G" Force (g):	+8/-4	Night/Weather Capabilities:	Limited

NOTES

THE L39 ALBATROSS IS A VERY WIDELY FLOWN TRAINER/LIGHT ATTACK AIRCRAFT. THE DESIGN IS CZECHOSLOVAKIAN, THOUGH THERE ARE SIGNIFICANT SOVIET INPUTS AND THE AIRCRAFT IS IN SERVICE WITH VARIOUS SOVIET ALLIES.

APPEARANCE: WINGS: LOW, SLIGHTLY SWEPT. ENGINES: SINGLE TURBOFAN IN FUSELAGE. FUSELAGE: LONG, SLENDER, POINTED NOSE. TAIL: TALL, SWEPT VERTICAL WITH INSET RUDDER.

VARIANTS

L39C: BASIC FLIGHT TRAINER.

L39V: SIMILAR TO THE L39C, BUT WITH SINGLE SEAT COCKPIT AND MODIFIED TO ACT AS TARGET TOW AIRCRAFT.

L39ZO: ARMED VERSION OF L39C, ADDING FOUR UNDERWING HARDPOINTS FOR A VARIETY OF GROUND ATTACK STORES.

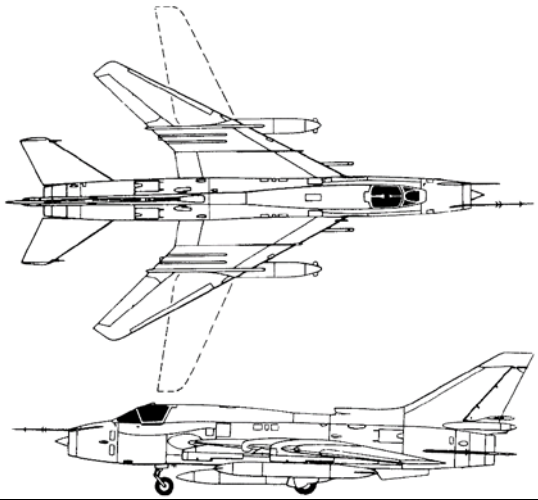
L39ZA: SIMILAR TO L39ZO, BUT WITH UNDER FUSELAGE GUN POD AND REINFORCED LANDING GEAR. USED FOR GROUND ATTACK AND RECONNAISSANCE MISSIONS.

L39MS: DEVELOPMENTAL VERSION INCORPORATING MORE ADVANCED AVIONICS AND NEW 4,852 LBS. THRUST ENGINE. ADDRESSED SOVIET AF REQUIREMENT TO TRAIN PILOTS FOR THE MIG-29 FULCRUM AND SU-27 FLANKER AIRCRAFT

L59:DEVELOPMENT OF THE L39MS WITH WESTERN ENGINE, AVIONICS, AND MARTIN-BAKER EJECTION SEATS

L-159: GROUND ATTACK VARIANT OF THE L59.

RUSSIAN GROUND-ATTACK AIRCRAFT SU-17/FITTER



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types		Ceiling (m):	
2x 30-mm NR-30 guns (rnds):	160	Service (clean):	
Other Loading Options		M2:	18,000
325-mm S-25 rockets:	1	M4:	15,200
80-mm S-8 rocket pods:	20	With External Stores:	INA
57-mm S-5 rocket pods:	32	Vertical Climb Rate (m/s):	230
AS-7/KERRY ASM:	1	Fuel (liters):	
AS-9/KYLE ASM:		Internal:	4,550
AS-10/KAREN ASM:		External 800 liter tanks:	< 4
AS-12/KEGLER ASM:		Range (km):	
AS-14/KEDGE ASM:		Max Load:	1,500
AA-2 ATOLL AAM:	2	With Aux Fuel:	INA
AA-8/APHID AAM:	2	Combat Radius:	330 to 685
AA-11/ARCHER AAM launchers:	2	Takeoff Run/Landing Roll (m):	
23-mm SPPU-22 Gun Pods		Prepared Surface:	900/950
External fuel tanks (liters)	800	Dimensions (m):	
100-kg, 250-kg, and 500-kg unguided and guided bomb		Length:	18.8
SYSTEM		Wingspan:	13.8 extended, 10.6 swept
Alternative Designations:	Su-20, Su-22, Strizh or Martlet	Height:	4.8
Date of Introduction:	1970	Standard Payload (kg):	
Proliferation:	19	External:	4,000
Description:		M4:	4,250
Crew:	1	Hardpoints:	8
Engines 28,660-hp Lyulka AL-21F-3(Su-17/20)/ or 1x 25,335-shp Tumansky:	1	Survivability/Countermeasures:	

R-29BS-300 (Su-22) turbojet with afterburner	1	Radar warning receiver:	Yes
Weight (kg):		chaff and flares:	Yes
Max Gross:		Armored cockpit:	
M2:	17,700	M3:	Yes
M4:	19,500	M4:	Yes
Normal Takeoff:		ARMAMENT:	
M2:	14,000	30-mm machinegun:	2
M4:	16,400	Range (practical) (m):	2,500
Empty:	10,000	Elevation/Traverse (rigidly mounted):	None
Speed (km/h):		Ammo Type:	
Max (at altitude):	Mach 2.1	HEFI:	Yes
Max (sea level):	Mach 1.1	APT:	Yes
Takeoff/Landing Speed:	265	CC:	Yes
Max "G" Force (g):	+7.0	Rate of Fire (rpm):	850
		AVIONICS/SENSOR/OPTICS:	Simple

NOTES

THE MID-WING PIVOT POINT OF THE SWEEP WINGS ALLOWS FOR POSITIONS OF 28, 45 OR 62 DEGREES. UP TO FOUR EXTERNAL FUEL TANKS CAN BE CARRIED ON WING PYLONS AND UNDER THE FUSELAGE. WHEN UNDER-FUSELAGE TANKS ARE CARRIED, ONLY THE TWO INBOARD WING PYLONS MAY BE USED FOR ORDNANCE. AVAILABLE MUNITIONS ARE SHOWN ABOVE; NOT ALL MAY BE EMPLOYED AT ONE TIME. MISSION DICTATES WEAPONS CONFIGURATION. EXTERNAL STORES ARE MOUNTED ON UNDERWING AND UNDERBODY HARDPOINTS. EACH WING HAS TWO POINTS, AND THE FUSELAGE HAS FOUR ATTACHMENT POINTS FOR A TOTAL OF EIGHT STATIONS. GUN PODS CAN BE MOUNTED TO FIRE REARWARD.

APPEARANCE: WINGS: LOW-MOUNT, VARIABLE, SWEPT AND TAPERED WITH BLUNT TIPS. ENGINES: ONE IN FUSELAGE, INTAKE IN NOSE. FUSELAGE: TUBULAR WITH BLUNT NOSE. TAIL: SWEPT-BACK AND TAPERED, FLATS MOUNTED ON FUSELAGE AND SWEPT-BACK.

VARIANTS

AIRCRAFT WAS DERIVED FROM SU-7 FITTER A BY INCORPORATING VARIABLE WINGS.

MANY VARIANTS ARE IN USE; HOWEVER, THE M3 AND M4 ARE THE MOST PROLIFERATED VERSIONS.

DOMESTIC AIRCRAFT USE NOMENCLATURE SU-17. EXPORT VERSIONS USE SU-20 AND SU-22.

SU-17/-17MK/-20/FITTER C: THE FIRST PRODUCTION VERSION. EXPORT IS CALLED SU-20.

SU-17M/ -17M2/ -17M2D FITTER D: EXTERNAL DOPPLER-NAV AND INTERNAL LASER RANGEFINDER. RECONNAISSANCE VERSION CALLED SU-17R.

SU-17UM/-22U/FITTER E: TWO-SEAT TRAINER WITH COMPONENTS OF SU-17M.

SU-17/FITTER G: COMBAT-READY TWO-SEAT TRAINER VARIANT OF FITTER H. EXPORT VERSION IS SU-22, WITH TUMANSKY ENGINE.

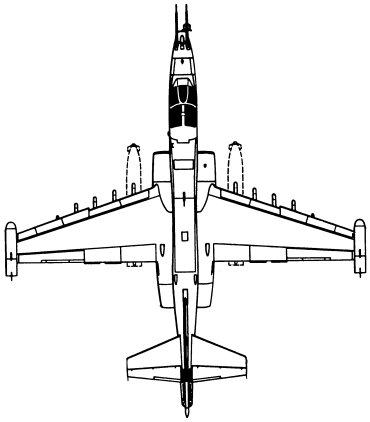
SU-17/-17M3/FITTER H: INCREASED PILOT VISIBILITY BY DROOPING THE AIRCRAFT NOSE, AND INCORPORATED AN INTERNAL DOPPLER-NAV AND LASER RANGEFINDER. RECONNAISSANCE VERSION CALLED SU-17M3R.

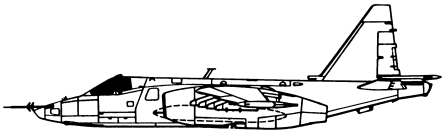
SU-17M4/-22M4/FITTER K: FIGHTER-BOMBER. ESSENTIALLY SAME AS ABOVE, BUT WITH AN ADDITIONAL AIR INTAKE. EMPLOYS DIGITAL NAVIGATION AND ATTACK AVIONICS.

SU-22/FITTER F: EXPORT VERSION OF FITTER D WITH TUMANSKY ENGINE.

SU-22/-22M3/FITTER J: SIMILAR TO FITTER H, BUT WITH INCREASED INTERNAL FUEL CAPACITY.

GEORGIAN/RUSSIAN MULTI-ROLE ATTACK AIRCRAFT SU-25TM AND SU-39





SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types		Takeoff Run/Landing Roll (m):	
2x 30-mm Gsh-30 guns (rnds):	1200	Prepared Surface:	550/600
Other Loading Options		Unprepared Surface:	650/750
AT-16 Vikhr-M ATGM:	8	Max Load:	1,200
23- or 30-mm GSH gun pods (rnds):	260	Dimensions (m):	
UB-20 80/122/240/340-mm rockets w/ semi-active laser homing:	8	Length:	15.3
AS-10/KAREN ASM:	8	Wingspan:	14.5
AS-11/KILTER ASM:	8	Height (gear extended):	5.2
AS-14/KEDGE ASM:	8	Standard Payload (kg):	
AS-17/KRYPTON ASM:	8	External:	6,400
AA-8/APHID AAM:	2	Hardpoints under-wing, w/500 kg ea.:	8
AA-11/ARCHER AAM launchers:	2	+ 2 light outer (± 65 kg) for AAM	
AA-12 ADDER AAM:	2	Dimensions (m):	
SYSTEM		Length:	15.3
Alternative Designations:	Gratch, Rook,	Wingspan:	14.5
Date of Introduction:		Height (gear extended):	5.2
Su-25TM:	1995	Standard Payload (kg):	
Proliferation:	> 16	External:	6,400

Description:		Survivability/Countermeasures:	
Crew:		Armored Titanium cockpit and engines:	Yes
Su-25TM:	1	12-mm titanium plate added between engines:	Yes
Su-39:	2	Zero/100 km/ejection seat:	Yes
Engines:2 x 9,900 lbs. thrust R-195:	2	Self-sealing fuel tanks:	Yes
Weight (kg):		Strengthened flight control linkage:	Yes
Maximum Gross:	17,600	IFF:	Yes
Normal Takeoff:	14,500	Exhaust cooling:	Yes
Empty:	9,525	L166S1/ShokogruzEO infrared jammer:	Yes
Speed (km/h):		Sirena 3/Pastilradar warning receiver:	Yes
Maximum (at altitude):	880	Omul ECM pods with UV-26 flares:	Yes
Maximum (sea level):	950	ARMAMENT:	
Maximum Attack Speed:	690	Hardpoints;	10
Cruise:	700	AVIONICS/SENSORS/OPTICS:	
Takeoff/Landing Speed:	220	SUO-39 FCS pod with Shkval-M sight system and Mercury (LLLTV):	Yes
Max “G” Force (g):	+6.5 g	Laser radar:	Yes
Service Ceiling:	(m):	Khod thermal imager:	Yes
Vertical Climb Rate (m/s):	72	23X image magnification aiming system (to 25 km):	Yes
Fuel (liters):		Active bomb sight:	Yes
Internal:	3,840	Laser rangefinder/ designator 10-15 km:	Yes
External:		Kopyo-25 pulse Doppler multi-role radar:	Yes
800:	4	SAU-8 automated control system:	Yes
1150:	2	INS:	Yes
Range Max Load (km):	500	GPS:	Yes
Plus2 Aux Fuel tanks:	750 or 1250	Doppler Radar:	Yes
Ferry Range (Max Fuel):	2,500	Night/Weather Capabilities:	Yes
Combat Radius:	556		

NOTES

THE AIRCRAFT CAN CARRY A SELF-CONTAINED MAINTENANCE KIT IN 4 UNDER-WING PODS. THE LASER TARGET DESIGNATOR CAN GUIDE A VARIETY OF BOMBS, MISSILES, AND ROCKETS, INCLUDING S-24 SAL-H ROCKETS, S-25L ROCKETS TO 7 KM, AND S-25LD ROCKETS TO 10 KMMIG-25P/PD FOXBAT-E: INTERCEPTOR WITH IMPROVED RADAR THAT HAS LIMITED LOOK-DOWN/SHOOT-DOWN CAPABILITY, IR SENSOR UNDER THE NOSE, AND UPGRADED ENGINE.

THE ENGINES CAN OPERATE ON ANY TYPE OF FUEL TO BE FOUND IN THE FORWARD-OPERATING AREAS, INCLUDING DIESEL AND GASOLINE. THUS IT CAN OPERATE FROM UNPREPARED AIRFIELDS.

APPEARANCE: WINGS: HIGH-MOUNT, TAPERED BACK, ENGINES: BOTH ALONG BODY, UNDER WINGS.

REPRESENTATIVE MIX FOR TARGETING ARMOR IS: 30-MM GUN, 4 PODS (16) AT-16 ATGMS, AND 2 PODS OF SAL-H GUIDED ROCKETS. TWO OTHER PODS HOLD FUEL OR AS-10/12 MISSILES. MISSILES MAY REQUIRE A TV, RADAR OR IR POD FOR GUIDANCE. TWO OUTER MOUNTS HOLD SINGLE AA-8 MISSILE.

VARIANTS

THE SU-25 (FROGFOOT A) WAS THE ORIGINAL 1-SEAT AIRCRAFT FIELDED IN 1980, WITH SU-25K FOR EXPORT. EARLY SU-25S HAD 2X SOYUZ/ GAVRILOV

R95SH ENGINES. MOST ARE NOW UPGRADED.

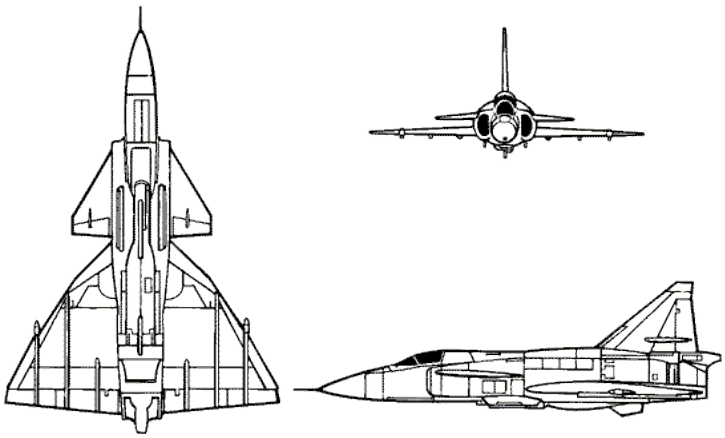
SU-25B/-25UB/-25UBK/-UBP/: A TWO-SEAT COMBAT AIRCRAFT, NAVAL VERSION, AND TRAINER. THE SU-25UT/UTG TRAINERS ARE AKA FROGFOOT-B.

SU-39/SU-25TM (DOMESTIC): DEVELOPED FROM THE SU-25UB 2-SEAT TRAINER. FOR FCS SEE ABOVE. HEIGHT IS 5.2 M FOR AVIONICS AND EXTRA FUEL. NEW R-195 ENGINES OFFER MORE THRUST, RANGE, CEILING, AND LOAD. NEW COUNTERMEASURE SUITES ARE USED.

SU-25UBM: THE LATEST UPGRADE HAS THE SH013 NAVIGATION RADAR AND THE PASTEL RADAR WARNER. THE MODERNIZED CABIN HAS HEADS-UP AND LCD COLOR DISPLAYS. IT CAN LAUNCH KAB-500KL LASER HOMING (SAL) AND KAB-500KR TV GUIDED BOMBS.

SU-25KM/SKORPION: ISRAELI/GEORGIAN UPGRADE, WITH A CHOICE AMONG WESTERN AVIONICS.

SWEDISH MULTI-ROLE ATTACK AIRCRAFT AJ37 / VIGGEN



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types:		Speed (km/h):	
30 mm Oerlikon KCA automatic cannon (JA37) (rnds):	150	Maximum (at altitude):	2,135, Mach 2
Other Loading Options:		Maximum (sea level):	1,469, Mach 1.2
AJ37:	7 – 9	Max "G" Force (g):	+7 g
RB24 or RB74 Sidewinder:	7 – 9	Ceiling (m):	18,300
RB28 Falcon AAM:	7 – 9	Vertical Climb Rate (m/s):	203
RB75 Maverick AGM:	7 – 9	Fuel (liters):	
75mm 19-round rocket pods:	4	Internal:	5,700
135mm 6-round rocket pods:	4	Range (km):	
30mm Aden gun pod and drop tanks:	Yes	With Aux Fuel:	2000
JA37:	Yes	Ferry:	2250
RB74 Sidewinder AAM:	6	Combat Radius (km):	
2 RB 71 Skyflash AAM:	2	Hi-lo-hi:	>1000
SYSTEM		Lo-lo-lo:	> 500
Alternative Designations:		Takeoff Run/Landing Roll (m):	400/500
Date of Introduction:	1971	Dimensions (m):	
Proliferation:	Sweden	Length:	16.3
		Wingspan:	10.6
Description:		Height:	5.6
Crew:	1	Standard Payload (kg):	
Engines 14,750 lbs. thrust Svenska Flygmotor RM8A turbofan, 25,970 lbs. thrust with afterburner:	1	External:	6,000
Weight (kg):		Hardpoints pylons:	7 – 9
Maximum Gross:	20,500	Survivability/Countermeasures::	
Normal Takeoff:	16,000	0-75 km/hr. ejection seat.	Yes
Empty:	12,250	ECM system:	Yes
		Chaff dispenser	Yes

		Deception jammer:	Yes

NOTES

THE BASIC PLATFORM WAS THE AJ37 ATTACK AIRCRAFT, FOLLOWED BY THE S37 RECONNAISSANCE VERSIONS AND THE JA37 FIGHTER. THE NEW AIRCRAFT HAD A NOVEL AND ADVANCED AERODYNAMIC CONFIGURATION TO MEET THE SHOT TAKE-OFF/LANDING AND OTHER PERFORMANCE REQUIREMENTS: A FIXED FOREPLANE WITH FLAPS WAS MOUNTED AHEAD OF AND SLIGHTLY ABOVE THE MAIN DELTA WING. A TOTAL OF 329 AIRCRAFT WERE BUILT IN ATTACK, TRAINER, TWO RECONNAISSANCE VERSIONS AND THE MORE POWERFUL FIGHTER VARIANT THAT INCLUDED NEW AVIONICS, NEW AIR-TO-AIR MISSILES AND EUROPE'S FIRST PULSE-DOPPLER RADAR.

APPEARANCE:

WINGS: LOW-MOUNTED, DELTA-SHAPED FROM BODY MIDSECTION TO THE EXHAUST. SMALL, CLIPPED DELTA WINGS FORWARD OF MAIN WINGS AND HIGH-MOUNTED ON BODY. ENGINES: ONE TURBOFAN IN THE BODY. FUSELAGE: SHORT AND WIDE WITH A POINTED SOLID NOSE TAIL: NO TAIL FLATS. LARGE, UNEQUALLY TAPERED FIN WITH A SMALL, CLIPPED TIP. TAIL: NO TAIL FLATS. LARGE, UNEQUALLY TAPERED FIN WITH A SMALL, CLIPPED TIP.

VARIANTS

AJ37: ALL-WEATHER ATTACK AIRCRAFT WITH INTERCEPT CAPABILITY.

AJS37: VIGGENS REFITTED FOR MULTI-ROLE SERVICE WITH UPGRADED CENTRAL COMPUTER AND ESM/ECM PYLON JAMMING POD DEVELOPED FOR THE JAS 39.

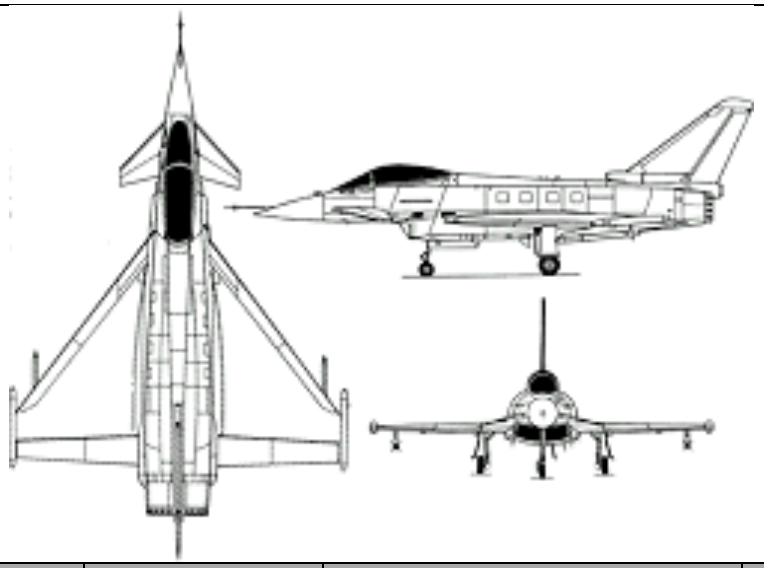
JA37: AIR SUPERIORITY FIGHTER WITH STRIKE CAPABILITY; UPRATED RM8B ENGINE AND AVIONICS.

SF37: ARMED PHOTO RECONNAISSANCE VERSION. EXTENSIVE IR AND ESM FIT INCLUDING RWR AND ELINT DATA RECORDERS.

SH37: MARITIME RECONNAISSANCE/STRIKE VERSION HAS 2 SIDEWINDER AAM ON OUTER WING PYLONS.

SK37: TWO-SEAT TRAINER VERSION.

BRITISH/GERMAN/ITALIAN/SPANISH MULTI-ROLE AIRCRAFT EF-2000 EUROFIGHTER



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types:		Combat Radius (km):	
Mauser BK 27-mm revolver cannon (rnds):	150	Ground attack, lo-lo-lo:	601
Air Superiority Packages:	Yes	Ground attack, hi-lo-hi:	1.389
BVRAAM:	6	Air defense with 3 hr. CAP:	185
ASRAAM:	6	AD with 10-min loiter:	1,389
Fuel tanks:		Takeoff Run (m):	300-700
1,500 (L):	2	Dimensions (m):	
1,000 (L):	1	Length:	16.0
Air Interdiction Package:		Wingspan:	11.0
Storm Shadow:	2	Height:	5.3
AMRAAM:	4	Standard Payload (kg):	
ASRAAM:	2	External:	6,500
Alarm	2	Hardpoints:	13
Fuel tanks:		Fuselage:	5
1,500 (L):	2	Wing (ea.):	4
1,000 (L):	1	Combat Radius (km):	
Suppression of Enemy Air Defense:	Yes	Ground attack, lo-lo-lo:	601
Alarm:	6	Ground attack, hi-lo-hi:	1.389
AMRAAMs:	4	Air defense with 3 hr. CAP:	185
ASRAAM:	4	AD with 10-min loiter:	1,389
Fuel tanks:		Takeoff Run (m):	300-700
1,000 (L):	1	Dimensions (m):	
Close Air Support Package:		Length:	16.0
Brimstone:	18	Wingspan:	11.0
AMRAAMs:	4	Height:	5.3

ASRAAM:	4	Standard Payload (kg):	
Fuel tanks:		External:	6,500
1,000 (L):	1	Hardpoints:	13
Maritime Attack Package:		Fuselage;	5
Penguin:	6	Wing (ea.):	4
AMRAAM:	4	Survivability/Countermeasures:	
ASRAAM:	2	Martin-Baker zero/zero ejection seat:	Yes
Fuel tanks:		DAAS (defensive aids sub-system) with electronic countermeasures/ support measures system (ECM/ ESM):	Yes
1,500 (L):	2	Front and rear missile warning:	Yes
1,000 (L):	1	Supersonic capable towed decoy system:	Yes
SYSTEM		Laser warning receivers:	Yes
Alternative Designations:	Typhoon	Chaff and flare dispensing system:	Yes
Date of Introduction:	2005	ARMAMENT:	
Proliferation:	5 countries (Britain, Greece, Germany, Italy, Spain)	Internal Mauser BK 27-mm revolver cannon:	Yes
Engines 13,500 lbs. thrust Eurojet EJ turbofans, 20,250 with afterburner:	2	AVIONICS/SENSOR/OPTICS:	
Weight (kg):		Helmet Mounted Symbology System (HMS):	Yes
Maximum Takeoff:	23,000	Heads-up-display:	
Normal Takeoff:		Flight reference data:	Yes
Empty:	9,750	Weapons Aiming and Cueing:	Yes
Speed (km/h):		FLIR Imaging:	Yes
Maximum (at altitude):	2,130, Mach 2.0	Head Down Display:	
Max “G” Force (g):	+9/-3 g	Tactical Situation:	Yes
Vertical Climb Rate (m/s):		System Status;	Yes
Fuel (liters):		Map Display:	Yes
Internal:		Multimode X-Pulse Doppler Radar:	Yes
External:	4,000	Infrared Search and Track System (IRST):	Yes
		Night / Weather Capabilities:	Yes

NOTES

EUROFIGHTER IS A SINGLE-SEAT, TWIN-ENGINE, AGILE COMBAT AIRCRAFT WHICH WILL BE USED IN THE AIR-TO-AIR, AIR-TO-GROUND, AND TACTICAL RECONNAISSANCE ROLES. THE DESIGN OF THE EUROFIGHTER IS OPTIMIZED FOR AIR DOMINANCE PERFORMANCE WITH HIGH INSTANTANEOUS AND SUSTAINED TURN RATES, AND SPECIFIC EXCESS POWER. SPECIAL EMPHASIS HAS BEEN PLACED ON LOW WING LOADING, HIGH THRUST TO WEIGHT RATIO, EXCELLENT ALL ROUND VISION AND CAREFREE HANDLING. THE USE OF STEALTH TECHNOLOGY IS INCORPORATED THROUGHOUT THE AIRCRAFT’S BASIC DESIGN.

APPEARANCE:

WINGS: CONSTANT LEADING EDGE SWEPT DELTA, WITH ALL-MOVING CANARD FOREPLANES PLACED AHEAD AND ABOVE THE MAIN WING. ENGINES: TWO TURBOFAN ENGINES FED BY A BROAD, ANGULAR GROUP UNDER THE FUSELAGE. FUSELAGE: CONVENTIONAL SEMI-MONOCOQUE WITH HEAVY BLENDING. TAIL: TALL SWEPT SINGLE FIN HAS AN INSET RUDDER. NO FLATS

VARIANTS

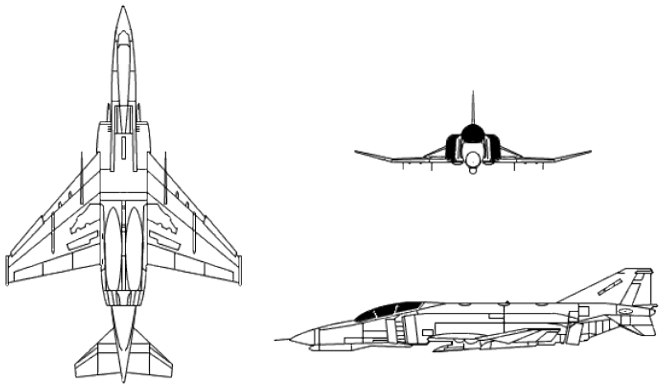
TWO-SEAT OPERATIONAL CONVERSION TRAINER: RETAINS FULL COMBAT CAPABILITY. SECOND SEAT FITTED IN PLACE OF ONE FUSELAGE FUEL TANK, CANOPY LENGTHENED AND DORSAL LINE EXTENDED AFT TO BASE OF TAIL.

TYPHOON: ORIGINALLY, THIS WAS THE NAME FOR THE EXPORT VARIANTS, BUT IT IS LIKELY TO BE APPLIED TO ALL AIRCRAFT WITH APPROPRIATE SPELLING CHANGES.

NAVAL VARIANT: VERSION PROPOSED AS A POSSIBLE COMPETITOR TO THE JOINT STRIKE FIGHTER FOR OPERATIONS OFF FUTURE BRITISH CARRIERS.

INTERDICTOR VARIANT: LONG-RANGE, DEEP-STRIKE VERSION, CAPABLE OF SURGICAL STRIKE AGAINST GROUND TARGETS USING STAND-OFF PRECISION GUIDED MISSILES THAT COULD BE FITTED WITH CONFORMAL FUEL TANKS FOR INCREASED RANGE.

AMERICAN FIGHTER-BOMBER AIRCRAFT F-4/PHANTOM



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types:		Combat Radius (km):	
Mauser BK 27-mm revolver cannon (rnds):	150	Ground attack, lo-lo-lo:	601
Air Superiority Packages:	Yes	Ground attack, hi-lo-hi:	1.389
BVRAAM:	6	Air defense with 3 hr. CAP:	185
ASRAAM:	6	AD with 10-min loiter:	1,389
Fuel tanks:		Takeoff Run (m):	300-700
1,500 (L):	2	Dimensions (m):	
1,000 (L):	1	Length:	16.0
Air Interdiction Package:		Wingspan:	11.0
Storm Shadow:	2	Height:	5.3
AMRAAM:	4	Standard Payload (kg):	
ASRAAM:	2	External:	6,500
Alarm	2	Hardpoints:	13 (5 fuselage, 4 ea. wing)
Fuel tanks:		Combat Radius (km):	
1,500 (L):	2	Ground attack, lo-lo-lo:	601
1,000 (L):	1	Ground attack, hi-lo-hi:	1.389
Suppression of Enemy Air Defense:	Yes	Air defense with 3 hr. CAP:	185
Alarm:	6	AD with 10-min loiter:	1,389
AMRAAMs:	4	Takeoff Run (m):	300-700
ASRAAM:	4	Dimensions (m):	
Fuel tanks:		Length:	16.0
1,000 (L):	1	Wingspan:	11.0
Close Air Support Package:		Height:	5.3
Brimstone:	18	Standard Payload (kg):	
AMRAAMs:	4	External:	6,500
ASRAAM:	4	Hardpoints:	13
Fuel tanks:		Fuselage;	5
1,000 (L):	1	Wing (ea.):	4
Maritime Attack Package:		Survivability/Countermeasures:	

Penguin:	6	Martin-Baker zero/zero ejection seat:	Yes
AMRAAM:	4	DAAS (defensive aids sub-system) with electronic countermeasures/ support measures system (ECM/ ESM):	Yes
ASRAAM:	2	Front and rear missile warning:	Yes
Fuel tanks:		Supersonic capable towed decoy system:	Yes
1,500 (L):	2	Laser warning receivers:	Yes
1,000 (L):	1	Chaff and flare dispensing system:	Yes
SYSTEM		ARMAMENT:	
Alternative Designations:	Typhoon	Internal Mauser BK 27-mm revolver cannon:	Yes
Date of Introduction:	2005	AVIONICS/SENSOR/OPTICS:	
Proliferation:	5 countries (Britain, Greece, Germany, Italy, Spain)	Helmet Mounted Symbology System (HMS):	Yes
Engines 13,500 lbs. thrust Eurojet EJ turbofans, 20,250 with afterburner:	2	Heads-up-display:	
Weight (kg):		Flight reference data:	Yes
Maximum Takeoff:	23,000	Weapons Aiming and Cueing:	Yes
Normal Takeoff:		FLIR Imaging:	Yes
Empty:	9,750	Head Down Display:	
Speed (km/h):		Tactical Situation:	Yes
Maximum (at altitude):	2,130, Mach 2.0	System Status;	Yes
Max “G” Force (g):	+9/-3 g	Map Display:	Yes
Vertical Climb Rate (m/s):		Multimode X-Pulse Doppler Radar:	Yes
Fuel (liters):		Infrared Search and Track System (IRST):	Yes
Internal:		Night / Weather Capabilities:	Yes
External:	4,000		

NOTES

F-4S ARE NO LONGER IN SERVICE IN THE U.S. MILITARY. THE QF-4 TARGET DRONE REMAINS IN US SERVICE. SEVERAL HUNDRED F-4S REMAIN IN SERVICE WITH GERMAN, JAPANESE, SOUTH KOREA, ISRAELI, GREEK, AND TURKISH AIR FORCES, WITH SEVERAL UPGRADE PROGRAMS UNDERWAY IN SEVERAL COUNTRIES. PLANNED AS AN ATTACK AIRCRAFT WITH FOUR 20 MM GUNS, IT WAS QUICKLY CHANGED INTO A VERY ADVANCED GUNLESS ALL-WEATHER INTERCEPTOR WITH ADVANCED RADAR AND MISSILE ARMAMENT. THE AIRCRAFT FLEW EVERY TRADITIONAL MILITARY MISSION: AIR SUPERIORITY, CLOSE AIR SUPPORT, INTERCEPTION, AIR DEFENSE, SUPPRESSION, LONG-RANGE STRIKE, FLEET DEFENSE, ATTACK, AND RECONNAISSANCE.

APPEARANCE: WINGS: SWEPT DELTA, LEADING EDGE HAVING GREATER SWEEP THAN THE TRAILING EDGES. ENGINES: TWO AFTERBURNING TURBOJETS HOUSED SIDE-BY-SIDE IN THE FUSELAGE. FUSELAGE: TUBULAR WITH POINTED NOSE AND TAPERED ENGINE HOUSING ON EACH SIDE. TAIL: SHORT, SHARPLY SWEPT FIN AND RUDDER.

VARIANTS

F-4B: FIRST PRODUCTION VARIANT FOR U.S. NAVY AND MARINE CORPS.

F-4C: FIRST PRODUCTION VARIANT FOR U.S. AIR FORCE.

F-4D: SIMILAR TO F-4C WITH IMPROVED RADAR, INS, GUN SIGHT AND WEAPONS RELEASE COMPUTER.

F-4E: IMPROVED AIR FORCE VERSION WITH NEW RADAR, SIX-BARREL CANNON, ADDED FUEL AND NEW ENGINE.

F-4EJ KAI: JAPANESE UPDATE PROGRAM, INCLUDED PULSE-DOPPLER RADAR, HUD, INS, AND RWR.

ISRAELI F-4E WILD WEASEL: F-4E CONFIGURED TO FIRE THE AGM-78B STANDARD ARM MISSILE.

F-4F: SIMILAR TO F-4E FOR GERMAN AIR FORCE. INTRODUCED LEADING-EDGE MANEUVERING SLATS.

F-4G WILD WEASEL: ATTACK/ELECTRONIC WARFARE (EW) VERSION OF THE F-4E FOR ANTI-RADAR ROLE.

F-4J: NAVY F-4B UPGRADE OF RADAR, FIRE CONTROL SYSTEM, ENGINE AND DROOPING AILERONS.

F-4K/FG1: ROYAL NAVY VERSION OF F-4J FOR CARRIER OPERATIONS.

F-4M/FGR2:ROYAL AIR FORCE VERSION OF THE F-4K

F-4N: UPGRADED F-4B WITH IMPROVED WEAPONS CONTROL SYSTEM AS WELLS STRUCTURAL STRENGTHENING.

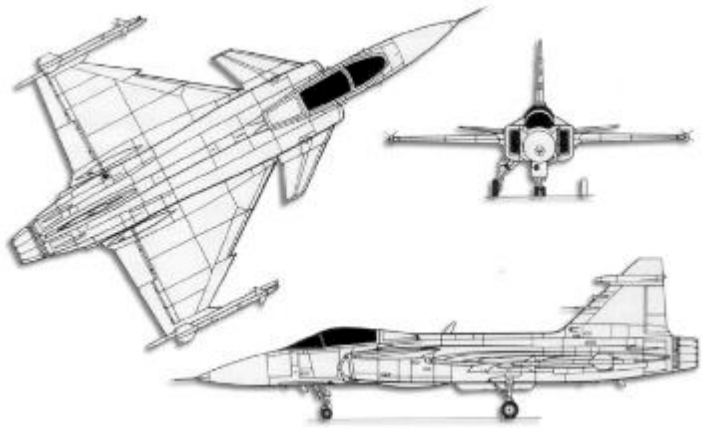
F-4S: REBUILT F-4JS, BUT WITH OUTER LEADING-EDGE MANEUVERING SLATS.

RF-4: RECONNAISSANCE VARIANT.

KORNAS 2000/SUPER PHANTOM (SLEDGEHAMMER 2000): ISRAELI-DEVELOPED UPGRADE TO EXTEND SERVICE LIFE INTO THE 21ST CENTURY AND SERVE AS THE BASE OF THE IAF'S AIR-TO-GROUND CAPABILITY.

ISRAELI F-4E SUPER PHANTOM/PHANTOM 2000: KORNAS 2000 VARIANT FITTED WITH NEW TURBOFAN ENGINES. REDUCED TAKE-OFF DISTANCE, INCREASED RATE OF CLIMB, AND INCREASED LOW-LEVEL SPEED.

SWEDEN MULTI-ROLE FIGHTER AIRCRAFT JAS39/GRIPEN



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types:		Range (km):	
Mauser BK 27-mm revolver cannon (rnds):	120	Combat Radius:	800
AIM-9 Sidewinder on the wingtips:	2	Ferry:	3,000
AIM-120 AMRAAM:	4	Takeoff Run/Landing Roll (m):	800/800
AGM-65A/B Maverick:	4	Dimensions (m):	
Saab RBS15F anti-shipping missile:	2	Length:	
Dasa DWS39 munitions dispenser or KEPD150 pods:	2	A/C:	14.1
Bofors rocket pods:	4	B/D:	14.8
Conventional bombs:	4	Wingspan over tip rails:	8.4
Description:		Height:	4.5
Crew:		Standard Payload (kg):	
JAS 39A/C	1	External:	3,600
JAS 39B/D	2	Hardpoints:	7
Engines 12,140 lbs. thrust Volvo Aero RM12 or 18,200 lbs. thrust with afterburner:	1	Wings:	4
Weight (kg):		Centerline:	1
Takeoff:		Wingtip Rails:	2
A/C:	12,500	Survivability/Countermeasures:	
B/D:	14,000	Martin-Baker zero/zero ejection seat:	Yes
Empty:		IFF and an integrated EW system that provides radar warning:	Yes
A/C:	6.500	Electronic support measures:	Yes
B/D:	7,100	Decoy system:	Yes
Speed (km/h):		Chaff and flare dispensing system:	Yes
Maximum (at altitude):	2,150, Mach 1.8+	ARMAMENT:	
Max “G” Force (g):	+9/-3	Mauser BK 27-mm revolver cannon:	Yes
Ceiling (m):	16,000	AVIONICS/SENSOR/OPTICS:	

Fuel (liters):		**Long-range multi-purpose pulse Doppler radar:**	**Yes**
Internal:		**Air-to-air operating mode:**	
A/C:	**3,008**	**Night / Weather Capabilities:**	**Yes**
B/D:	**2,852**		
External:	**3,300**		

NOTES

THE JAS 39 GRIPEN IS A FOURTH GENERATION, MULTI-ROLE COMBAT AIRCRAFT. THE GRIPEN IS THE FIRST SWEDISH AIRCRAFT THAT CAN BE USED FOR INTERCEPTION, GROUND-ATTACK, AND RECONNAISSANCE (HENCE THE SWEDISH ABBREVIATION JAS – FIGHTER (J), ATTACK (A), AND RECONNAISSANCE (R)) AND IT IS NOW SUCCESSIVELY REPLACING THE DRAKEN AND THE VIGGEN .THE JAS 39 IS PART OF A SYSTEM THAT FIGHTS THE "INFORMATION WAR" IN WHICH AIRCRAFT RECEIVE AND CONVEY INFORMATION THROUGH AN AIR-TO-AIR TACTICAL INFORMATION DATA LINK SYSTEM (TIDLS).

APPEARANCE:

WINGS: MULTI-SPARRED DELTA. LARGE, SWEPT, ALL-MOVING FOREPLANE CANARDS MOUNTED ON ENGINE INTAKE SHOULDERS. ENGINES: TURBOFAN WITH INTAKE BOXES ON BOTH SIDES OF FUSELAGE. FUSELAGE: TAIL: LEADING EDGE SWEPT FIN WITH UPRIGHT INSET RUDDER.

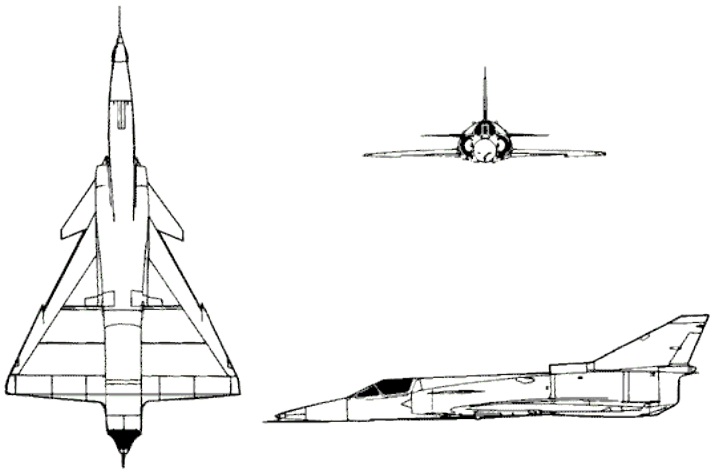
VARIANTS

JAS 39A: ORIGINAL SINGLE-SEAT VERSION SUPPLIED TO THE SWEDISH AIR FORCE.

JAS 39B: DESIGN-STUDY CONTRACT FOR TRAINER/RECONNAISSANCE VARIANT AWARDED TO JAS IN 1989; FUSELAGE PLUG INSERTED TO MAKE ROOM FOR SECOND SEAT.

JAS 39C/D: NATO-COMPATIBLE EXPORT VARIANT EQUIPPED WITH OBOGS, FLIR, NVG-COMPATIBLE COCKPIT, LASER-DESIGNATOR POD, HMD. HIGHER GROSS TAKEOFF WEIGHT. THE 39D IS THE TWO-SEAT EQUIVALENT.

ISRAELI MULTI-ROLE FIGHTER KFIR (LION CUB)



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types:		Range (km):	
Internal 30-mm cannons (x2):	140	Ferry:	
Other Loading Options:	Yes	C2:	2,991
Python/Shafrir/AIM-9:	2	C7:	3,232
AGM-45 Shrike ARM:	2	Combat Radius (km):	
AGM-65 Maverick:	1	Intercept Mission:	
1,500 (L):	2	C2:	347
1,000 (L):	1	C7:	776
Bombs:		Combat Air Patrol:	
GBU-15 glide bomb:	1	C2:	699
227 kg:	6	C7:	882
363 kg or 454 kg:	2	Ground Attack:	
1,361 kg:	1	C2:	768
Fuel tanks External:	3	C7:	1,186
(L):	4,700	Takeoff Run/Landing Roll (m):	
SYSTEM		Max Load:	
Alternative Designations:	C2; C7	C2:	1,455
Date of Introduction:	1975	C7:	1,555
Proliferation:	6 countries	Dimensions (m):	
Description:		Length:	15.7
Crew:	1	Wingspan:	8.2
Engines:		Height:	4.6
17,750 lbs. thrust General Electric J79-GE-1JE Turbojet (C2):	1	Standard Payload (kg):	
18,750 lbs. thrust (C7):	1	External:	
Weight (kg):		C2:	4,277
Maximum Takeoff:	16,500	C7:	5,775
Normal Takeoff:		Hardpoints including missiles:	
Empty:	7,285	C2:	7
Speed (km/h):		C7:	9

Max (at altitude):	2,440,Mach 2.3	Survivability/Countermeasures:	
Max (sea level):	1,389,Mach 1.1	Cockpit pressurized, heated, and air conditioned:	Yes
Takeoff/Landing Speed:	220	Martin-baker zero/zero ejection seats:	Yes
Max "G" Force (g):	+7.5 g	In-flight refueling:	Yes
Ceiling (m):	17,680	IFF, ECM pods:	Yes
Vertical Climb Rate (m/s):	233	Radar warning receiver:	Yes
Fuel (liters):		Chaff and Flares:	yes
Internal:	3,243	ARMAMENT:	
External:	4,700	2 internal 30-mm DEFA 552 cannons:	Yes

NOTES

OVER 230 AIRCRAFT WERE IN MILITARY SERVICE WITH ISRAEL AND SEVERAL OTHER NATIONS, BUT MOST OF THE ISRAELI KFIRS ARE NOW IN STORAGE.

APPEARANCE: WINGS: LOW-MOUNTED, DELTA-SHAPED WITH A SAW TOOTH IN THE LEADING EDGE. ENGINES: ONE TURBOJET. FUSELAGE: TUBE SHAPED WITH A LONG, SOLID, POINTED NOSE. TAIL: NO TAIL FLATS. FIN IS SWEPT-BACK AND TAPERED WITH A STEP IN THE LEADING EDGE.

VARIANTS

KIFR C1: INITIAL PRODUCTION MODEL, LEASED TO THE US NAVY AND MARINE CORPS AND RE-DESIGNATED F-21A.

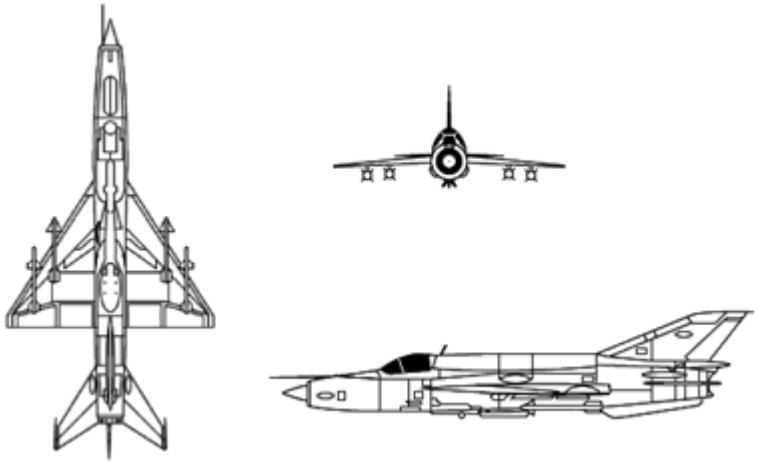
F-21A: SLIGHTLY MODIFIED C1, USED TO TRAIN US COMBAT PILOTS IN ADVERSARY TACTICS. USED BY US NAVY FROM 1985 TO MAY 1988. USED BY USMC FROM 1987 TO SEP 1989.

KFIR C2: REVISED AIRFRAME WITH FOREPLANES AND NOSE STRAKE ADDED.

KFIR C7: UPGRADED VERSION WITH NEW AVIONICS: WDNS-391 WEAPONS CONTROL SYSTEM WITH STORES MANAGEMENT DISPLAY, UPRATED GE J79-1JE ENGINE AND GREATER INTERNAL FUEL CAPACITY.

KFIR-2000: DESIGNED AS A COST-EFFECTIVE MULTIROLE AIRCRAFT.

RUSSIAN MULTI-ROLE FIGHTER AIRCRAFT MIG-21/FISHBED



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types		Fuel (liters):	
23-mm Gsh-23 2-barrel cannon (rnds):	200	Internal:	2,650
Other Loading Options:	2	External (x2):	1,470
AA-8 Aphid:			
AA-2C or D Atoll:	2 - 4	Range (km):	
Gun Pods:	2	Ferry:	2,100
Unguided bombs:		High Alt w/internal fuel and 2 AAM:	1,000
Rockets:	4	Low Alt w/internal fuel and 2 AAM:	560
SYSTEM		Takeoff Run/Landing Roll with drag chute (m):	900/650
Alternative Designations:	J-7 (Chinese)	Dimensions (m):	
Date of Introduction:	1958	Length:	
Proliferation:	> 40 countries	w/out probe:	14.5
Description:		w/probe:	15.8
Crew:	1	Wingspan:	7.2
Engines:		Height:	4.5
12,675 lbs. thrust w/afterburner Tumansky R-11F-300 (MiG-21):	1	Standard Payload 4 under wing pylons (kg):	1,200
14,550 lbs. thrust Wopen-13 turbofan (J-8):	1	Survivability/Countermeasures:	
Weight (kg):		Pressurized cockpit with ejection seat:	Yes
Normal Takeoff:	8,825	Radar warning receiver:	Yes
Speed (km/h):		Chaff and flares:	Yes
Max (at altitude):	2,175 (Mach 2.05)	ARMAMENT:	
Max (sea level):	1,300 (Mach 1.05)	NR-30 guns in the forward fuselage (early models) (ea.):	2
Landing Speed:	270	GSh-23 23-mm cannons and 200 rounds (Fishbed-D and later models):	2
Max “G” Force (g):	+8.5 g	AVIONICS/SENSOR/OPTICS:	

Ceiling (m):	18,000	Spin Scan or Jay Bird airborne interception radar and a gyro-stabilized gun sight:	Yes
Vertical Climb Rate (m/s):	225	Night/Weather Capabilities:;	Limited

NOTES

A PRINCIPAL WEAKNESS OF THE MIG-21 DESIGN IS THE REARWARD SHIFT OF THE CENTER OF GRAVITY AS THE FUSELAGE TANKS ARE EMPTIED. A FULL ONE-THIRD OF THE FUEL ON BOARD CANNOT BE USED FOR THIS REASON. THE SAME LIMITATION EFFECTIVELY REDUCES MACH 2 FLIGHT TIME TO PERFUNCTORY HIGH-SPEED TESTS. THE MIG-21 IS A SIMPLE, RELIABLE AIRCRAFT WITH HONEST FLYING CHARACTERISTICS. IT IS ALSO CONSIDERED TO BE A COMPETENT DOG-FIGHTER AGAINST MOST WESTERN AIRCRAFT. INDIA HAS SUFFERED AN ALMOST INCREDIBLE STRING OF MIG-21 CRASHES SINCE 1998, INCLUDING SEVERAL NOTABLE INCIDENTS THAT HAVE KILLED PEOPLE ON THE GROUND. FROM JANUARY 1998 TO DECEMBER 2002 THERE WERE OVER 50 MIG-21 CRASHES, INCLUDING THREE THAT KILLED A TOTAL OF 13 PEOPLE ON THE GROUND. ANALYSTS ARE DEBATING IF THE AGE OF THE AIRCRAFT IS AN ISSUE OR IF THERE ARE SERIOUS ERRORS IN PILOT TRAINING. THE MIG-21 IS A SHORT-RANGE DAY FIGHTER-INTERCEPTOR WITH LIMITED POSSIBILITIES IN ADVERSE WEATHER CONDITIONS

APPEARANCE: WINGS: MID-MOUNT, DELTA, SQUARED TIPS. ENGINES: ONE TURBOFAN IN FUSELAGE. FUSELAGE: LONG AND TUBULAR, WITH BLUNT NOSE AND BUBBLE CANOPY. TAIL: SWEPT-BACK, TAPERED WITH SQUARE TIP. FLATS ARE MID-MOUNTED ON THE BODY, SWEPT-BACK, AND TAPERED WITH SQUARE TIPS.

VARIANTS

MIG-21 FISHBED-C, D, AND F VARIANTS ARE FIGHTERS. LATER RUSSIAN VARIANTS ARE MULTI-ROLE FIGHTERS, EXCEPT H (RECON).

MIG-21F FISHBED-C: FIRST PRODUCTION VARIANT WITH RD-11 ENGINE. 1 X NR-30 30-MM CANNON.

MIG-21PF FISHBED-D: INTERCEPTOR WITH ENLARGED INTAKE THAT BECAME STANDARD. SPIN SCAN RADAR. PITOT TUBE RELOCATED TO TOP OF INTAKE.

MIG-21PF FISHBED-E: PRINCIPAL PF PRODUCTION VERSION. GP-9 23-MM GUN PACK. PROVISION FOR ROCKET-ASSISTED TAKE-OFF, GROUND (RATOG).

MIG-21FL FISHBED-E: EXPORT VARIANT OF PF WITHOUT RATOG. FITTED WITH SPIN SCAN RADAR.

MIG-21 FISHBED-G: DERIVATIVE USED TO TEST LIFT AND CRUISE ENGINE VERTICAL TAKE-OFF AND LANDING (VSTOL) DESIGN. ALTHOUGH NOT PRODUCED, CONFIGURATION LATER REAPPEARED IN YAK-38 FORGER NAVAL VSTOL AIRCRAFT.

MIG-21R FISHBED-H: RECON VERSION WITH ELECTRONIC INTELLIGENCE EQUIPMENT IN BELLY PACKS, FOR DAY/NIGHT PHOTOGRAPHIC, LASER, IR OR TV SENSORS.

MIG-21PFMA FISHBED-J: TWO ADDITIONAL WING PYLONS. JAY BIRD RADAR CAPABLE OF GUIDING SEMI-ACTIVE RADAR HOMING ADVANCED ATOLL AAM.

MIG-21MF FISHBED-J: UPDATED PFMA USING 14,550-LB STATIC THRUST TUMANSKY R-13-300 ENGINE. WING STRESSED FOR LOW-LEVEL FLIGHT PERMITTING MACH 1.06 AT LOW ALTITUDE.

MIG-21M FISHBED-J: EXPORT VERSION OF MIG-21 PFMA WITH TUMANSKY R-11F2S-300 ENGINE. BUILT IN INDIA FROM 1973 TO 1981.

MIG-21SMB FISHBED-K: SIMILAR TO MIG-21MF, WITH EXTENSION OF DEEP DORSAL SPINE FOR FUEL TANK AND AERODYNAMIC SHAPING, ECM FAIRINGS ON WING TIP.

MIG-21 BIS FISHBED-L: THIRD GENERATION MIG-21, SIMPLER CONSTRUCTION, LONGER FATIGUE LIFE, GREATER FUEL CAPACITY. IT HAS IMPROVED COMPUTER-BASED FIRE CONTROL.

MIG-21 BIS FISHBED-N: SIMILAR TO FISHBED-L, BUT WITH 16,535-LB STATIC THRUST TUMANSKY R-25 ENGINE.

MIG-21-93 FISHBED-N: MIDLIFE UPGRADE PACKAGE BASED ON THE MIG-21 BIS. THE LATEST VERSION WAS ALSO DEVELOPED FOR UPGRADE OF OLDER MIG-21S, WITH UPGRADED FIRE CONTROL AND THE COHERENT PULSE-DOPPLER KOPYO RADAR, (PERMITTING USE OF RADAR-GUIDED AND OTHER PRECISION MUNITIONS). MISSILES AVAILABLE INCLUDE: AA-12 ADDER, AA-11 ARCHER, AA-10 ALAMO, AS-10, AS-12, AND AS-17.IT CAN ALSO DELIVER KAB-500R AND KAB-500L GUIDED BOMBS. A FACTORY UPGRADED AND EXPORTABLE VERSION IS OFFERED.

MIG-21 BISON. INDIAN LICENSED UPGRADE FOR THEIR MIG-21S TO THE MIG-21-93 STANDARD, BEGUN IN THE EARLY 2000S. THIS PROGRAM IS PROBABLY ENDED, WITH A RECENT REPORT THAT INDIA WILL SCRAP ITS FLEET OF MIG-21S, AND REPLACE THEM WITH NEWER RUSSIAN AIRCRAFT.

MIG-21-2000: ISRAEL AIRCRAFT INDUSTRIES (IAI) UPGRADE. CAPABLE OF USING RUSSIAN STANDARD ARMAMENT AND THE RAFAEL PYTHON 4 AAM

MIG-21 LANCER: ROMANIA'S AEROSTAR AND ISRAEL'S ELBIT JOINTLY DESIGNED THIS UPGRADE PROGRAM FOR 110 ROMANIAN AIR FORCE MIG-21S: 25 AIR DEFENSE, 75 GROUND-ATTACK AND 10 TWO-SEAT TRAINERS.

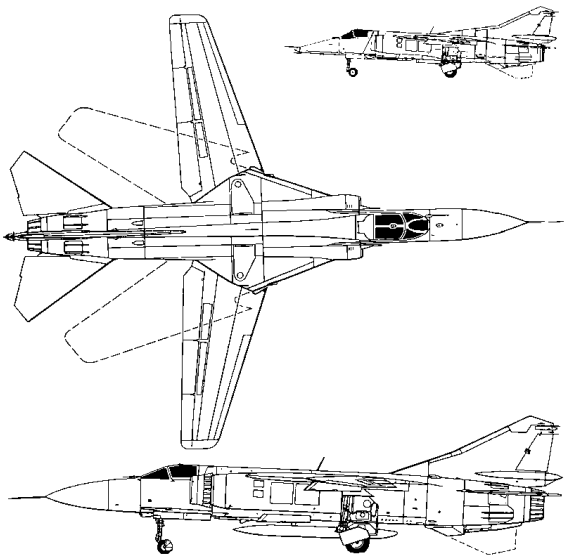
MIG-21U MONGOL-A: TRAINER VERSION WITH TWO-SEATS AND WITH WEAPONS REMOVED.

MIG-21US MONGOL-B: A MODIFIED VERSION WITH NO DORSAL FIN AND BROADER VERTICAL TAIL SURFACES. SIMILAR TO MONGOL-A, WITH SPS FLAP-BLOWING AND RETRACTABLE INSTRUCTOR PERISCOPE.

MIG-21UM MONGOL-B: TRAINER WITH R-13-300 ENGINE. SIMILAR TO MIG-21F.

J-8: CHINESE AIRCRAFT IS LOOSELY BASED ON MIG-21AND MIG-23 FEATURES.

RUSSIAN MULTI-ROLE FIGHTER AIRCRAFT MiG-23/MiG-7/FLOGGER



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types		Fuel (liters):	
23-mm Gsh-23L-twin gun (rnds):	200	Internal:	
23-mm Gsh-6-23 Gatling gun	260	MiG-23:	4,250
Other Loading Options:	2	MiG-27:	5,400
AA-7 APEX (K-23R/T):	2	External 800 liter tanks:	5
AA-8/APHID AAM launchers:	2	Range (km):	
AS-7/KERRY ASM:	4	Max Load:	1,500
AS-10/KAREN ASM:	4	With Aux Fuel:	2,500
AS-12/KEGLER ASM:	4	Combat Radius:	1,150
AS-14/KEDGE ASM:	4	Takeoff Run/Landing Roll (m):	
Rockets:	4	Prepared Surface:	
240-mm S-24 rockets:	1	MiG-23:	500/750
80-mm S-8 rkt pods:	20	MiG-27:	950/1,300
57-mm S-5 rkt pods:	32	Dimensions (m):	
Unguided Bombs:		Length:	
50 kg:		MiG-23:	16.8
100 kg:		MiG-27:	17.1
200 kg:		Wingspan:	
1,000 kg):		Extended:	14.0
SYSTEM		Swept;	7.8
Alternative Designations:	MiG-27, Bahadur, or Valiant (Indian variant)	Height:	
Date of Introduction:	1972	MiG-23:	4.8
Proliferation:	>23 countries	MiG-27:	5.0
Description:		Standard Payload (kg):	
Crew:	1	External:	

Landing Speed:	270	MiG-23:	3,000
Max "G" Force (g):	+8.5	MiG-27:	4,000
Ceiling (m):	18,000	Hardpoints:	
Vertical Climb Rate (m/s):	225	MiG-23:	6
Engines:		MiG-27:	7
28,660-shp Soyuz/Kachaturov R-35-300 turbojet, afterburner (MiG-23):	1	Survivability/Countermeasures:	
25,335-shp R-29B-300 turbojet, afterburner (MiG-27):	1	Pressurized cockpit with zero/130 ejection seat:	Yes
Weight (kg):		Infrared and radar jammer:	Yes
Max Gross:		Radar warning receiver:	Yes
MiG-23:	17,800	Decoy:	Yes
MiG-27:	20,700	Chaff and flares:	Yes
Normal Takeoff:		Armored Cockpit (MiG-27):	Yes
MiG-23:	14,840	ARMAMENT:	
MiG-27:	18,900	Gsh-6-23	
Empty:		23-mm twin gun, Gsh-23L:	
MiG-23:	10,200	Range (practical) (m):	2,500
MiG-27:	11,908	Elevation/Traverse (rigidly mounted):	None
Speed (km/h):		Ammo Type:	
Max (at altitude):		HEFI:	Yes
MiG-23:	Mach 2.35	Rate of Fire (rpm):	9,000
MiG-27:	Mach 1.7	23-mm 6x barrel Gatling gun, Gsh-6-23:	
Max (sea level):	Mach 1.2	Range (m) (practical):	2,500
Takeoff/Landing Speed:	315/270	Elevation/Traverse (rigidly mounted):	None
Max "G" Force (g):		Ammo Type:	HEFI
MiG-23:	+8.5	Rate of Fire (rpm):	9,000
MiG-27:	+7.0	AVIONICS/SENSOR/OPTICS;	
Ceiling (m):		Acquisition and tracking radar (MiG-23):	Yes
Service (clean):	18,600	IR Sensor (MiG-23):	Yes
With External Stores:	INA	Doppler Nav System (MiG-23):	Yes
Vertical Climb Rate (m/s):	240	Laser rangefinder/designator (MiG-23B and MiG-27):	Yes
		TV sighting system (MiG-23B and MiG-27):	Yes
		Acquisition and tracking radar (MiG-23B and MiG-27):	Yes
		Night/Weather Capabilities:	
		MiG-23 (Night and day only):	Yes
		MiG-27:	Yes

NOTES

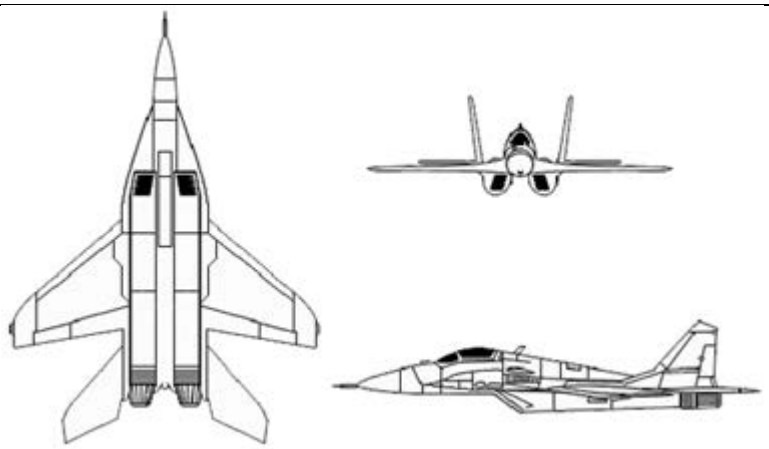
INSET LINE-DRAWING SHOWS NOSE AND INTAKE DIFFERENCES OF THE MIG-27.THIS DIFFERENCE ALLOWS FOR A LASER RANGEFINDER/TARGET DESIGNATOR. THE SWEEP WING IS CAPABLE OF THREE ANGLES: 16, 45, AND 72 DEGREES. THE VENTRAL FIN ON THE BOTTOM REAR OF THE FUSELAGE FOLDS FOR TAKEOFF AND LANDING. UP TO FIVE EXTERNAL FUEL TANKS CAN BE CARRIED ON THE MIG-23, AND FOUR ON THE MIG-27, BUT THE MIG-

27 CAN ALSO BE FITTED FOR AERIAL REFUELING. AVAILABLE MUNITIONS ARE SHOWN ABOVE; NOT ALL MAY BE EMPLOYED AT ONE TIME. MISSION DICTATES WEAPONS CONFIGURATION. EXTERNAL STORES ARE MOUNTED ON UNDERWING AND UNDERBODY HARDPOINTS. EACH WING HAS ONE POINT, TWO POINTS ARE UNDER THE INTAKES ALONG THE FUSELAGE, AND THE CENTER FUSELAGE ATTACHMENT POINT GIVES FIVE TOTAL STATIONS. THE MIG-27 THEN ADDS TWO MORE BOMB RACKS UNDER THE WINGS FOR A TOTAL OF SEVEN STATIONS.
APPEARANCE: WINGS: MID-MOUNT, DELTA, SQUARED TIPS. ENGINES: ONE TURBOFAN IN FUSELAGE. FUSELAGE: LONG AND TUBULAR, WITH BLUNT NOSE AND BUBBLE CANOPY. TAIL: SWEPT-BACK, TAPERED WITH SQUARE TIP. FLATS ARE MID-MOUNTED ON THE BODY, SWEPT-BACK, AND TAPERED WITH SQUARE TIPS.

APPEARANCE: WINGS: HIGH-MOUNT, VARIABLE, TAPERED. ENGINES: ONE IN FUSELAGE. FUSELAGE: LONG AND TUBULAR, WITH BOX-LIKE INTAKES AND LARGE, SWEPT BELLY-FIN. TAIL: SWEPT-BACK, TAPERED WITH ANGULAR TIP, SWEPT, TAPERED FLATS MOUNTED ON FUSELAGE

VARIANTS
MIG-23M/FLOGGER B:FIRST PRODUCTION VERSION AS STANDARD INTERCEPTOR, - PULSE DOPPLER RADAR, IMPROVED ENGINE, IRST,
AA-7, ETC.
MIG-23U/-23UM/-23UB/FLOGGER C: A TANDEM SEAT COMBAT AND TRAINER VARIANT.
MIG-23MS/FLOGGER E: EXPORT BUILT TO B STANDARD. MIG-23MF DOWNSPEC VERSION
MIG-23B/FLOGGER F: INTERIM GROUND ATTACK VARIANT WITH AL-21 TURBOJET ENGINE, NO RADAR, AND TAPERED NOSE. THE MIG-23BN VARIANT RETURNED TO THE R-35-300 ENGINE.
MIG-23ML/FLOGGER G:LIGHTWEIGHT VERSION WITH IMPROVED ENGINE AND AVIONICS
MIG-23P/FLOGGER G: FIGHTER VARIANT SIMILAR TO FLOGGER B, BUT WITH DIGITAL AUTOPILOT FOR GROUND CONTROL.
MIG-23BK/-23BM/FLOGGER-H: GROUND ATTACK VERSIONS WITH THE UPRATED ENGINE, AND AVIONICS PODS BORROWED FROM THE MIG-27.
MIG-23MLD/FLOGGER K: UPGRADED MULTI-ROLE FIGHTER WITH IMPROVED AERODYNAMICS, LATEST MISSILE, AND OTHER IMPROVEMENTS. THIS IS CONSIDERED THE BEST CURRENT PRODUCTION UPGRADE AVAILABLE.
MIG-27K/FLOGGER D: GROUND-ATTACK VARIANT WITH INTERNAL GSH-6-23 23-MM GUN. APPEARANCE DIFFERS BY TAPERED NOSE.
MIG-27D/-27M/FLOGGER J: APPEARANCE DIFFERS BY A LONG DOWNWARD-SLOPING, POINTED NOSE. AIRCRAFT HAS A TV/LASER DESIGNATOR. CAN BE FITTED WITH A THREE-CAMERA RECON POD.
MIG-27L: EXPORT VERSIONS BUILT BY HINDUSTAN AERONAUTICS IN INDIA.
J-8: CHINESE AIRCRAFT IS LOOSELY BASED ON MIG-21AND MIG-23 FEATURES.

RUSSIAN MULTI-ROLE FIGHTER AIRCRAFT MIG-29/FULCRUM



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types		Ceiling (m):	
30-mm Gsh-30-1 cannon (rnds):	150	Service (clean):	18,000
Other Loading Options:		With External Stores:	17,500
AA-8 APHID AAM :	6	Vertical Climb Rate (m/s):	330
AA-10 ALAMO AAM:	4	Fuel (liters):	
AA-11 ARCHER AAM:	4	Internal:	4,300
AA-12 ADDER AAM;	4	External:	4,150
AS-14 KEDGE:	2	Range (km) (3 drop tanks):	
AS-17 KRYPTON:	2	Maximum:	1,500
Bombs:	4	Low altitude (on internal fuel):	710
250 kg Bombs:	8	Ferry (3 external tanks):	2,900
500 kg Bombs:	4	Takeoff Run/Landing Roll (m):	
ZB-500 (Napalm tanks):	4	Prepared Surface:	550/900
KMGU-2 (sub munition dispensers):	4	Afterburner/Drag Chute:	250/660
		Dimensions (m):	
Rockets:		Length:	17.3
130 mm and 240 mm rockets:	4	Wingspan:	11.4
B-8M1 (20 x 80 mm) rocket pack:	4	Height:	4.8
Fuel:		Standard Payload (kg):	
3 External Tanks;:	4150	External FULCRUM-C/D and MiG-29SMT:	3,000 - 4,000
SYSTEM		Hardpoints (wing pylons):	6
Alternative Designations:		Survivability/Countermeasures:	
Date of Introduction:	1983	Zero/zero ejection seat:	Yes
Proliferation:	> 25 country	Radar warning receiver:	Yes
Description:		Radar jammer:	Yes
Crew:	1	Chaff and flares:	Yes
Engines:		ARMAMENT:	

Kimov/Sakisov RD-33 Turbofans (18,300 lbs.) each:	2	30-mm cannon in the left wing root:	1
14,550 lbs. thrust Wopen-13 turbofan (J-8):	1	AVIONICS/SENSOR/OPTICS:	
Weight (kg):		Coherent pulse-Doppler look-down/ shoot-down radar range 9km):	Yes
Max Gross:	22,000	Search range (km):	70
Normal Takeoff:	16,800	Tracking range (km0;	35
Empty:	10,900	Targets tracked;	10
Speed (km/h):		Targets engaged;	2
Max (at altitude):	2,400	Heads-Up-Display (HUD):	Yes
Max (sea level):	1,500	infrared search and track system (IRST):	Yes
Takeoff/Landing Speed:	240	Night/Weather Capabilities:;	Yes
Max "G" Force (g):	+9.0		

NOTES

APPEARANCE:
WINGS: SWEPT-BACK AND TAPERED WITH SQUARE TIPS. ENGINES: TWIN JETS MOUNTED LOW AND TO THE SIDES OF THE FUSELAGE. DIAGONAL-SHAPED AIR INTAKES. FUSELAGE: LONG, THIN, SLENDER BODY WITH LONG POINTED DROOPING NOSE. TAILFINS HAVE SHARPLY TAPERED LEADING EDGES, CANTED OUTWARD WITH ANGULAR CUTOFF TIPS. FLATS ARE HIGH-MOUNTED ON THE FUSELAGE, MOVABLE, SWEPT-BACK, AND TAPERED WITH A NEGATIVE SLANT.

VARIANTS

MIG-29/FULCRUM A: SINGLE SEAT TACTICAL FIGHTER DESIGNED TO OPERATE UNDER GROUND CONTROL.

MIG-29UB/FULCRUM B: OPERATIONAL CONVERSION TRAINER; TWO-SEAT CONFIGURATION. AIR-DEFENSE ROLE.

MIG-29S/FULCRUM C: PRODUCTION MULTI-ROLE VARIANT FITTED WITH DORSAL HUMP HOUSING UPGRADED AVIONICS, AND UPRATED FLIGHT-CONTROL SYSTEM WITH SOME AERODYNAMIC TWEAKING. PRINCIPAL UPGRADE WAS NO-19 FIRE CONTROL RADAR, WHICH CAN ENGAGE TWO TARGETS SIMULTANEOUSLY.

MIG-29SD: FULCRUM AN EXPORT UPGRADE VERSION OF MIG-29 TO FULCRUM C STANDARD.

MIG-29SM: CURRENT PRODUCTION UPGRADE WITH ASM CAPABILITY.

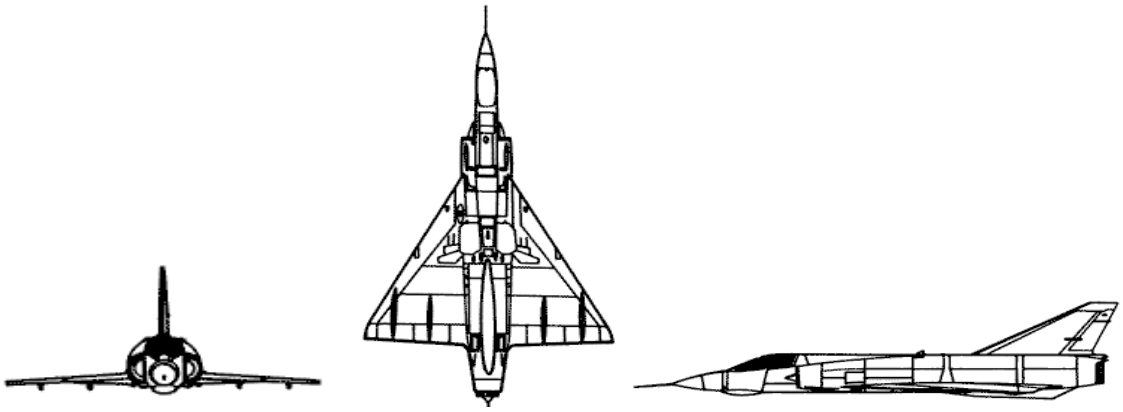
MIG-29K/FULCRUM D: A CARRIER BORNE VERSION OF THE FULCRUM.

BAAZ (FALCON): NAME GIVEN TO THE MIG-29 INDIAN AIR FORCE, WHICH BEGAN OPERATING THE AIRCRAFT IN 1987.

MIG-30: PROPOSED GROUND-ATTACK VARIANT OFFERED TO INDIA IN 1991 AS SUBSTITUTE FOR THE LIGHT COMBAT AIRCRAFT (LCA).

MIG-29SMT: ADVANCED MULTI-ROLE DESIGN, WITH CAPABILITY FOR IMPROVED ASMS, SUCH AS AS-14 AND AS-17.

FRENCH MULTI-ROLE FIGHTER AIRCRAFT MIRAGE 2000



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types		Engines:	
Two 30-mm DFEA 554 guns(C/E/-5)	125	14,462 lbs. thrust SNECMA M53-P2 Turbofan:	1
Other Loading Options		21,385 lbs. thrust with afterburner:	1
AAMs:		Weight (kg):	
R550 Magic 2:	2 - 4	Maximum Takeoff:	
AIM-9 Sidewinder:	2 - 4	C:	17,000
Super 530:	2 - 4	Empty:	
MICA (2000-5):	4 - 6	C/E/-5:	7,500
AGMs:		B/N/D/S:	7,616
AS30L:	2	Speed (km/h):	
BGL laser-guided rocket/gun pods:	1 - 2	Maximum (at altitude):	2,630, Mach 2.2
18-round 68 mm rocket pods:	4	Maximum (sea level):	Mach 1.2
100 mm rocket packs:	2	Max “G” Force (g):	+9
CC630 twin 30 mm cannon pack:	1	Ceiling (m):	18,000
BOMBS:		Vertical Climb Rate (m/s):	285
35 kg BAP100 anti-runway:	18	Fuel (liters):	
250 kg conventional:	18	Internal:	3,978
200 kg Durandal anti-runway:	18	External:	4,700
Belouga cluster:	5 - 6	Range (km):	
400 kg BM400 modular:	5 - 6	Maximum Load:	2,960
1,000 kg BGL laser-guided:	1 - 2	With Aux Fuel (3 tanks):	3,600
Anti-radar:		Combat Radius:	900
Armat:	2	Dimensions (m):	
Anti-ship:		Length:	14.4
AM39 Exocet:	2	Wingspan:	9.2
Nuclear:		Height:	5.2
ASMP cruise missile (2000N):	1	Maximum Payload (kg):	6,300
Pods:		Hardpoints:	9

Recce/Offensive or intelligence ECM:	1	Under fuselage:	5
FLIR navigation:	1	Under each wing:	2
Fuel:		Survivability/Countermeasures:	
3 External fuel tanks (liters):	4,700	Martin-Baker zero/zero ejection seats:	Yes
SYSTEM		Canopy covered in gold film to reduce radar signature:	Yes
Alternative Designations:		ARMAMENT:	Yes
Date of Introduction:		30-mm DFEA 554 guns (C/E/-5):	2
C:	1983	AVIONICS/SENSOR/OPTICS:	
D:	1993	Pulse Doppler radar:	Yes
Proliferation:	8 countries	Look-down-shoot-down capacity:	Yes
Description:		Fly-by-wire:	Yes
Crew:		Automatic pilot:	Yes
B/C/D (Pilot):	1	Inertial guidance systems:	2
B/C/N (Pilot and Nav/Weapons officer):	2	Terrain following radar:	Yes
		Digital map:	Yes
		Integrated GPS:	Yes
		LASER designation pod with thermal camera:	Yes

NOTES

APPEARANCE: WINGS: LOW-MOUNTED DELTA, CLIPPED TIPS. ENGINES: TURBOFAN IN THE FUSELAGE. FUSELAGE: TUBE-SHAPED WITH A POINTED NOSE AND BUBBLE CANOPY. TAIL: TALL, SWEPT-BACK AND TAPERED WITH A CLIPPED TIP. THERE ARE NO TAIL FLATS.

VARIANTS

MIRAGE 2000B: TWO-SEAT, COMBAT-CAPABLE TRAINER VERSION. LACKS INTERNAL GUNS.

MIRAGE 2000C: INITIAL PRODUCTION SINGLE-SEAT VERSION.

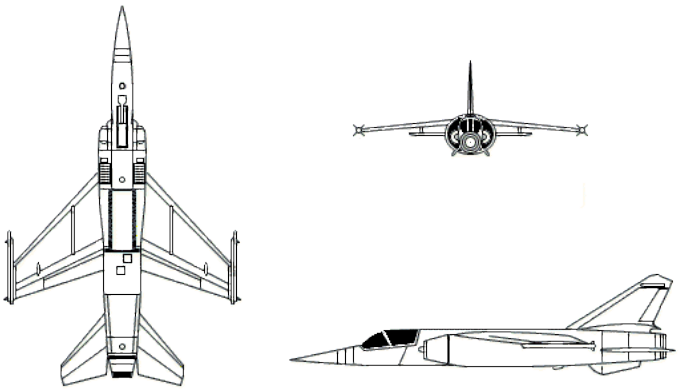
MIRAGE 2000N: TWO-SEAT, NUCLEAR-CAPABLE FIGHTER/BOMBER VERSION IN FRENCH SERVICE ONLY. NO INTERNAL GUN. MOVING MAP DISPLAY, 60 M PENETRATION ALTITUDE.

MIRAGE 2000D: TWO-SEAT, CONVENTIONALLY ARMED VARIANT OF THE 2000N FOR LOW-LEVEL AND NIGHT-TIME STRIKE MISSION; SOME STEALTH MEASURES APPLIED INCLUDING GOLD-FILM COATING ON THE CANOPY AND CAMOUFLAGE.

MIRAGE 2000-5: CONVENTIONAL MULTI-MODE FIGHTER OFFERED FOR EXPORT.22, 050 LBS. THRUST SNECMA M53-P20 ENGINE OFFERED AS AN ALTERNATIVE.

MIRAGE 2000R: RECONNAISSANCE VERSION OF 2000C. FITTED WITH CAMERA PODS, ELECTRONIC INTELLIGENCE AND ECM EQUIPMENT

FRENCH MULTI-PURPOSE FIGHTER AIRCRAFT MIRAGE F1



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types		Maximum (at altitude):	2,334, Mach 2.2
Two integral 30-mm DFEA Cannons:	135	Maximum (sea level):	1,471, Mach 1.2
Other Loading Options		Ceiling (m):	20,000
AAMs:		Vertical Climb Rate (m/s):	213
Super R530 AAM:	2	Fuel (liters):	
Armat ARM:	1	Internal:	4,200
AM 39 Exocet anti-ship missile:	1 - 2	External:	4,460
AS30L AGM:	1 - 2	Cruise:	2,170
30-mm DEFA gun pods:	2	Range (km):	
BOMBS:		Cruise:	2,170
Laser guided:		Ferry:	3,300
400 kg conventional:		Dimensions (m):	
1000 kg conventional:		Length:	15.3
ATLIS laser designation pod:		Wingspan:	8.4
250kg/BAP 100/BAT-100:	14	Height :	4.5
200 kg Durandal anti-runway:		Standard Payload (kg):	
Belouga cluster:		External:	6,300
Rockets:		Hardpoints:	5
68 mm rocket pods:	18	Centerline:	1
Anti-radar:		Each Wing:	2
R550 Magic or AIM-9 Sidewinder AAM:	2	Survivability/Countermeasures:	
SYSTEM		In-flight refueling:	Yes
Alternative Designations:		Martin-Baker zero/zero ejection seats:	Yes
Date of Introduction:	1974	IFF:	Yes
Proliferation:	> 11 countries	Infrared jammer:	Yes
Description:		Radar Warning Receiver:	Yes
Crew:	1	Electronic Countermeasures:	Yes
Engines:		AVIONICS/SENSOR/OPTICS:	
11,023 lbs. thrust SNECMA Atar 9K-50 turbojet:	1	Cyrano IVM radar (air-to-air, air-to-ground):	Yes

15,873 lbs. thrust with afterburner:	1	Inertial navigation system:	Yes
Weight (kg):		Panoramic camera:	Yes
Maximum Takeoff:	16,200	Vertical camera:	Yes
Normal Takeoff:	10,900	IR thermographic captor:	Yes
Empty:	7,400	Night/Weather Capabilities:	
Speed (km/h):		Interceptor:	Yes
		Fighter-Bomber:	Yes
		Dedicated Reconnaissance:	Yes

NOTES

THE MIRAGE F1 IS A MULTI-PURPOSE ATTACK/FIGHTER AIRCRAFT OF CONSIDERABLE VERSATILITY. IT CAN BE EMPLOYED IN THE INTERCEPT, GROUND ATTACK, RECONNAISSANCE, TRAINING, ELECTRONIC WARFARE, AND ELECTRONIC INTELLIGENCE ROLES. THE FRENCH AIR FORCE ORDERED THE MIRAGE F1 FOR ITS INTERCEPTOR SQUADRONS, AND THE FIRST F1S ENTERED SERVICE IN 1973.THE F1 PROVED A VERY POPULAR EXPORT, WITH OVER 500 OF THEM SOLD ABROAD IN THE FIRST 10 YEARS OF PRODUCTION. MORE THAN 700 MIRAGE F1'S HAVE BEEN SOLD TO SOME 11COUNTRIES.

APPEARANCE: WINGS: HIGH-MOUNTED, SWEPT-BACK, AND TAPERED. ENGINES: ONE TURBOJET BURIED IN THE AFT FUSELAGE. FUSELAGE: LONG, SLENDER, POINTED NOSE AND BLUNT TAIL. TAIL: SWEPT-BACK AND TAPERED FIN WITH A BLUNT TIP. FLATS ARE MID-MOUNTED ON THE FUSELAGE, SWEPT-BACK, AND TAPERED WITH BLUNT TIPS

VARIANTS

F1-C: FIRST PRODUCTION VERSION FOR SERVICE WITH FRANCE AND FOR EXPORT. AVIONICS ORIENTATED TOWARD AIR-TO-AIR INTERCEPTION.

F1-A:INITIAL PRODUCTION GROUND ATTACK VERSION WITH SMALL ADIA 2 TARGET-RANGING RADAR, RETRACTABLE REFUELING PROBE, GROUND ATTACK SYSTEM AVIONICS SUITE.

F1-B: TWO-SEAT COMBAT-CAPABLE TRAINER VERSION OF F1-C. INTEGRAL CANNON REMOVED.

F1-D: TWO-SEAT COMBAT-CAPABLE TRAINER VERSION OF THE F1-E.

F1-E: EXPORT VERSION WITH STRETCHED FUSELAGE AND IMPROVED AVIONICS.

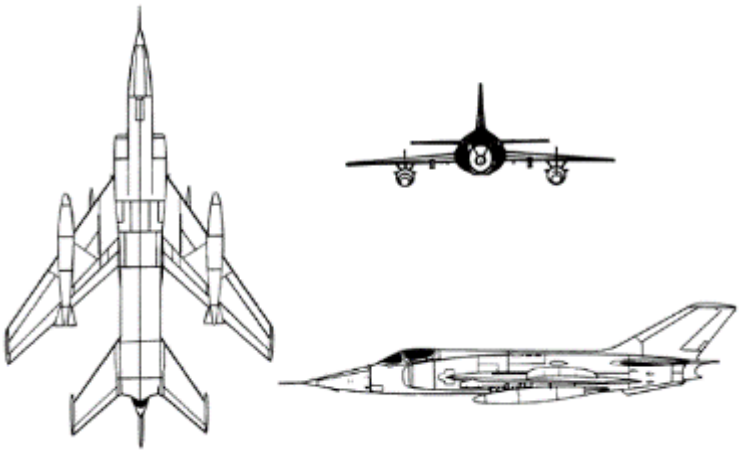
F1-R (F1-CR-200): RECONNAISSANCE/ELINT/EW VERSION. FITTED WITH GROUND MAPPING AND OTHER LOW-ALTITUDE MODES RADAR, DIGITAL NAVIGATION/ ATTACK COMPUTER, HEADS-UP-DISPLAY, INERTIAL NAVIGATION SYSTEM, AND AIR DATA COMPUTER.

F1-CT: CANADIAN AIR FORCE REPLACEMENT FOR THE OLDER MIRAGE III AND SOME JAGUAR AIRCRAFT. USED AS STRIKE AIRCRAFT.

MIRAGE F1/M53: FITTED WITH 18,740 LBS. THRUST SNECMA M53, ENGINE LATER ADOPTED FOR MIRAGE 2000.

C-14: SPANISH DESIGNATION FOR MIRAGE F1.

CHINESE MULTI-ROLE FIGHTER AIRCRAFT Q-5/FANTAN



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types		Maximum (sea level):	1,120
2 x Norinco 23-2K 23mm cannon (rnds):	200	Max "G" Force (g):	+7.5
Other Loading Options:	2	(Max armament):	+5.0
Bombs:		Ceiling (m):	
225 kg;	6	Service (clean):	15,900
250 kg;	6	Vertical Climb Rate (m/s):	148
340 kg	2	Fuel (liters):	
Duranal anti-runway	6	Internal:	3,648
BL755 cluster	2	External:	1,520
Rocket pods:	4	Range (km):	
8-round 57mm/68mm:	2	Maximum Load1,816	
7-round 90mm:	2	Combat Radius:	550
130mm rockets:	4	Takeoff/Landing Roll (m):	1250/804
Missiles:		Dimensions (m):	
PL-2/PL-2B/PL-7 anti-air:	2	Length:	15.7
AIM-9 Sidewinder anti-air:	2	Wingspan:	9.7
Matra R550 Magic anti-air:	2	Height (gear extended):	4.5
CSS-N-4 Sardine anti-ship;		Standard Payload (kg):	
ECM Pods:		External:	2,000
Fuel:		Hardpoints:	10
2 External Fuel Tanks (liters ea.):	760	On fuselage:	4
SYSTEM		Under each wing:	3
Alternative Designations:	A-5 export version	Survivability/Countermeasures:	
Date of Introduction:	1970	Pressurized and air conditioned armored cockpit with one-piece jettisonable canopy:	Yes
Proliferation:	>5 countries	Zero/250 to 850 km/h ejection seat:	Yes
Description:		ECM pod and RWR:	Yes
Crew:	1 (pilot)	ARMAMENT:	

Engines:		Norinco 23-2K 23-mm cannons, one per wing root:	2
5,400 lbs. thrust Wopen-6 turbojets 7,165 lbs. thrust w/afterburner:	2	AVIONICS/SENSOR/OPTICS:	
5,400 lbs. thrust Wopen-6A turbojets 8,930 lbs. thrust w/afterburner (Exports):	2	IFF:	Yes
Weight (kg):		VHF transponder;	Yes
Maximum Gross:	12,000	Radio Compass:	Yes
Empty:	6,636	Low-altitude radio altimeter:	Yes
Speed (km/h):		Horizon gyro:	Yes
Maximum (at altitude):	1,340	Optical sight :	Yes

NOTES

THE Q-5 IS A SINGLE-SEAT, TWIN-ENGINE SUPERSONIC FIGHTER DEVELOPED BY THE NANCHANG AIRCRAFT COMPANY OF CHINA. IT OFFERS ENHANCED COMBAT PERFORMANCE PARTICULARLY AT LOW AND SUPER-LOW ALTITUDE. IT IS USED MAINLY TO ASSIST GROUND TROOPS IN ATTACKING CONCENTRATED TARGETS ON LAND, KEY TRANSPORTATION POINTS AND SHIPS NEAR THE COAST. IT CAN ALSO INTERCEPT AND FIGHT ENEMY AIRCRAFT.

APPEARANCE: WINGS: MID-MOUNTED, SWEPT BACK, AND TAPERED WITH BLUNT TIPS AND WING FENCES. ENGINES: TWO TURBOJETS IN THE FUSELAGE WITH SEMICIRCULAR AIR INTAKES AND TWO EXHAUSTS. FUSELAGE: THICK, FLATTENED, WITH AN UPWARD TAPER TO THE REAR SECTION. TAIL: FLATS ARE HIGH-MOUNTED ON THE BODY, SWEPT-BACK, AND TAPERED WITH SQUARE TIPS. SHARPLY SWEPT-BACK TAIL FIN HAS A BLUNT TIP.

VARIANTS

Q-5: FIRST VERSION WITH INTERNAL BOMB BAY. THE Q-PREFIX INDICATES THE AIRCRAFT IS IN THE CHINESE MILITARY SERVICE. THE A-PREFIX DENOTES THE EXPORT VERSION

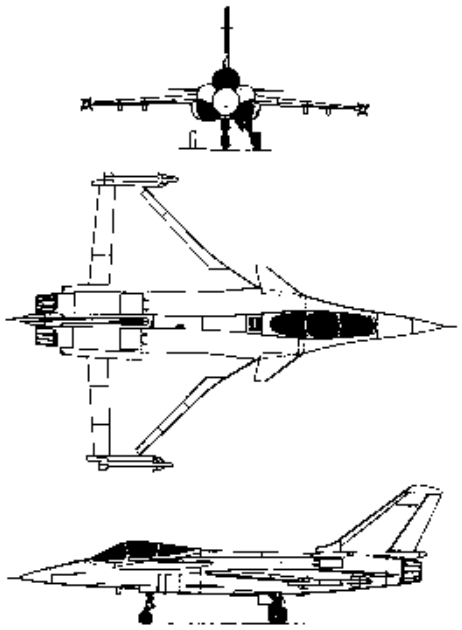
Q-5 I/A-5A: BECAME THE STANDARD CONFIGURATION. ENTERED PRODUCTION IN LATE 1970S. INTERNAL WEAPONS BAY CONVERTED INTO ADDITIONAL FUEL TANKS, TWO FUSELAGE PYLONS AND OUTER WING PYLONS ADDED. FORTY EXPORTED TO NORTH KOREA.

Q-5IA: INTRODUCED KEY REFINEMENTS, INCLUDING THE ADDITION OF TWO UNDER WING PYLONS, BETTER SELF-PROTECTION AND IMPROVED OPTICAL SIGHTS.

Q-5 II/Q-5B/A-5B: NEARLY IDENTICAL TO THE Q-5IA. INCLUDES RWR. MAY ALSO HAVE RANGING RADAR AND ALR-1 LASER TO WORK WITH PRECISION-GUIDED BOMBS. HUD, MISSION COMPUTER AND ECM ALSO INCLUDED.

Q-5-III/A-5C: MAJOR EXPORT VERSION. A SOMEWHAT LONGER AND WIDER Q-5 II. INCLUDES IMPROVED AVIONICS, MARTIN BAKER PKD10 ZERO-ZERO EJECTION SEAT

FRENCH MULTI-ROLE FIGHTER AIRCRAFT RAFALE



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types		Proliferation:	Expected to be exported
30-mm DFEA 791B Cannons (rnds):	300	Description:	
Other Loading Options		Crew:	
Magic:	6	M/C:	1
Mica:	10	B:	2
Sidewinder:	6	Engines19, 955 lbs. thrust SNECMA M-88-3 turbofans with afterburner:	2
ASRAAM	6	Weight (kg):	
AMRAAM:	5	Maximum Gross:	24,500
Exocet:	4	Maximum Takeoff:	20,000
Penguin 3:	4	Empty:	
Harpoon:	4	M:	9670
AS30L:	4	B/C:	9,060
Apache:	3	Speed (km/h):	
Alarm:	5	High-Altitude:	2,125
Harm:	5	Low-level:	1,853
Maverick:	4	Maximum:	2,390
Bombs;		Max “G” Force (g):	+9/-3.6
1000 kg;	3	Ceiling (m):	16,765
400 kg;	5	Vertical Climb Rate (m/s):	305
GBU-12	5	Fuel (liters):	
GBU-10	3	Internal:	5,325
250 kg-Mk 82:	20	External:	6,000
400 kg-Mk 83:	10	Range (km):	
Belouga cluster:	10	Maximum Load:	2,110

Bap 100:	10	With Aux Fuel (3 tanks):	3.520
Bat 120:	10	Combat Radius:	1,882
Derandal:	10	Takeoff Run/Landing Roll (m):	400-1000/450
Fuel:		Dimensions (m):	
1,300 L:	3	Length:	115.3
1,700 L:	3	Wingspan:	10.9
2,000 L:	3	Height:	5.4
Pods:		Standard Payload (kg):	9,500
PDLCT TV and FLIR:	1	External:	9,500
ECM:		Hardpoints:	14
RECCE IR:	1	Rafale M:	13
SLAR:	1	Survivability/Countermeasures:	
HAROLD:	1	Martin-Baker zero/zero ejection seat:	Yes
Twin gun pod (600 rounds):	1	Canopy gold coated to reduce radar reflections:	Yes
SYSTEM		ARMAMENT:	
Alternative Designations:		DEFA 791B 30-mm cannon:	1
Date of Introduction:			
M:	2001		
B/C:	2006		

NOTES

RAFALE IS A TWIN-JET COMBAT AIRCRAFT CAPABLE OF CARRYING OUT A WIDE RANGE OF SHORT- AND LONG-RANGE MISSIONS INCLUDING GROUND AND SEA ATTACK, AIR DEFENSE AND AIR SUPERIORITY, RECONNAISSANCE, AND HIGH-ACCURACY STRIKE OR NUCLEAR STRIKE DETERRENCE.

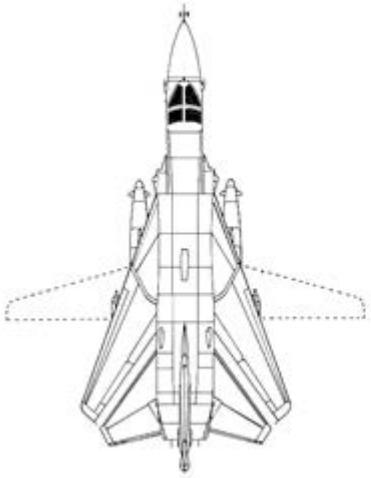
APPEARANCE: WINGS: MID-MOUNTED DELTA. ENGINES: TWO TURBOFANS BURIED IN AFT FUSELAGE. FUSELAGE: CONVENTIONAL SEMI-MONOCOQUE WITH SOME BLENDING. TAILFIN HAS SHARPLY SWEPT LEADING EDGE AND SWEPT, INSET RUDDER. IN PLACE OF HORIZONTAL STABILIZERS AFT IT HAS RELATIVELY LARGE, SWEPT, ALL-MOVING CANARDS SHOULDER-MOUNTED ABOVE AND AHEAD OF THE WING LEADING EDGE.

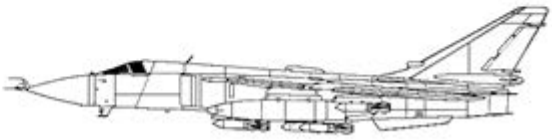
VARIANTS

RAFALE B/C ACT: SINGLE-SEAT VARIANT INTENDED TO REPLACE SEPECAT JAGUAR. ONE VERSION WILL BE ARMED WITH ASMP AND REPLACE THE MIRAGE IV PENETRATING BOMBERS. ONE VERSION WILL BE FITTED WITH SNECMA M-88-2 ENGINES AND RDX RADAR.

RAFALE M ACM: CARRIER-CAPABLE STRIKE AIRCRAFT TO REPLACE F-8 CRUSADER AND SUPER ETENDARD.EMPTY WEIGHT WILL BE 750 KG HEAVIER THAN ACT. IT ALSO HAS A CARRIER-LANDING ARRESTOR HOOK AND ONE LESS HARDPOINT FOR WEAPONS.

RUSSIAN MULTI-ROLE AIRCRAFT SU-24/FENCER





SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types		With External Stores:	INA
23-mm 6x barrel Gsh-23 cannon (rnds):	250	Vertical Climb Rate (m/s):	150
Other Loading Options:	2	Fuel (liters):	
TN1000 or TN11200 nuclear weapons:		Internal:	11,760
100-kg FAB-100 bombs:	38	External:	8,000
TV or laser-guided bombs:	4	Range (km):	
		Maximum Load:	940
AS-7/KERRY ASM:	1	With Aux Fuel:	1,230
AS-10/KAREN ASM:		Combat Radius:	950
AS-12/KEGLER ASM:		Takeoff Run/Landing Roll (m):	
AS-13/KINGBOLT ASM:		Prepared Surface:	1,100-1,200/950
AS-14/KEDGE ASM:		Dimensions (m):	
AS-17/KRYPTON ASM:		Length:	24.6
S-25LD 266-mm precision rockets:		Wingspan:	
Gun pods:	3	Extended:	17.6
AA-8/APHID or AA-11 AAM:	2	Swept:	10.4
External fuel tanks (liters):	2,000 – 3,000	Height (gear extended):	6.2
SYSTEM		Standard Payload (kg):	
Alternative Designations:	See Variants	External:	8,000
Date of Introduction:	1975	Hardpoints underwing:	9
Proliferation:	> 11 countries	Survivability/Countermeasures:	
Description:		Pressurized cockpit with zero/zero ejection seats:	Yes
Crew (pilot, weapons operator):	2	Infrared and radar jammer:	Yes
Engines 17,200-shp Lyluka AL-21F-3A turbojet (24,700-shp with afterburner):	2	Radar and missile warning Receivers:	Yes
Weight (kg):		chaff and flares:	Yes

Maximum Gross:	39,700	ARMAMENT:	
Normal Takeoff:	35,910	23-mm 6x barrel Gatling gun, Gsh-6-23:	
Empty:	22,320	Range (m) (practical):	2,500
Speed (km/h):		Elevation/Traverse (rigid mount):	None
Maximum (at altitude):	2,320	Ammo Type:	HEFI
Maximum (sea level):	1,530	Rate of Fire (rpm):	9,000
Maximum Attack Speed:	1,200	AVIONICS/SENSOR/OPTICS:	
Cruise:	INA	Integrated navigation and	
Takeoff/Landing Speed:	INA	fire control radars:	Yes
Max "G" Force (g):	+6.5 g	Pulse-doppler terrain following radar coupled to autopilot:	Yes
Ceiling (m):		Laser/TV targeting and weapon guidance:	Yes
Service (clean):	17,500	Night/Weather Capabilities::	Yes

NOTES

THIS AIRCRAFT WAS THE FIRST DEVELOPED SPECIFICALLY FOR THE GROUND-ATTACK ROLE, BUT HAS BEEN ADAPTED FOR OTHERS. ITS VARIABLE SWEPT WING CAN BE SET AT 16, 45, OR 69 DEGREES. SOME AIRCRAFT ARE CAPABLE OF AERIAL REFUELING. ALL CAN CARRY UP TO THREE EXTERNAL FUEL TANKS FOR EXTENDED RANGE. THERE IS NO INTERNAL WEAPONS BAY. NOT ALL MUNITIONS MAY BE EMPLOYED AT ONE TIME. MISSION DICTATES WEAPONS CONFIGURATION. EXTERNAL STORES ARE MOUNTED ON UNDERWING HARDPOINTS. EACH WING HAS FOUR POINTS. THE CENTER FUSELAGE ATTACHMENT POINT GIVES NINE TOTAL STATIONS.

APPEARANCE: WINGS: HIGH-MOUNT, VARIABLE, TAPERED BACK. ENGINES: BOTH ALONG BODY, UNDER WINGS.

VARIANTS

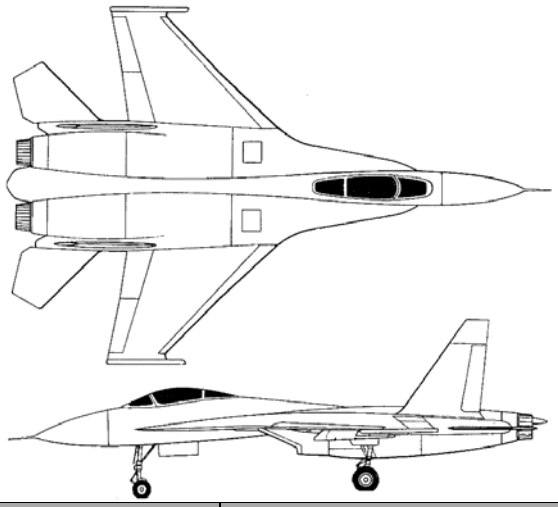
SU-24M/-24MK/FENCER D: GROUND ATTACK VERSION AND EXPORT MODEL.

SU-24MK/FENCER D MODERNIZED: CURRENTLY MARKETED GROUND ATTACK VARIANT HAS UPGRADES SUCH ASILS-31 HEADS-UP DISPLAY COMPUTER GPS FCS, DIGITAL MAP DISPLAY, KS-418E RADAR JAMMER PODS, AND ACCESS TO RECENT MISSILES (E.G., AS-13, AS-17, S-25LD LASER DESIGNATED ROCKETS AND AA-11 AAM).

SU-24MR/FENCER E: RECONNAISSANCE VARIANT FOR MISSIONS TO 400 KM, WITH BKR-1SENSOR SUITE: A-100 SERIES AND AP-402M CAMERAS, AIST-MTV CAMERA, SHPIL-2M LASER RADAR SYSTEM, ZIMA IR CAMERA, AND SHTIK SIDE-LOOKING RADAR (24 KM RANGE, 5M ACCURACY).SYSTEM CAN OPERATE DAY OR NIGHT. THE BOK-2 ECM SYSTEM IS USED. OPTIONS INCLUDE EFIR-1M RADIATION DETECTION POD, KADR FILM DROP SYSTEM, AND TANGAZH ELINT POD. DATA OTHER THAN OPTICAL IS TRANSMITTED DIGITALLY. ANOTHER OPTION IS 2 XAA-8/APHID ASMS.

SU-24MP/FENCER F: ELECTRONIC WARFARE/ JAMMING/SIGINT VARIANT. BUKET SERIES JAMMERS ARE AKA SPS-22, -33, -44, OR -55.FASOL SERIES (SPS-5, -5M AND -5- 2X) RADAR NOISE JAMMERS ARE AVAILABLE. GERAN (SPS-161 OR GERAN F) IS A 2ND GENACTIVE JAMMER. GERAN/SPS-162 JAMS 6-12 GHZ, WITH 100 KW. ARMAMENT INCLUDES 23-MM GUN AND (OPTIONAL) 4 X AA-8 ASMS

RUSSIAN MULTI-ROLE FIGHTER AIRCRAFT SU-27/FLANKER-B AND VARIANTS



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types		Hardpoints:	
30-mm Gsh-30-1 cannon (rnds):	150	FLANKER-B:	10
Other Loading Options:	2	C:	12
AA-10A-D/ALAMOAAM	10	Takeoff Run/Landing Roll (m):	
AA-8/APHID AAM		Prepared Surface (variant dependent):	500 to 650/600
AA-9/AMOS AAM		Su-35:	720 / 1,200/1,200
AA-11/ARCHER AAM		Dimensions (m):	
AA-12 ADDER AAMs		Length:	21.9
AS-7/KERRY ASM:		Wingspan:	14.7
AS-10/KAREN ASM:	8	Height:	5.5
AS-12/KEGLER ASM:		Standard Payload (kg):	
AS-13/KINGBOLT ASM:		External:	6,000
AS-14/KEDGE ASM:	6	Survivability/Countermeasures:	
AS-17/KRYPTON ASM:		Zero/zero ejection seat:	Yes
AS-18/KAZOO ASM:	2	Infrared and radar jammer (SPS-171):	Yes
Gun pods:	3	Radar and missile warning receivers:	Yes
AA-8/APHID or AA-11 AAM:	2	Chaff and flares:	Yes
420-mm S-25 rockets (1 each):	4	ARMAMENT:	
80-mm S-8 rocket pod (20 ea.):	4	30-mm gun mounted in the right wing:	Yes
122-mm S-13 rocket pod (5 each):	4	30-mm gun, Gsh-30-1:	
250-kg, or 500-kg unguided and guided bombs:		Range (m) (practical):	4,000
SYSTEM		Elevation/Traverse (rigidly mounted):	None
Alternative Designations:	Chinese J-11	Ammo Type HEFI, APT, CC:	Yes
Date of Introduction:	1986	Rate of Fire (rpm):	1,500

Proliferation:	> 5 countries	AVIONICS/SENSOR/OPTICS:	
Description:	Variants in ( )	External:	8,000
Crew:	1	Hardpoints underwing:	9
Engines 27,557-shp Lyluka AL-31F turbojet with afterburner :	2	Survivability/Countermeasures:	
Weight (kg):		Pressurized cockpit with zero/zero ejection seats:	Yes
Max Gross (B/SM):	28,300/33,000	Infrared and radar jammer:	Yes
Normal Takeoff (B/SM):	23,000/23,700	Radar and missile warning Receivers:	Yes
Empty:	17,690	Chaff and flares:	Yes
Speed (km/h):		ARMAMENT:	
Max (at altitude):	Mach 2.35	23-mm 6x barrel Gatling gun, Gsh-6-23:	
Max (sea level):	Mach 1.1	Range (m) (practical):	2,500
Takeoff/Landing Speed:	250/231	Elevation/Traverse (rigid mount):	None
Max “G” Force (g)Control limited:	+9.0	Ammo Type HEFI:	Yes
Ceiling (m):		Rate of Fire (rpm):	9,000
Service (clean):	18,000	AVIONICS/SENSOR/OPTICS:	
With External Stores:	INA	Pulse-Doppler look-down/ shoot-down radar:	
Vertical Climb Rate (m/s):	305	Search range (km):	240
Fuel (liters):		Track range (km):	185
Internal (B/SM):	6,600/11,775	Multi Target Capability:	Yes
External:	no provision	IR Sensor:	Yes
Range (km):		Laser Designator:	Yes
Max Load:	3,790	Heads Up Display:	Yes
With Aux Fuel (B/SM):	4,390		
Combat Radius:	1,500		

NOTES

THE SU-27 IS PRIMARILY AN ALL-WEATHER INTERCEPTOR/FIGHTER AIRCRAFT USED FOR AIR DEFENSE. LATER VERSIONS ARE CAPABLE OF ALSO PERFORMING GROUND ATTACK MISSIONS. IT IS HIGHLY MANEUVERABLE BECAUSE OF A FLY-BY-WIRE CONTROL SYSTEM, WHICH AUTOMATICALLY RESTRICTS AIRCRAFT ANGLES OF ATTACK AND MAXIMUM G-LOADS DURING FLIGHT. EXTERNAL FUEL TANKS CAN BE CARRIED ON SOME VARIANTS, AND SOME ARE FITTED FOR AERIAL REFUELING, BUT THESE ARE GENERALLY NAVAL VERSIONS RATHER THAN AIR DEFENSE OR STRIKE VERSIONS. AVAILABLE MUNITIONS ARE SHOWN ABOVE; NOT ALL MAY BE EMPLOYED AT ONE TIME. MISSION DICTATES WEAPONS CONFIGURATION. EXTERNAL STORES ARE MOUNTED ON UNDERWING AND UNDERBODY HARDPOINTS. EACH WING HAS TWO POINTS AND AN ADDITIONAL RAIL ON THE WINGTIP. TWO POINTS ARE UNDER THE INTAKES ALONG THE FUSELAGE, AND TWO ARE CENTRALLY LOCATED UNDERNEATH THE FUSELAGE NEAR THE CENTERLINE AND BETWEEN THE INTAKES FOR A TOTAL OF TEN STATIONS.

APPEARANCE: WINGS: MID-MOUNT, SWEPT, SQUARE TIPS. ENGINES: TWO IN FUSELAGE, WITH SQUARE UNDERWING INTAKES. FUSELAGE: POINTED NOSE, RECTANGULAR FROM INTAKES TO TAIL. TAIL: TWIN TAPERED, SWEPT FINS, WITH MID-MOUNT, TAPERED, SWEPT FLATS

VARIANTS

SU-27/FLANKER B: PRODUCTION SINGLE-SEAT AIR SUPERIORITY FIGHTER USED IN RUSSIAN UNITS.

THERE ARE DOZENS OF UPGRADE PROGRAMS, MORE THAN A DOZEN FIELDED VARIANTS, AND SEVERAL DEVELOPED AIRCRAFT WITH DIFFERENT DESIGNATORS (SU-30, SU-34, SU-35, AND SU-37).

SU-27SK/-27P/FLANKER B: VARIANT EXPORTED TO CHINA WITH GROUND ATTACK CAPABILITY.J-11: CHINESE BUILT VERSION.

SU-27SM:MULTI-ROLE VERSION, WITH 12 HARDPOINTS, GREATER INTERNAL FUEL AND PAYLOAD CAPACITY, AND AIR REFUEL CAPABILITY.

SU-27UB/FLANKER C:TWO-SEAT MODEL (EXPORT -UBK), AS COMMAND AIRCRAFT, TRAINER AND INTERCEPTOR.JJ-11:CHINESE BUILT VERSION

SU-27K/FLANKER D: NAVAL VARIANT, READILY NOTICEABLE BY CANARDS FORWARD OF THE WINGS.

SU-27M/FLANKER E: MULTI-ROLE UPGRADE WITH HIGHER FINS, UPGRADED AVIONICS, ETC., DEVELOPED IN LATE 1980S.AN EXPORT VERSION CALLED SU-35 WAS MARKETED. IT HAD MORE POWERFUL 28,218-SHP LYLUKA AL-31FM ENGINES, THRUST-VECTORING NOZZLES FOR HIGHER GROSS WEIGHT AND GREATER RANGE. IT ALSO FEATURED BETTER RADAR AND TARGETING SYSTEMS FOR MULTIPLE ENGAGEMENTS. DIMENSIONS SLIGHTLY INCREASED, NOTICEABLE BY CANARDS FORWARD OF WINGS. FIELDING WAS MINIMAL, AND NONE WERE SOLD.SU-35UB WAS A TWO-SEATER UPGRADE VERSION.

SU-37/"SUPER FLANKER": SINGLE-SEAT MULTI-ROLE FIGHTER WITH THRUST VECTORING CAPABILITY AND SUFFICIENT MOBILITY FOR THE *KULBIT* PITCH-UP MANEUVER INTO A TIGHT 360 DEGREE SOMERSAULT, AS WELL AS IMPROVED LONG-RANGE WEAPONS AND FIRE CONTROL. EXPECTED FUTURE PRODUCTION VERSION IS SU-37MR. HOWEVER, AFTER THE ONE SU-27M CONVERSION TO SU-37 CRASHED DURING A FERRY FLIGHT, ALL WORK ON THE AIRCRAFT ENDED IN 2002.PRODUCTION IS UNLIKELY.

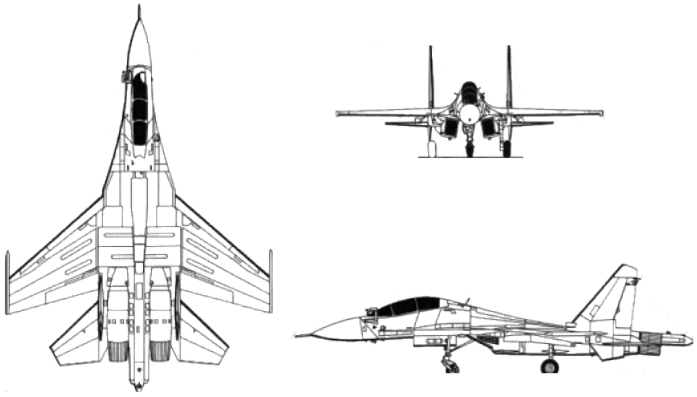
SU-27/SU-30 MAJOR/MINOR MODERNIZATION: UPGRADE PROGRAMS ARE BEING IMPLEMENTED TO BRING SU-27S UP TO SU-30 STANDARD, AND SOME SINGLE-SEAT UPGRADES TO THE STANDARD.

SU-30/FLANKER-F: PRODUCTION TWO-SEATER AIRCRAFT DEVELOPED FROM SU-27.

SU-34/FULLBACK: THIS 2-SEAT BOMBER VERSION HAS A SIDE-BY-SIDE COCKPIT, HIGH PAYLOAD FOR USE IN BOMBER MISSIONS AND MANEUVERABILITY SIMILAR TO FIGHTERS. EARLIER DESIGNATIONS INCLUDE: SU-27IB, SU-32, SU-32FN, AND SU-32MF.PRODUCTION AND EARLY FIELDING IS NOW UNDERWAY. THIS AIRCRAFT IS SCHEDULED TO GENERALLY REPLACE SU-24S IN RUSSIAN FORCES FOR THE STRIKE ROLE.

SU-35/SU-27BM: THIS NEW SINGLE-SEATER MULTI-ROLE FIGHTER IS DEVELOPED TO REPLACE SU-27M.THE 4+++ GENERATION PROTOTYPE FIRST FLEW IN 2008.IT INCLUDES A NEW AIRFRAME, WITH LARGER WINGS AND INTAKES, BUT NO CANARDS. IT HAS BIGGER ENGINES; NEW IRBIS-E PHASED-ARRAY RADAR, NEW IRST, AND 12 HARD POINTS FOR THE LATEST WEAPONS ARE INCLUDED. THE SU-35 EXPORT VERSION IS COMPLETELY DIFFERENT FROM THE PREVIOUS AIRCRAFT WITH THE SAME DESIGNATION. THE AIRCRAFT IS DUE TO BEGIN PRODUCTION IN 2010, WITH FOCUS ON EXPORT CUSTOMERS. AN ATTRACTIVE FEATURE IS NO USE OF WESTERN TECHNOLOGY, WHICH IS VULNERABLE TO EXPLOITATION OR EXPORT RESTRICTIONS. THE RUSSIAN DOMESTIC VERSION IS SU-35S.

RUSSIAN MULTI-ROLE FIGHTER SU-30/FLANKER-F AND EXPORT SU-30MK SERIES



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types		Takeoff /Landing Roll (m):	550/670
30-mm Gsh-30-1 cannon (rnds):	150	Dimensions (m):	
Other Loading Options:	2	Length:	21.9
AA-10A-D/ALAMOAAM	6	Wingspan:	14.7
AA-11/ARCHER AAM	6	Height:	6.4
AA-12 ADDER AAMs	6	Standard Payload (kg):	
AS-14/KEDGE ASM:	6	External:	8,000
AS-17/KRYPTON ASM:	6	Hardpoints pylons:	12
AS-18/KAZOO ASM:	2	Survivability/Countermeasures:	
Gun pods:	3	Zero/zero ejection seat:	Yes
420-mm S-25 rockets (1 each):		Infrared and radar jammer:	Yes
80-mm S-8 rocket pod (20 ea.):		Radar and missile warning receivers:	Yes
122-mm S-13 rocket pod (5 each):		Chaff and flares:	Yes
250-kg, or 500-kg unguided and guided bombs:		Gaseous oxygen for 10 hours of flight:	Yes
KAB-500Kr Bombs:	6	ARMAMENT:	
KAB-1500Kr Bombs:	2	30-mm gun mounted in the right wing:	Yes
SYSTEM		30-mm gun, Gsh-30-1:	
Alternative Designations:	Su-27PU	Range (m):	(practical) 4,000
Date of Introduction:	1996	Elevation/Traverse:	None (rigidly mounted)
Proliferation:	China, India, Russia	Ammo Type:	HEFI, APT, CC
Description:	Variants in ( )	Rate of Fire (rpm):	1,500
Crew Su-30MK:	3	AVIONICS/SENSOR/OPTICS:	
Engines 16,755 lbs. thrust Saturn AL-31F turbofans, 27,558 lbs. thrust with afterburner:	2	Pulse-Doppler look-down/ shoot-down radar:	
Weight (kg):		Search range (km):	240

Maximum Takeoff:	38,000	Track range (km):	185
Normal Takeoff:	24,140	Multi Target Capability:	Yes
Empty:	17,900	IR Sensor:	Yes
Speed (km/h):		Laser Designator:	yes
Maximum (at altitude):	2,125, Mach 2.0	Heads Up Display:	Yes
Maximum (sea level):	1,350	AVIONICS/SENSOR/OPTICS:	
Max "G" Force (g):	+8	Pulse-Doppler look-down/ shoot-down radar:	
Ceiling (m):	17,500	Search range (km):	240
Vertical Climb Rate (m/s):		Track range (km):	185
Fuel (liters):		Multi Target Capability:	Yes
Internal:	9,400	IR Sensor:	Yes
Range (km):		Laser Designator:	yes
Unrefueled:	3,000	Heads Up Display:	Yes
One refueling:	5,200		
With Aux Fuel:	4,390 (SM)		
Combat Radius:	1,500		

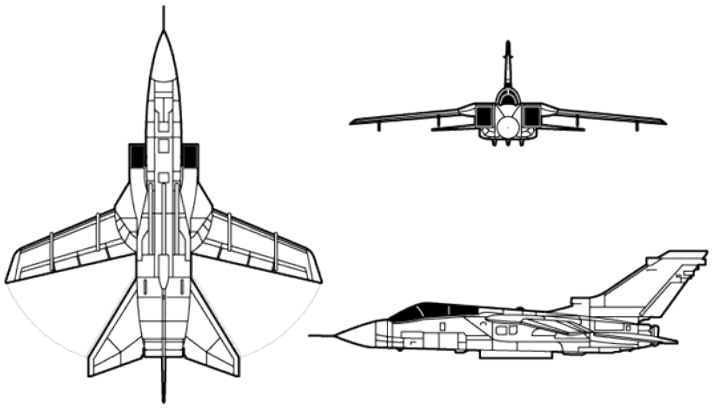
NOTES

A SMALL NUMBER OF THE AIR SUPERIORITY FIGHTERS HAVE BEEN PRODUCED. THE GREATER EXPORT MARKET IS FOR MULTI-ROLE VERSIONS

APPEARANCE: WINGS: MID-MOUNT, SWEPT, SQUARE TIPS. ENGINES: TWO IN FUSELAGE, WITH SQUARE UNDERWING INTAKES. FUSELAGE: POINTED NOSE, HUMPED PROFILE AT THE COCKPIT AND TAPERED TO NEARLY FLAT AT THE ENGINES

VARIANTS
TWO-SEATER AIRCRAFT IS SIGNIFICANTLY UPGRADED AND DERIVED FROM SU-27 SINGLE-SEAT AIRCRAFT.
SU-30M: THE FIRST REAL MULTI-ROLE AIRCRAFT IN THE SU-27 FAMILY, WITH ALL NECESSARY SUB-SYSTEMS. THESE WERE CONVERTED INTO DEMONSTRATORS FOR EXPORTS.
SU-30MK: EXPORT SERIES VERSION. THE SU-30MK2 ANTI-SHIP UPGRADE VERSION HAS BEEN EXPORTED.
SU-30MKK/FLANKER-G: MULTI-ROLE UPGRADE UTILIZING AIR-TO-GROUND WEAPONS TO A MORE ADVANCED VERSION INCORPORATING NEW RADAR, CANARDS AND THRUST VECTORING.JJ-11: CHINESE LICENSE-BUILT VERSION.
SU-30MKI/FLANKER-H: VERSION OF THE SU-30MK MADE FOR INDIA. MOST WILL BE PRODUCED BY AN INDIAN FIRM. SOME WESTERN EQUIPMENT REPLACED MUCH OF THE RUSSIAN SYSTEMS. SU-30MKM: VERSION FOR USE BY MALAYSIA.

BRITISH/GERMAN MULTI-ROLE AIRCRAFT TORNADO IDS



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types:		Ceiling (m):	+15,000
2 integral IWKA-Mauser 27-mm (rnds):	180	Fuel (liters):	
Other Loading Options lbs.:	< 9,000	Internal (RAF/RSAF):	6,393/5,842
Bombs:		External:	4,500
Air-to-air missiles:	< 8	Range (km):	
Anti-radar missiles:		Tactical Radius (hi-lo-hi profile with 2,629 kg) (km):	1,390
Anti-runway sub munition dispensers:		Ferry:	3,890
Stand-off weapons systems:		Takeoff Run/Landing Roll (m):	900/370
Air-to-surface missiles:		Dimensions (m):	
Brimstone ATGM:		Length:	16.7
Storm Shadow Cruise Missile:	1	Wingspan extended:	13.9
		Swept:	8.6
Sea Eagle Anti-Ship Missiles:	4	Height:	5.6
Raptor EO/IR Recon Pod:	1	Standard Payload (kg):	
Internal sensors:	3	External:	9,000
Paveway Laser-Guided Bombs:		Hardpoints:	7
		under fuselage	3
		under wing (ea.):	2
Flares:		Survivability/Countermeasures:	
EW equipment:		Martin-Baker MK-10A zero/zero ejection seat (2ea):	Yes
1500 L or 2250 L drop fuel tanks:		Radar Homing and Warning (RHAW):	Yes
SYSTEM		Active ECM pod:	Yes
Alternative Designations:		Chaff and flare dispensing system:	Yes
Date of Introduction:	1982	IFF:	Yes
Proliferation:	Germany, Great Britain, Italy, and Saudi Arabia	ARMAMENT:	

Description:		Internal Mauser 25-mm cannon (2ea):	Yes
Crew:	2 (pilot, weapons officer)	AVIONICS/SENSOR/OPTICS:	
Engines 9,000 lbs. thrust Turbo-Union RB199-34R turbofans, 16,000 lbs. thrust with afterburner:	2	Multi-mode, ground-mapping and terrain-following radar):	Yes
Weight (kg):		Digital Inertial Navigation System (INS):	Yes
Max Takeoff:		Doppler radar with Kalman filter:	Yes
Clean, full internal fuel:	20,411	Heads-up-display:	Yes
Full external load:	27,215	Laser Ranger and Marked Target Seeker (LRMTS):	Yes
Empty:	14,091	Night/Weather Capabilities:	
Speed (km/h):		All-weather close air support/battlefield interdiction	
Maximum (at altitude):	2,340, Mach 2.2	Interdiction/counter-air strike	
Max "G" Force (g):	+7.5	Naval strike and all-weather day and night reconnaissance capable	
Internal:			
External:	4,000		

NOTES

DESIGNED AND BUILT AS A COLLABORATIVE PROJECT IN THE UK, GERMANY, AND ITALY, THE TORNADO IS IN SERVICE WITH ALL THREE AIR FORCES AND THE GERMAN NAVY. TORNADO IS ALSO IN SERVICE IN SAUDI ARABIA AND OMAN. IT IS A TWIN-SEAT, TWIN-ENGINE, VARIABLE GEOMETRY AIRCRAFT AND IS SUPERSONIC AT ALL ALTITUDES.

APPEARANCE:

WINGS: HIGH-MOUNTED, VARIABLE-GEOMETRY, SWEPT-BACK, AND TAPERED WITH ANGULAR, BLUNT TIPS. ENGINES: TWO TURBOFANS INSIDE THE BODY. FUSELAGE: SOLID WITH A NEEDLE NOSE, THICKENS MIDSECTION AND TAPERS TOWARD THE TAIL. TAIL: TALL, SWEPT-BACK, AND HAS A TAPERED FIN WITH A CURVED TIP AND A STEP IN THE LEADING EDGE. FLATS ARE LARGE, MID-MOUNTED ON THE BODY, SWEPT-BACK, AND TAPERED WITH BLUNT TIPS.

VARIANTS

TORNADO IDS: DESIGNATED GR1 IN RAF SERVICE. GROUND ATTACK/ INTERDICTION VERSION. SOME HAVE BEEN ADAPTED FOR THE ANTI-SHIPPING ROLE.

TAC-R TORNADO GR1A: RAF GR1S MODIFIED AS DEDICATED TACTICAL RECONNAISSANCE AIRCRAFT. FITTED WITH A MARCONI DEFENSIVE SYSTEMS EMITTER LOCATION SYSTEM. BOTH 27-MM CANNONS WERE REMOVED.

TORNADO GR1B: MODIFIED FOR MARITIME STRIKE MISSIONS WITH SEA EAGLE ANTI-SHIP MISSILES. RAF DISCARDED GR1B DESIGNATION IN JULY 2001.

TORNADO ADVAIR DEFENSE VARIANT

TORNADO ECR: ELECTRONIC COMBAT AND RECONNAISSANCE VARIANT FOR GERMAN AND ITALIAN SERVICE

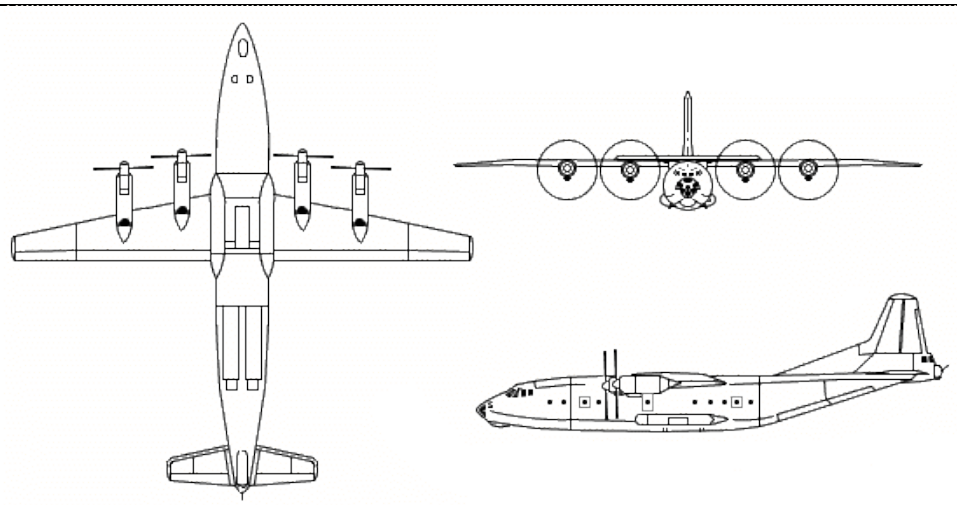
RUSSIAN TRANSPORT AIRCRAFT AN-2/COLT



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
SYSTEM		Takeoff Run/Landing Roll (m):	
Alternative Designations:	INA	Prepared Surface:	150/170
Date of Introduction:	1948	Unprepared Surface:	200/185
Proliferation:	At least 32 countries	Max Load:	INA
Description:		Dimensions (m):	
Crew:	2 (pilots)	Length:	12.7
Engines 1,000-shp Shevetsov Ash-62 or PZL Kalisz Ash-621R 9-cylinder radial piston driving a four-bladed, variable-pitch propeller:	1	Wingspan:	18.2
Weight (kg):		Height:	4.0
Max Gross:	5,500	Cabin Dimensions (m):	
Normal Takeoff:	INA	Floor Length:	4.1
Empty:	3,450	Width:	1.6
Speed (km/h):		Height:	1.8
Max:	258	Standard Payload (kg):	
Min:	90	Internal:	1,500
Cruise:	185	Transports 12 troops or paratroops, or 6 litters.	
Takeoff/Landing Speed:	85	Survivability/Countermeasures:	
Max “G” Force (g):	-1.0 - +3.7	None	
Ceiling (m):		ARMAMENT:	
Service (clean):	4,400	12.7-mm machineguns:	Experimental
Vertical Climb Rate (m/s):	3.0	23-mm machineguns:	Experimental
Fuel (liters):		Unguided aerial rockets:	Experimental
Internal:	1,200	AVIONICS/SENSOR/OPTICS	
External:	None	Flight avionics only.	Yes
Range (km):		Night/Weather Capabilities:	
Max Load:	900	The An-2 is capable of flight under day and instrument meteorological conditions.	

NOTES
THE WINGS AND ELEVATORS ARE FABRIC-COVERED, WHILE THE FUSELAGE IS METAL. THIS AIRCRAFT CAN OPERATE FROM UNIMPROVED AIRFIELDS, AND IS NOTED FOR SHORT TAKEOFF AND LANDING CAPABILITIES, AND RUGGEDNESS. ITS LOW ACOUSTIC SIGNATURE AND SLOWER SPEEDS ALLOW FOR STEALTHY OPERATION. CABIN CONTAINS TIP-UP SEATS, WHICH CAN BE EASILY FOLDED TO ALLOW SPACE FOR CARGO. SKIS OR PONTOONS CAN BE EMPLOYED ON THE MAIN LANDING GEAR STRUTS.
APPEARANCE: WINGS: BIPLANE AND RECTANGULAR-SHAPED WITH CURVED TIPS, ONE HIGH-MOUNT AND ONE LOW MOUNT (SHORTER), BRACED BY STRUTS. ENGINES: ONE MOUNTED IN NOSE. FUSELAGE: SHORT, THICK, WITH BLUNT NOSE. TAIL: TAPERED WITH ROUND TIP, RECTANGULAR, LOW-MOUNTED FLATS.
VARIANTS
THIS AIRCRAFT WAS ORIGINALLY BUILT IN RUSSIA. NOW IT IS PRODUCED IN CHINA AND POLAND.
AN-2D/-2TD: SPECIALLY MODIFIED FOR PARACHUTE TRAINING AND SPECIAL OPERATIONS.
AN-2P/-2T/-2TP: PASSENGER AND GENERAL TRANSPORT VARIANTS.
AN-2V/-2M/-4: SEAPLANE VARIANT WITH FLOATS IN PLACE OF MAIN LANDING GEAR.
AN-3: THIS VARIANT EMPLOYS AN UPGRADED 1,450-SHP GLUSHENKOV TVD-20 TURBOPROP ENGINE, AND A LARGER THREE-BLADED PROPELLER. THIS ALLOWS FOR AN INCREASED TAKEOFF WEIGHT OF 5,800 KG.
Y-5/C-5: CHINESE-BUILT VERSION AND CHINESE EXPORT NOMENCLATURE.

RUSSIAN CARGO/TRANSPORT AIRCRAFT AN-12/CUB



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
SYSTEM		Dimensions (m):	
Alternative Designations:		Length:	33.1
Date of Introduction:	1959	Wingspan:	38.0
Proliferation:	< 17 countries	Height:	10.6
Description:		Hatch Opening:	(m)
Crew (including tail gunner):	6	Length:	7.7
Engines 4,000-shp Ivchenko AI-20K with 4-blade reversible pitch propellers:	4	Width:	3.0
Weight (kg):		Cargo Hold (m):	
Max Gross:	61,000	Length:	13.5
Normal Takeoff:	55,100	Width:	3.5
Empty:	28,000	Height:	2.6
Speed (km/h):		Volume:	122.8 cu m
Max:	777	Standard Payload (kg):	
Min:	163	Internal:	
Cruise:		Troops:	90
Max 670		Paratroops:	60
Econ 580		Vehicles:	Yes
Landing Speed:	200	Weapons:	Yes
Ceiling (m):	10,200	Cargo:	Yes
Vertical Climb Rate (m/s):	10	Survivability/Countermeasures:	
Internal Fuel (liters):		Warning radar in the tail:	Yes
Normal:	13,900	ARMAMENT:	Yes
Maximum:	19,100	2 NR-23 23-mm cannons in tail turret:	Yes
Range (km):		AVIONICS/SENSOR/OPTICS:	
Max Load:	1,400	I-band ground mapping and precision location radar in chin radome.	Yes

10,000 kg Load:	3,600	Night/Weather Capabilities:	No
Max Fuel:	5,700		
Takeoff Run/Landing Roll (m):	700/500		

NOTES

THE AN-12 CUB IS A VERY WIDELY USED RUSSIAN CARGO AND PARATROOP AIRCRAFT, SIMILAR IN APPEARANCE, PAYLOAD AND ROLE TO THE C-130 HERCULES. IT IS A MILITARY VERSION OF THE AN-10. BEFORE THE COLLAPSE OF THE SOVIET UNION, THE CUB WAS THE PRINCIPAL MILITARY TRANSPORT AND WAS ADAPTED FOR THE ELECTRONIC INTELLIGENCE (ELINT) AND ELECTRONIC COUNTERMEASURES (ECM) ROLES BY THE SOVIET NAVY AND POSSIBLY SEVERAL OTHER COUNTRIES.

APPEARANCE: WINGS: HIGH WING, TAPERED LEADING EDGE, STRAIGHT TRAILING EDGES, AND BLUNT TIPS. ENGINES: 4 ENGINES IN THIN NACELLES EXTENDING FORWARD FROM THE UNDERSIDE OF THE WING. FUSELAGE: GLAZED ROUNDED NOSE; CONSTANT CROSS-SECTION CARGO HOLD; BROAD, FLAT BOTTOM TURNS UPWARD TO THE TAIL GUNNER'S POSITION. TAIL: SET HIGH ON AFT FUSELAGE WITH DOUBLE-TAPERED FIN AND FULL-HEIGHT RUDDER MOUNTED UP GUNNER'S POSITION. LARGE DORSAL FILLET SLOPES DOWN FROM FIN TO TOP OF FUSELAGE.

VARIANTS

CUB (AN-12BP): STANDARD TRANSPORT/CARGO VERSION; SEVERAL ELECTRONIC BLISTERS FITTED.

CUB-A: ELINT VERSION: BLADE AERIALS FITTED ON FRONT OF FUSELAGE, AFT OF FLIGHT DECK.

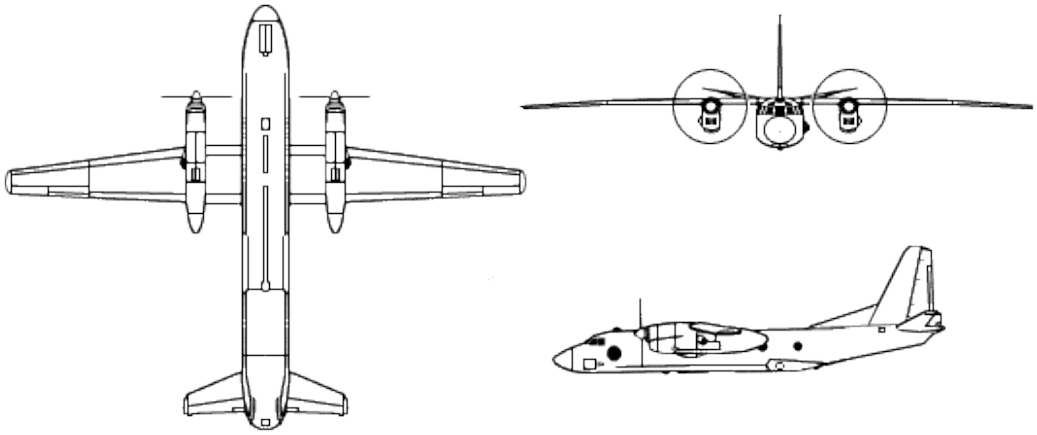
CUB-B: NAVAL ELINT VERSION. PALLETIZED PASSIVE RECEIVERS, FREQUENCY ANALYZERS, RECORDING EQUIPMENT AND ACCOMMODATION FOR EW PERSONNEL IN MAIN CARGO COMPARTMENT.

CUB-C: ECM VERSION. VENTRAL ANTENNA HOUSINGS, JAMMERS ON PALLETS, AND OTHER FEATURES INDICATE THE CAPABILITY OF ELINT COLLECTION.

CUB-D: UPGRADED CUB-C WITH ADDITIONAL ECM EQUIPMENT NAVAL ELECTRONIC WARFARE VERSION.

SHAANXI Y-8: CHINESE MANUFACTURED.

RUSSIAN TRANSPORT AIRCRAFT AN-26/CURL



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
SYSTEM		Width:	2.4
Alternative Designations:		Height:	1.9
Date of Introduction:	1970	Standard Payload (kg):	
Proliferation:	> 28 countries	Internal:	
Description:		Normal:4,500	
Crew (pilot, copilot, navigator, flight engineer, radio operator):	5	Max:	5,500
Engines 2,820 ehp Ivchenko AI-24VT turboprops and 1 x 1,765 lbs. thrust RU 19A-300 turbojet for takeoff assist:	2	Transports:	
Weight (kg):		Seats in Pressurized Cargo bay:	38 - 40
Max Takeoff:	24,000	Litters with attendants:	24
Empty:	15,020	Survivability/Countermeasures:	
Speed (km/h):		Air-conditioned and pressurized cabin:	Yes
Max:	540	Emergency escape hatch in door immediately aft of flight deck:	Yes
Cruise:	440	Chaff/flare dispensers pylon-mounted:	Yes
Takeoff/Landing Speed:	200/190	Two ADF radio altimeter:	Yes
Ceiling (m):	7,500	Glide path receivers:	Yes
Vertical Climb Rate (m/s):	8	Glide slope receiver:	Yes
Fuel (liters):		Marker beacon receiver:	Yes
Internal:	7,050	Weather/navigation radar:	Yes
Range (km):		Directional gyro:	Yes
Max Payload:	1,100	Flight recorder:	Yes
Max Fuel:	2,550	Optional OPB-1R sight for pinpoint dropping of freight:	Yes
Takeoff Run/Landing Roll (m):	780/730	Medical equipment:	Yes
Dimensions (m):		Liquid heating system:	Yes

Length:	**23.8**	**Night/Weather Capabilities:**	**No**
Wingspan:	**29.2**		
Height:	**8.6**		
Cabin Dimensions (m):			
Length:	**11.5**		

NOTES

THE AN-26 CURL IS A WIDELY USED SHORT-HAUL CARGO/TRANSPORT. IT CAN BE MODIFIED TO PERFORM PARATROOP TRANSPORT, MEDICAL EVACUATION, OR PASSENGER TRANSPORTATION. THE AN-26 IS PRODUCED IN BOTH MILITARY AND CIVIL AIR VERSIONS WITH ESSENTIALLY THE SAME FEATURES.

APPEARANCE: WINGS: HIGH-MOUNTED, EQUALLY TAPERED FROM ENGINES TO THE BLUNT TIPS ENGINES: TWO TURBOPROPS MOUNTED IN PODS BENEATH THE WINGS, WHICH EXTEND BEYOND THE WINGS' LEADING AND TRAILING EDGES FUSELAGE: LONG AND SLENDER WITH AN UPSWEPT REAR SECTION AND A SOLID, ROUNDED NOSE, FEATURING A STEPPED COCKPIT. TAIL: BACK-TAPERED BLUNT TIPPED FIN. HIGH-MOUNTED BACK-TAPERED FLATS WITH BLUNT TIPS, AND HAVE A POSITIVE SLANT

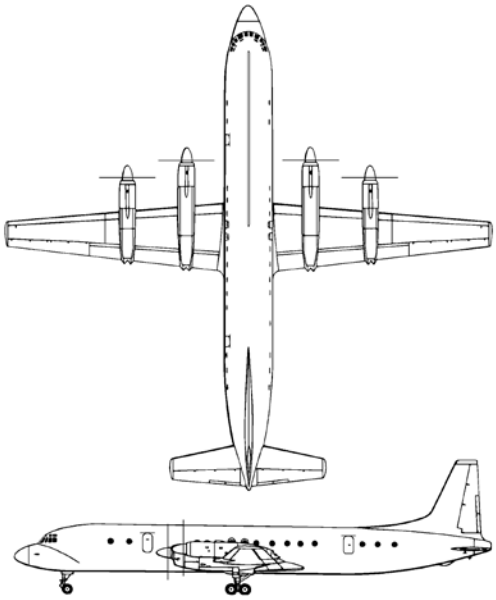
VARIANTS

AN-26: ORIGINAL PRODUCTION VERSION.

AN-26B: UPGRADED VERSION WITH IMPROVED CARGO HANDLING EQUIPMENT.

Y7H/Y7H-500: CHINESE PRODUCTION VERSION

RUSSIAN TRANSPORT AIRCRAFT IL-18/COOT



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
SYSTEM		Fuel (liters):	
Alternative Designations:	Il-20, Il-22	Internal (D/E):	30,000 / 23,700
Date of Introduction:	1959	External: None	
Proliferation:	>5 countries	Range (km):	
Description:		Max Load (D/E):	4,000 / 3,200
Crew (2x pilots, 1x navigator, 1x radio operator, 1x flight engineer):	5	Normal Load (D/E):	6,500 /5,200
Engines 250-shp Ivchenko AI-20M turboprop driving 4x four-bladed reversible-pitch propellers:	4	Takeoff Run/Landing Roll (m):	
Weight (kg):		Prepared Surface (D/E):	1,300 / 850
Max Gross (D/E):	64,000 / 61,200	Unprepared Surface: INA	
Empty(D/E):	35,000 /34,610	Dimensions (m):	
Speed (km/h):		Length:	35.9
Max:	675	Wingspan:	37.4
Min:	INA	Height:	10.2
Cruise:	625	Cabin Dimensions (m):	
Takeoff/Landing Speed:	INA	Floor Length:	24
Max “G” Force (g):	INA	Width:	3.2
Ceiling (m):		Height:	2
Service (clean):	10,000	Standard Payload (kg):	
Operating Altitude:	8,000-10,000	Internal:	13,500
Vertical Climb Rate (m/s):	INA	Troops:	122
Dimensions (m):		ELINT Operators:	20
Length:	23.8	Survivability/Countermeasures:	None

Wingspan:	29.2	ARMAMENT:	None
Height:	8.6	AVIONICS/SENSOR/OPTICS	
Cabin Dimensions (m):		Flight avionics:	Yes
Length:	11.5		

NOTES

APPEARANCE: WINGS: LOW-MOUNTED AND TAPERED WITH BLUNT TIPS. ENGINES: FOUR MOUNTED ON WINGS AND EXTENDING FORWARD. FUSELAGE: ROUND, CIGAR-SHAPED, TAPERED AT REAR WITH ROUNDED NOSE. TAIL: TAPERED WITH SQUARE TIP, FUSELAGE-MOUNTED, TAPERED FLATS

VARIANTS

THIS AIRCRAFT WAS ORIGINALLY DESIGNED AS A CIVILIAN TRANSPORT AIRCRAFT, BUT HAS BEEN ADAPTED FOR MILITARY USES.

IL-18D: HAS A CENTER FUEL TANK FOR LONGER FLIGHT DURATION AND EXTENDED RANGE.

IL-18E: VARIANT WITHOUT CENTER FUEL TANK.

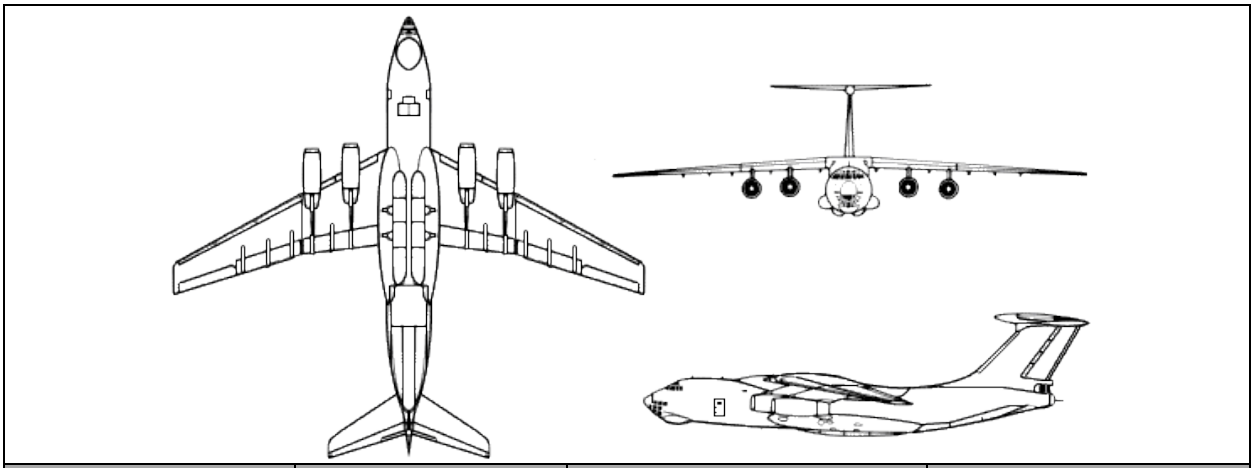
IL-20/COOT A: UNARMED STRATEGIC ELECTRONIC INTELLIGENCE/ RECONNAISSANCE AND SURVEILLANCE AIRCRAFT. THE AIRFRAME IS ESSENTIALLY THE SAME AS THE IL-18D, BUT A CYLINDER CONTAINING A POSSIBLE SIDE-LOOKING AIRBORNE RADAR IS MOUNTED UNDER THE FUSELAGE FORWARD OF THE WING. SMALLER CONTAINERS ON THE FORWARD SIDES OF THE FUSELAGE HOUSES POSSIBLE CAMERAS AND SENSORS. MANY SMALL ANTENNAS ARE LOCATED UNDER THE FUSELAGE.

IL-20M: VERSION WITH A SIDE-LOOKING AIRBORNE RADAR (SLAR), A-87P LOROP CAMERAS, AND A ROMB 4 SIGINT SYSTEM.

IL-22M/COOT B: AN AIRBORNE COMMAND POST VARIANT OF THE IL-18D AIRFRAME.

COOT-C: LATER ELINT PLATFORM

RUSSIAN CARGO/TRANSPORT AIRCRAFT IL-76/CANDID



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
SYSTEM		Dimensions (m):	
Alternative Designations:		Length:	46.6
Date of Introduction:	1975	Wingspan:	50.5
Proliferation:	> 12 countries	Height:	14.8
Description:	(Il-76MD)	Hatch:	(m)
Crew (2x pilots, 1x navigator, 1x radio operator, 1x flight engineer):	5	Height:	3.4
Engines 26,455 lbs. thrust Rybinsk D-30KP II turbofan with thrust reversers:	4	Width:	3.5
Weight (kg):		Cargo Hold (m):	
Empty:	89,000	Length to Ramp:	20.0
Takeoff:		Length with Ramp:	24.5
General Max:	190,000	Width:	3.5
Allowable Max:	210,000	Height:	3.4
Unprepared Runway Max:	157,500	Standard Payload (kg):	
Speed (km/h):		Internal:	47,000
Max:	919	Troops:	140
Cruise:	780	Paratroops:	125
Ceiling (m):	10,500	Survivability/Countermeasures:	
Fuel (liters):		Entire aircraft pressurized:	Yes
Internal 12 tanks:	109,480	Crew emergency escape hatch forward of main entry door:	Yes
External:	None	Flares for illuminating landing area:	Yes
Range (km):		Radar warning receiver:	Yes
Length:	23.8	Electronic jammers:	Yes
Wingspan:	29.2	Chaff and flares:	Yes
Height:	8.6	ARMAMENT:	

Cabin Dimensions (m):		GSh-23L twin-barreled cannon in tail turret:	Yes
Length:	11.5	AVIONICS/SENSOR/OPTICS:	
Max Load:	3,800	Standard flight controls:	Yes
Normal Load:	4,760	Weather radar in nose:	Yes
Max Fuel:	7,800	navigation and ground mapping radar in radome:	Yes
Small Load (20,000) Payload kg:	7,300	Night/Weather Capabilities:	Yes
Takeoff Run/Landing Roll (m):	1,700/900-1,000		

NOTES

APPEARANCE: WINGS: HIGH-MOUNTED, SWEPT-BACK, AND TAPERED WITH BLUNT TIPS. TRAILING EDGE HAS A SLIGHT CRESCENT SHAPE. ENGINES: FOUR MOUNTED PYLONS UNDER AND EXTENDING FORWARD OF WINGS' LEADING EDGE. FUSELAGE: LONG, ROUND AND TAPERING TO THE REAR, ROUNDED NOSE WITH CHIN RADOME. TAIL: T-TAIL WITH CURVED LEADING EDGE AND INSET RUDDER. SWEPT TAIL PLANES MEET AT TOP OF THE TAIL.

VARIANTS

IL-76 CANDID-A: FIRST PRODUCTION MODEL.

IL-76M CANDID-B: ADDED REAR TURRET WITH TWO 23-MM NR-23 GUNS AND SMALL ECM FAIRINGS EACH SIDE OF NAVIGATOR'S WINDOWS.

IL-76MD CANDID-B: MILITARY VERSION OF IL-76T. T STANDS FOR TRANSPORT; D STANDS FOR LONG-RANGE.

IL-76MF: MILITARY VARIANT WITH STRETCHED FUSELAGE AND MORE POWERFUL ENGINE.

IL-76MF-100: A DERIVATIVE OF THE IL-76M WITH CFM56-5C TURBOFANS. RANGE INCREASED TO 7,000 KM WITH 40,000 KG LOAD.

IL-76PP: ELECTRONIC COUNTERMEASURES AIRCRAFT

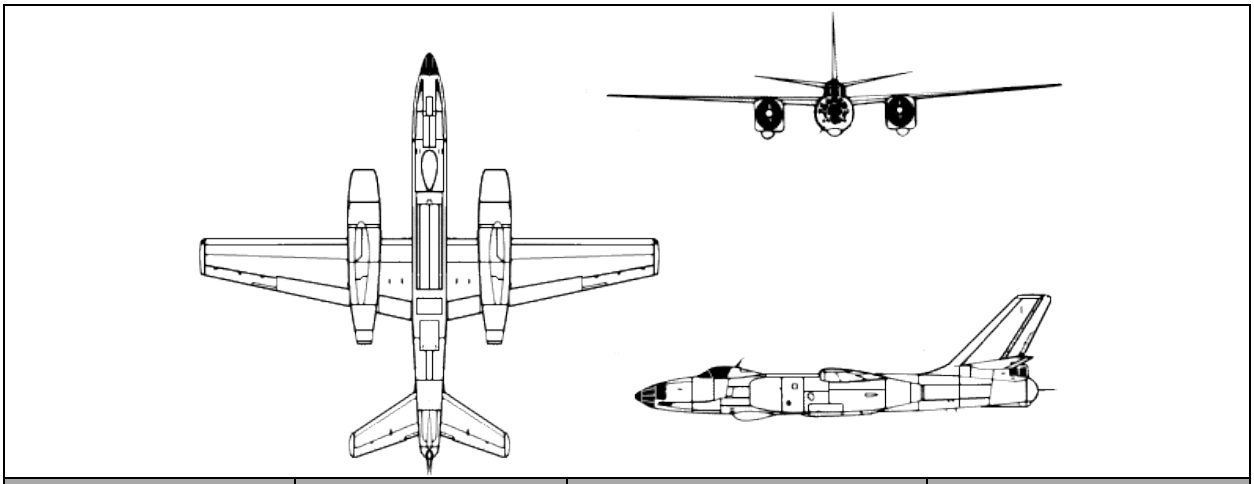
IL-76PS/IL-84: SEARCH AND RESCUE CAPABLE OF 3-HOUR PATROL WITH RADIUS OF 3,000 KM.

IL-76VPK/IL-82 AIRBORNE COMMAND POST: VARIANT OF IL-76MD. FITTED WITH SPECIALIZED COMMUNICATIONS EQUIPMENT.

A-50/MAINSTAY: AWACS VERSION.

MIDAS: AERIAL TANKER VERSION.

CHINESE LIGHT BOMBER AIRCRAFT H-5 AND RUSSIAN/CZECH IL-28/BEAGLE



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
SYSTEM		Speed (km/h):	
Alternative Designations:	Hongzhaji-5 H-5 is a Chinese adaptation of the IL-28.	Max:	900
Date of Introduction:	1966, 1950 for Il-28	Cruise:	769
Proliferation:	> 24 countries	Ceiling (m):	12,500
Description:		Vertical Climb Rate (m/s):	15
Crew (pilot, navigator/bombardier, radio operator/gunner):	3	Fuel (liters):	7,908
Engines 5,952 lbs. thrust Wopen-5 turbojets:	2	Range (km) empty:	3,550
Weight (kg):		Combat Radius (w/max payload):	1,100
Max Takeoff:	21,200	Takeoff Run/Landing Roll (m):	980/930
Empty:	12,890	Dimensions (m):	
General Max:	190,000	Length:	17.6
Allowable Max:	210,000	Wingspan:	21.5
Unprepared Runway Max:	157,500	Height:	6.7
Speed (km/h):		Weapons load (kg):	
Max:	919	Max:	3,000
Cruise:	780	Normal:	1,000
Ceiling (m):	10,500	Survivability/Countermeasures::	
Fuel (liters):		Pilot and navigator ejection seats:	Yes
Internal 12 tanks:	109,480	Gunner/radio operator has escape hatch:	Yes
External:	None	ARMAMENT:	
Range (km):		23-mm NR-23 cannons :	4
Length:	23.8	2 fixed in nose (rnds):	100
Wingspan:	29.2	Tail position (rnds):	250

Height:	8.6	Bombs:	
Cabin Dimensions (m):		Bombs or torpedoes in internal weapons bay (kg):	3,000
Length:	11.5	500 kg bombs:	Option
Max Load:	3,800	53 VA torpedoes:	Option
Normal Load:	4,760	250 kg bombs:	Option
Max Fuel:	7,800	single 3,000 kg bomb:	Option
Small Load (20,000) Payload kg:	7,300	AVIONICS/SENSOR/OPTICS:	
Takeoff Run/Landing Roll (m):	1,700/900-1,000	Standard flight controls:	Yes
		Navigation and ground mapping radar in radome:	Yes
		Night/Weather Capabilities:	Yes

NOTES

THE TWIN-ENGINE LIGHT BOMBER IS ALSO USED AS A MARITIME STRIKE AND TRAINER AIRCRAFT.

APPEARANCE: WINGS: SHOULDER-MOUNTED WELL AFT ON FUSELAGE.

VARIANTS

CHINESE VARIANTS INCLUDE THE FOLLOWING.

H-5: BASIC BOMBER VERSION.

HJ-5: TRAINER VERSION.

HZ-5: RECONNAISSANCE VERSION.

RUSSIAN VARIANTS INCLUDE THE FOLLOWING.

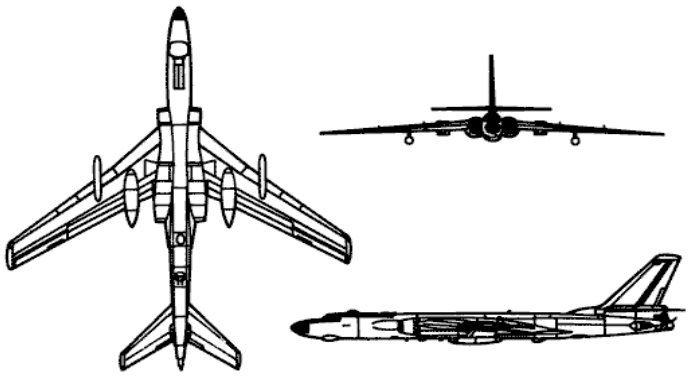
IL-28R: PHOTO-RECONNAISSANCE VARIANT

IL-28RTR: RADAR RECON (ELINT) VARIANT

AN ECM VERSION WAS ALSO DEVELOPED.

IL-46: SAME DESIGN BUT TWICE AS LARGE.

CHINESE MEDIUM BOMBER H-6 (HONGZHAJI-6)



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types	Combat Load	Ceiling (m):	12,000
Type 23-1 30-mm Cannon:		Vertical Climb Rate (m/s):	19
Other Loading Options:		Fuel (kg):	
C502 ASMs externally (no internal):	2	Internal:	33,000
500kg Bombs:	12	External Underwing tanks (ea.):	2
1000kg Bombs internally:	6	Range (km):	
10 kt to 3 Mt (nuclear Bombs):	1 - 3	Maximum:	4,300
SYSTEM		Combat Radius:	1,800
Alternative Designations:	Hong-6, NOTES	Endurance hh:mm:	5:41
Date of Introduction:	1968	Dimensions (m):	
Proliferation:	Only China	Length:	34.8
Description:		Wingspan:	34.2
SYSTEM		Height (gear extended):	10.4
Alternative Designations:	Hong-6, NOTES	Internal Payload (kg):	
Date of Introduction:	1968	Normal:	3,000
Proliferation:	Only China	Maximum:	9,000
Description:		Survivability/Countermeasures:	
Crew:	2 pilots	Defensive electronic countermeasures system:	Yes
Navigator/bombardier:	1	Type 23-1 30-mm Cannon (ea.):	6
Tail gunner:	1	Twin-gun tail turret:	1
Observer positions in rear fuselage:	2	Twin remote controlled ventral/dorsal barbettes:	2
Engines 20,944 lbs. thrust Xian Wopen-8 turbojets:	2	AVIONICS/SENSOR/OPTICS:	
Weight (kg):		Automatic navigation system with Doppler and INS inputs:	Yes
Maximum Takeoff:	75,800	Offensive navigation/attack radar. RWR:	Yes
Empty:	38,530	Night/Weather Capabilities:	Poor
Speed (km/h):			

Maximum Clean Speed at 6,000 m:	992		
Max Cruise w/2 x C-601 ALCMs:	786		
Takeoff/Landing Speed:	302/233		
Max "G" Force (g):	+6.5		

NOTES

THE H-6 IS A CHINESE ADAPTATION OF THE FORMER SOVIET TU-16/BADGER MEDIUM BOMBER. IT IS USED FOR AIR-LAUNCHED CRUISE MISSILES AS WELL AS CONVENTIONAL AND NUCLEAR BOMB DELIVERY. IT CAN ALSO BE USED AS A NAVAL ANTI-SHIPPING STRIKE AIRCRAFT. IT HAS GONE THROUGH SEVERAL VARIANTS SINCE ITS INTRODUCTION IN THE 1950S. THE MOST CURRENT VERSION IS THE CHINESE NAVY'S H-6D IV.

APPEARANCE: WINGS: MID-MOUNTED, SWEPT-BACK, AND TAPERED WITH BLUNT TIPS. ENGINES: TWO TURBOJETS MOUNTED IN WING ROOTS, WHICH EXTEND BEYOND THE LEADING AND TRAILING EDGES OF THE WING ROOT. FUSELAGE: LONG, SLENDER AND BULGING WHERE ENGINES ARE MOUNTED AND TAPERED TO THE TAIL. TAIL: SWEPT-BACK, TAPERED FIN AND FLATS WITH BLUNT TIPS.

VARIANTS

H-6A I: PRODUCTION MODEL OF THE CHINESE REVERSE ENGINEERING OF THE TU-16 BADGER. EXPORT VERSION ARE DESIGNED B-6. NEARLY IDENTICAL TO THE ORIGINAL TU-16 BADGER, EXCEPT IT WAS POWERED BY XIAN WP8 TURBOJETS.

H-9A I/E: SECOND GENERATION OF THE H-6 BOMBER AND THE ONE USED BY THE CHINESE AIR FORCE. STARBOARD SIDE 23-MM NOSE CANNON WAS REMOVED AND IMPROVED ECM/ESM, BOMBING AND NAVIGATIONAL SYSTEMS WERE INSTALLED.

H-6B II, H-6C III: EQUIPPED WITH A DOPPLER RADAR, A NAVIGATION COMPUTER AND INERTIAL NAVIGATION EQUIPMENT.

H-6DU/H-6U TANKER: FIRST FLIGHT IN 1990. CARRIES TWO UNDERWING HOSE-AND-DROGUE PODS TO REFUEL TWO J-8DS SIMULTANEOUSLY.

H-6 ELECTRONIC WARFARE PLATFORM: MODELS HAVE BEEN SEEN. A LONG, CANOE-SHAPED RADOME ON THE LOWER FUSELAGE, AN EXTRA ANTENNA FAIRING ON THE TOP OF THE FUSELAGE AND A SOLID NOSECONE. COULD HOUSE A SIDE-LOOKING RADAR OR AIRCRAFT COULD SERVE IN AN ELINT OR OFFENSIVE ECM ROLE.

RUSSIAN LONG-RANGE BOMBER TU-22M3/BACKFIRE-C



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types		Maximum (sea level):	1,050, Mach 0.9
23-mm twin barrel gun (ea.):	1	Cruise:	800
Other Loading Options:		Takeoff/Landing Speed:	370/285
Missiles:	1 - 3	Max "G" Force (g):	+2.5
AS-4 Kitchen ASM:		Ceiling (m):	17,000
AS-17 Krypton ASM:		Fuel est. (liters):	16,500
AS-20 Kayak ASM:		Maximum Unrefueled Combat Radius (km):	4,000
AS-9 Kyle ARM:		Supersonic, hi-hi-hi, 12,000 kg weapons:	1,500 - 1,850
AS-16 Kickback short range attack:	6	Subsonic, lo-lo-lo, 12,000 kg weapons:	1,500 – 1,665
Bombs:	8	Subsonic, hi-hi-hi, max weapons:	2,200
3,000 kg:	2	Takeoff Run/Landing Roll (m):	2,000 – 2,100/1,200 – 1,300
1,500 kg:	8	Dimensions (m):	
500 kg:	42	Length:	42.4
250 kg:	69	Wingspan extended / swept:	34.3 / 23.4
100 kg:	69	Height:	10.8
Mines:		Standard Payload Max (kg):	24,000
1,500 kg:	8	External:	12,000
SYSTEM		Internal:	12,000
Alternative Designations:		ARMAMENT:	
Date of Introduction:	1974	23-mm 2x barrel NR-23 gun, in the tai:	Yes
Proliferation:	Russia and Ukraine	AVIONICS/SENSOR/OPTICS:	
Description:		Automatic high- and low-altitude preprogrammed flight control, with automatic approach:	Yes
Crew (pilot, copilot, navigator, defensive systems operator):	4	Secure SATCOM datalink receiver and comms:	Yes
Engines 50,000 lbs. thrust NK-25 turbofans:	2	Missile targeting and navigation radar:	Yes
Weight (kg):		Video camera to provide visual assistance for weapons aiming at high altitude:	Yes

Max Takeoff:	126,000	TV remote gun and bomb sights:	Yes
Empty:	49,500	PRS-3/Argon-2 ranging radar:	Yes
Speed (km/h):		PNA-D attack radar:	Yes
Maximum (at altitude):	2,327 Mach 2.05	Night/Weather Capabilities:	Good

NOTES

THE BACKFIRE IS A LONG-RANGE AIRCRAFT CAPABLE OF PERFORMING NUCLEAR AND CONVENTIONAL ATTACK, ANTI-SHIP, AND RECONNAISSANCE MISSIONS. ITS LOW-LEVEL PENETRATION FEATURES MAKE IT A MUCH MORE SURVIVABLE SYSTEM THAN ITS PREDECESSORS. CARRYING EITHER BOMBS OR AS-4/KITCHEN AIR-TO-SURFACE MISSILES, IT IS A VERSATILE STRIKE AIRCRAFT, BELIEVED TO BE INTENDED FOR THEATER ATTACK IN EUROPE AND ASIA, BUT ALSO POTENTIALLY CAPABLE OF MISSIONS AGAINST THE UNITED STATES. THE BACKFIRE CAN BE EQUIPPED WITH PROBES FOR IN-FLIGHT REFUELING, WHICH WOULD FURTHER INCREASE ITS RANGE AND FLEXIBILITY.

APPEARANCE: WINGS: LARGE FIXED GLOVE FOR VARIABLE-GEOMETRY SWEPT WINGS ENGINES: TURBOFANS FITTED SIDE-BY-SIDE IN THE AFT FUSELAGE: CIRCULAR FORWARD OF THE WINGS, CENTER FUSELAGE FLANKED BY RECTANGULAR ENGINE INTAKES. TAIL: ALL SWEPT TAIL SURFACES, WITH LARGE DORSAL FIN.

VARIANTS

TU-22M2 BACKFIRE-B: THE INITIAL PRODUCTION MODEL. A REFUELING PROBE CAN BE FITTED, HOWEVER MOST HAVE BEEN REMOVED. DEVELOPED FOR THE LONG-RANGE STRATEGIC BOMBING ROLE.

TU-22M2YE BACKFIRE-B: THIS VARIANT HAS THE NEW NK-55 ENGINES AND ADVANCED FLIGHT CONTROL SYSTEM. FLIGHT CHARACTERISTICS WERE NOT IMPROVED.

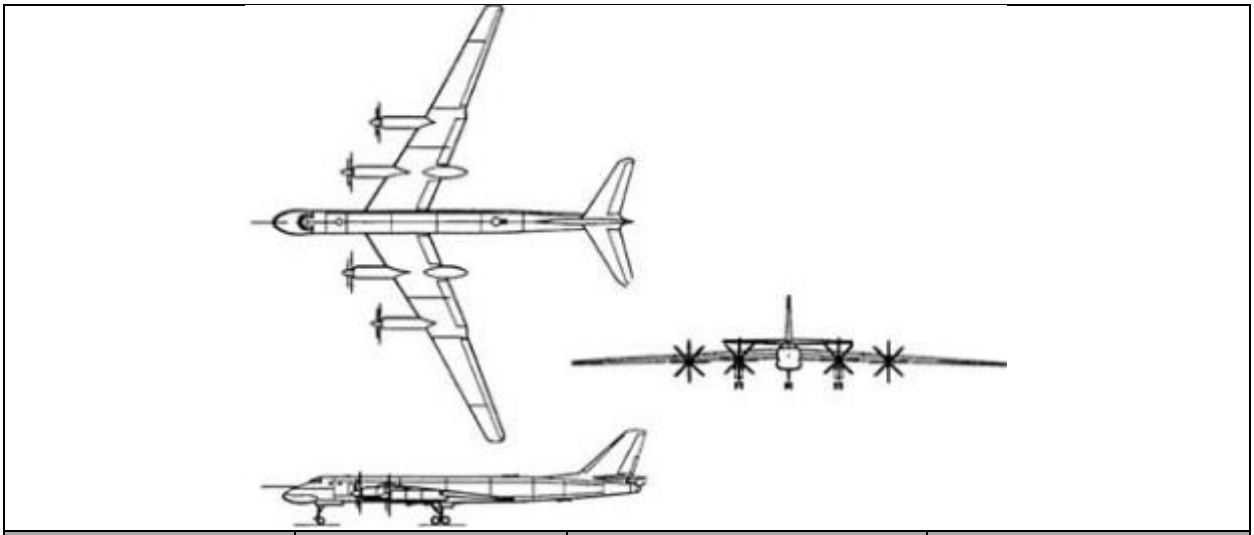
TU-22M3 BACKFIRE-C: UPGRADES RESULTED IN NEW RADAR, ENGINE INTAKES, AND ENGINES. THE AIRCRAFT HAS AN IMPROVED WEAPONS CAPABILITY, INCREASING THE BOMB AND CRUISE MISSILE PAYLOADS.

TU-22MR: 1985 RECON VARIANT WITH SHOMPOL SLAR AND ELINT EQUIPMENT.

TU-22MP: IW VARIANT, CURRENTLY UNFIELDED

FURTHER UPGRADES ARE EXPECTED FOR DELIVERY OF ADDITIONAL PRECISION MUNITIONS.

RUSSIAN LONG-RANGE BOMBER AIRCRAFT TU-95/BEAR



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Weapon & Ammunition Types		Max load:	6,500
twin-barrel 23-mm GSh-23 in tail turret (ea.):	1 - 2	One Refueling:	14,100
Other Loading Options:		Takeoff Run (m):	2,450
Missiles:	1 - 3	Dimensions (m):	
AS-4 Kitchen ALCM:	2	Length:	49.1
AS-15 Kent ALCM:	10	Wingspan:	50.0
SYSTEM		Height:	13.3
Alternative Designations:		Internal Payload (kg):	
Date of Introduction:	1959	Normal:	9,000
Proliferation:	India	Maximum:	20,000
Description:		MKU-6 Rotary Launcher:	
Crew (pilot, copilot, navigator/weapons officer, defensive system officer, flight engineer, tail gunner)r):	7	AS-15 Kent missiles:	6
Engines 15,000 eshp Kuznetsove NK-12MP turboprops (max) 9,870 eshp (cruise):	4	Survivability/Countermeasures::	
Weight (kg):		Ejection seats:	No
Maximum Takeoff:	185,000	Crewmember Conveyor in flight deck floor:	Yes
Maximum In-flight:	187,000	Astrodome in roof:	Yes
Maximum Landing:	135,000	ECM pods:	Yes
Empty:	94,400	Infrared warning system:	Yes
Speed (km/h):		Gun fire control radar:	Yes
Maximum (at altitude):	830	Ground Bouncer ECM jamming system:	Yes

Maximum (sea level):	550	Radar warning receiver:	Yes
Cruise:	735	Chaff and flares:	Yes
Takeoff/Landing Speed:	300/275	ARMAMENT:	
Max "G" Force (g):	+2	twin-barrel 23-mm GSh-23 in tail turret::	1 - 2
Ceiling (m):	10,500	AVIONICS/SENSOR/OPTICS:	Yes
Fuel (liters) Internal:	95,000	Short range navigation system:	Yes
Range (km):		Navigation/ bombing radar:	Yes
No Refueling (normal load):	10,500	Weather radar:	Yes
		Terrain-following radar:	Yes
		IFF:	Yes
		Thermal anti-icing:	Yes
		Night/Weather Capabilities::	Yes

NOTES

THE BEAR IS A LONG-RANGE STRATEGIC BOMBER, WITH VARIANTS IN NAVAL SERVICE IN RECONNAISSANCE, ANTI-SUBMARINE WARFARE, AND COMMUNICATIONS RELAY ROLES. IT IS THE ONLY TURBOPROP-PROPELLED STRATEGIC BOMBER IN OPERATIONAL SERVICE IN THE WORLD AND IS HIGHLY REGARDED BY ITS CREWS.

APPEARANCE: WINGS: SWEPT, HIGH-MOUNTED MID FUSELAGE. ENGINES: FOUR 8-BLADE TURBOPROP ENGINES IN SEPARATE WING NACELLES. FUSELAGE: SLENDER, CIRCULAR-SECTION, SEMI-MONOCOQUE FUSELAGE. TAIL: SWEPT FIN, WITH DORSAL FILLET AND INSET RUDDER. SWEPT TAIL PLANES MOUNTED AT BASE OF FIN

VARIANTS

TU-95/TU-95M BEAR-A STRATEGIC BOMBER: BASIC PRODUCTION VERSION. TU-95M HAD MORE POWERFUL AND FUEL-EFFICIENT ENGINES.

TU-95V BEAR-A NUCLEAR BOMBER: ONE AIRCRAFT MADE TO CARRY LARGE HYDROGEN BOMBS. BOMB WEIGHED 27,500 KG AND HAD 58 MEGATONS YIELD.

TU-95K/TU-95KD BEAR-B MISSILE CARRIER: RADOME AND ADDITIONAL 23-MM GUN IN NOSE, UNDER FUSELAGE FITTINGS FOR LARGE CRUISE MISSILE, AND ELINT EQUIPMENT. TU-95KD RECEIVED AN AIR REFUELING SYSTEM.

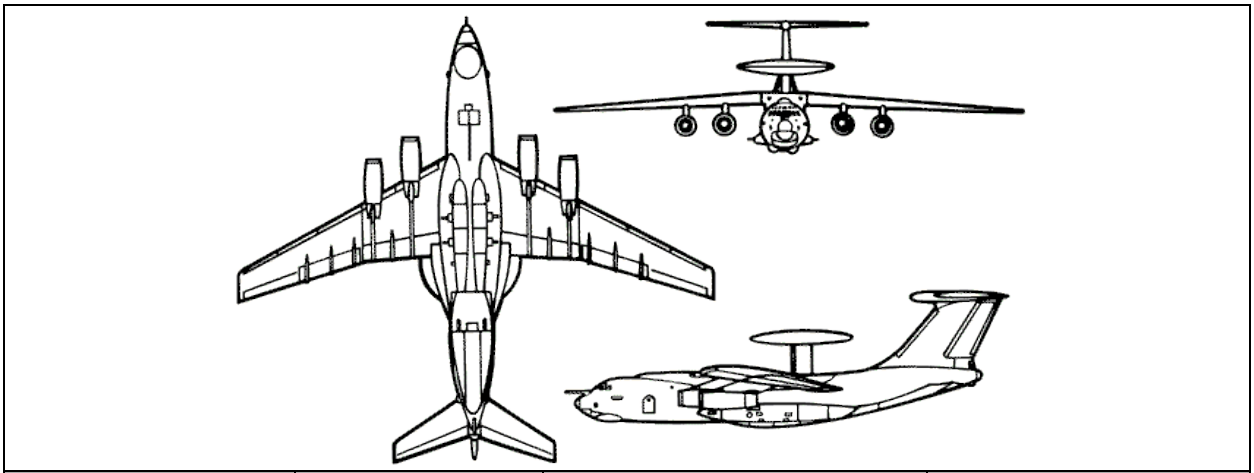
TU-95KM BEAR-C MISSILE CARRIER/ RECONNAISSANCE: SIMILAR TO BEAR-B, BUT WITH TWO ELINT SYSTEMS AND CROWN DRUM RADAR AND BOX TAIL TAIL-WARNING RADAR.

TU-95RT BEAR-D ELINT RECONNAISSANCE: NAVAL RECONNAISSANCE AND TARGETING VARIANT.

TU-95M BEAR-E PHOTO-RECONNAISSANCE: AIR FORCES PHOTO RECONNAISSANCE VERSION.

TU-95MS/TU-95MS6/TU-95MS16 BEAR-H BOMBER: CURRENT MAIN SERVICE VERSION; WITH TOADSTOOL TERRAIN FOLLOWING AND CLAM PIPE GROUND MAPPING, TARGET ACQUISITION RADAR. TU-95MS6 WAS FIRST TO CARRY MISSILES IN AN INTERNAL ROTARY LAUNCHER. TU-95MS16 ADDS UNDER FUSELAGE AND UNDER-WING PYLONS TO CARRY MORE MISSILES.

RUSSIAN AIRBORNE WARNING AND CONTROL SYSTEM AIRCRAFT
A-50E/MAINSTAY



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
SYSTEM		Cargo Hold(m):	
Alternative Designations:	See Variants	Length to ramp:	20.0
Date of Introduction:	1987 original	Length including ramp:	24.5
Proliferation:	6	Width:	3.4
Description:		Height:	3.5
Crew:	5	Standard Payload (kg):	
Pilots:	2	Internal (M / MD):	40,000 / 48,000
Flight Crew:	3	Endurance with internal fuel and maximum payload hh:mm:	4:00
Mission Operators:	10	Survivability/Countermeasures:	
SYSTEM		IFF:	Yes
Engines 26,455 lbs. thrust Soloview D-30KP turbofans:	4	Wingtip countermeasures pod:	Yes
Weight (kg):		Flare pack each side of rear fuselage:	Yes
Max takeoff:	170,000 (Il-76M), 190,000 (Il-76MD)	IR warning receiver:	Yes
Empty:	61,000	ARMAMENT:	Yes
Speed (km/h):		TV remote gun and bomb sights:	Yes
Max:	850	PRS-3/Argon-2 ranging radar:	Yes
Cruise:	750 - 800	PNA-D attack radar:	Yes
Description:		Night/Weather Capabilities:	Good
Crew (pilot, copilot, navigator, defensive systems operator):	4	23-mm cannons fitted in a manned position at the base of the rudder (ea.):	2
Engines 50,000 lbs. thrust NK-25 turbofans:	2	AVIONICS/SENSOR/OPTICS	
Weight (kg):		Description (A-50E):	Yes
Max Takeoff:	126,000	Color CRT displays for radar observers:	Yes

Empty:	49,500	Satellite data link to ground stations:	Yes
Speed (km/h):		Weather radar in nose:	Yes
Maximum (at altitude):	2,327 Mach 2.05	Ground-mapping and navigation radar under nose:	Yes
Ceiling (m):	15,500	Signal detection radar:	50-500 MHZ
Fuel (liters):		Electronic Intel radar:	.5-18 GHZ
Internal:	81,830	Ground Target Detect Range:	Single Target:
Range (km):		Target Node:	250 km (tanks, etc.)
Max Payload:	5,000	Ship-size Target:	400 km
Max Fuel:	6,700	Air Target Tracking Range:	
Takeoff Run/Landing Roll (m):	850/450	Bombers:	650 km
Dimensions (m):		MiG- 21Target size:	230 km
Length:	46.6	Low-Flyers:	To radio horizon
Wingspan:	50.6		
Height:	14.8		

NOTES

MAINSTAY IS INTENDED TO DETECT AND IDENTIFY AIRBORNE OBJECTS, DETERMINE THEIR COORDINATES AND FLIGHT PATH DATA AND TRANSFER THE INFORMATION TO AIR DEFENSE CPS AND ACTS AS A CONTROL CENTER TO GUIDE FIGHTER-INTERCEPTORS. IT ALSO DETECTS GROUND AND SEA TARGETS AND GUIDES TACTICAL AIRCRAFT TO COMBAT AREAS TO ATTACK GROUND TARGETS AT LOW ALTITUDES. THE 10 MISSION OPERATORS CAN TRACK 50 TARGETS AND GUIDE INTERCEPTION OF 10 SIMULTANEOUSLY.

CAPABILITIES (A-50E): DETECTING AND TRACKING AIRCRAFT AND CRUISE MISSILES FLYING AT LOW ALTITUDE OVER LAND AND WATER, AND OF HELPING DIRECT FIGHTER OPERATIONS OVER COMBAT AREAS AS WELL AS ENHANCING AIR SURVEILLANCE AND DEFENSE.

APPEARANCE:

WINGS: HIGH-MOUNTED, SWEPT-BACK, AND TAPERED WITH BLUNT TIPS. TRAILING EDGE HAS A SLIGHT CRESCENT SHAPE. CHASSIS: IL-76/CANDID TRANSPORT. ENGINES: FOUR MOUNTED PYLONS UNDER AND EXTENDING FORWARD OF WINGS' LEADING EDGE. FUSELAGE: LONG, ROUND AND TAPERING TO THE REAR, ROUNDED NOSE WITH CHIN RADOME. LARGE ROTATING RADOME ABOVE THE FUSELAGE. TAIL: T-TAIL WITH CURVED LEADING EDGE AND INSET RUDDER. SWEPT TAIL PLANES MEET AT TOP OF THE TAIL.

VARIANTS

EARLIER VERSIONS INCLUDED A-50 WITH SHMEL RADAR. THE A-50U/MAINSTAY B HAS A SHMEL-M RADAR VARIANT.

A-50M: VARIANT HAS SHMEL-2 RADAR, RESISTS MOST CM, SIMILAR TO US AN/APY-1/-2.

A-50E: HAS BEEN EXPORTED. AN ISRAELI MODIFIED VARIANT WITH NEW ENGINES AND PHALCON RADAR WILL BE EXPORTED TO INDIA.

SWEDEN AIRBORNE ECM/EW POD, SAAB BOQ X-300 (ON JAS39/GRIPEN)



SYSTEM	SPECIFICATIONS	PERFORMANCE	SPECIFICATIONS
Alternative Designations:	None	Intern Range (km):	
Date of Introduction:	1997	Combat Radius:	800
Proliferation:	Sweden (Hungary and South Africa – planned)	Ferry:	3,000
Description:		Takeoff Run/Landing Roll (m)	800/800al:
Crew:	1 (pilot) (JAS 39A/C), 2 pilots (JAS 39B/D)	External:	3,300.
Appearance:		Dimensions (m):	
Wings:	Multi-sparred delta.	Length:	14.1 (A/C), 14.8 (B/D)
Engines:	Turbofan with intake boxes on both	Wingspan (m):	8.4
Sides of fuselage.		Height:	4.5
Tail:	Leading edge swept fin with upright inset rudder.	BOQ-X300 ECM/EW POD.	
Engines:	1 x 12,140 lbs. thrust Volvo Aero RM12, 18,200 lbs. thrust with afterburner	Alternative Designations:	None
Weight (kg):		DATE OF INTRODUCTION:	2012
Takeoff:	12,500 (A/C), 14,000 (B/D)	PROLIFERATION:	Sweden
Empty:	6.500 (A/C), 7,100 (B/D)	COUNTRY OF ORIGIN:	Sweden
Speed (km/h):		FREQ. BANDS:	S/C/X/Ku/K
Maximum (at altitude):	2,150, Mach 1.8+	FREQ. RANGE (MHz):	2-40,000
Max “G” Force (g):	+9/-3 g	RANGE:	INA
Ceiling (m):	16,000	POWER OUTPUT:	INA
Fuel (liters):		TYPE:	Airborne ECM, radar jamming system.

NOTES

THE BOQ-X300 HIGH-PERFORMANCE JAMMING POD IS THE LATEST POD BEING DEVELOPED BY SAAB FOR THE GRIPEN FIGHTER. THE POD IS A MODULAR SYSTEM THAT INTEGRATES A SOPHISTICATED JAMMER, SUPPORTED BY A RWR AND ESM SYSTEM. AS AN OPTION, THE POD CAN BE CONFIGURED WITH A DUAL FIBER OPTIC TOWED DECOY TO PROVIDE EFFECTIVE COUNTERMEASURES AGAINST MONOPULSE THREAT. THE BOQ-X300 PROVIDES SELF-PROTECTION FOR HIGH

VALUE ASSETS SUCH AS FIGHTER, ATTACK AND RECONNAISSANCE AIRCRAFT. THE POD IS DESIGNED TO SUPPRESS LEGACY THREATS, SURFACE BASED AS WELL AS AIRBORNE. A SECONDARY ROLE FOR THE BOQ-X300 IS TO PROVIDE JAMMING FOR TRAINING OF RADAR OPERATORS IN AIRBORNE AS WELL AS GROUND- OR SEA-BASED ENVIRONMENTS.

Dec
2016

Worldwide Equipment Guide

Chapter 3: Unmanned Aerial Vehicles



TRADOC G-2 ACE–Threats Integration
Ft. Leavenworth, KS

Distribution Statement: Approved for public release; distribution is unlimited.

Chapter 3: Unmanned Aerial Vehicles and Related Technologies

An aviation technology which has seen the greatest expansion of research, development, and fielding activity in recent years is the unmanned aerial vehicle (UAV). According to a 2015 research report by the Rand Corporation there are 960 UAVs being produced by 270 companies in 57 countries. They also claim that in the past two years the number of UAVs has gone up 40% with the number of UAV companies entering the market increasing by 20% and the number of countries involved up by 50%. Another market study from the Teal Group in 2014 estimated UAV spending will nearly double over the next decade from current worldwide UAV expenditures of $6.4 billion annually to $11.5 billion, totaling almost $91 billion in the next ten years.

Despite defense budget cutbacks, UAVs are projected to see steady growth as users continue to seek their versatility, robustness, and feasibility. Reasons for expanding the use of these systems are their capabilities to extend our vision and reach over any terrain, against any force, with fewer restrictions, dangers, and support requirements as opposed to manned systems. Since they are unmanned they can go into areas where risk to crews might hinder a mission. Uses for UAVs have also expanded beyond their initial RISTA mission, to include, security patrolling, delivery of information warfare (INFOWAR) systems (e.g., jammers), communications retransmission, attack, counter-air harassment of enemy aircraft, and remote materials delivery. Advances in lightweight materials, imagery systems, and navigation technologies, particularly commercial, have lowered costs and facilitated these changes.

This chapter provides characteristics of selected UAVs in use or readily available to the OPFOR. UAVs discussed are those likely to be encountered by U.S. forces in various environments and levels of conflict, or are representative of the range of systems fielded and available. The selection of UAVs is not intended to be all-inclusive.

UAVs come in various types, sizes, and levels of complexity, each having their own purpose and advantage in an operational environment. For example, fixed-wing, propeller-driven platforms excel in endurance and range. Jet-propelled UAVs trade endurance and maneuverability for speed. Rotary-wing UAVs can carry relatively large payloads, offer the best maneuverability, and trade higher initial cost for long-term reliability and reduced casualty rates.

A UAV is a system comprised of self-propulsion, maneuver capability, and guidance. Current UAV sizes range from large high-altitude long endurance (HALE) aircraft, to mini-UAVs (MUAVs), which can now mount a stabilized gimbaled payload with multiple sensors. A rapidly expanding trend is the proliferation of MUAVs and micro-aerial vehicles (MAVs) for use at the lower tactical levels as well as civilian applications. The MAVs are normally hand launched, hard to detect, easy to use, and relatively inexpensive to purchase.

Among the most critical considerations for selecting UAVs are their operating range, operating altitude, and endurance (e.g. flight time). Tactical and operational systems must be reusable so the operating radius is critical. UAVs must at least range beyond the longest weapon range to provide warning time. Those not directly supporting weapons must have more range and time to observe larger areas. Usually,

fixed-wing systems are better suited for covering wide areas and rotary-wing for supporting tactical weapons and operating in defilade areas.

Diverse transport and launch configurations are available for UAVs. Israeli helicopters have carried Skylite A UAVs in ATGM racks, and launched them to survey areas where there may be some risk. The Skylite A can also be canister-mounted to fit on vehicles for launch at short halts, or launch from mortars. Another likely mini-UAV launch platform in the near-term (1-5 years) are airships (e.g. powered blimps and air defense aerostat balloons). Naval ships are using UAVs; and submarines have demonstrated their use while operating at periscope depth.

Several terms have recently been used to categorize UAVs and other unmanned aerial surveillance systems. However, the terms listed below should be understood to avoid confusion.

- The acronym, UAS, is currently used in some U.S. communities, with different meanings, but usually as unmanned aerial sensors, to emphasize the wide range of UAV designs available for U.S. force requirements, with a focus on RISTA applications.
- For some users, unmanned aerial sensors is an umbrella term which can include UAVs (vehicles both guided and self-propelled), as well as related technologies (e.g. unmanned aerial sensors other than UAVs). Thus, related technologies include remotely launched sensor munitions, with still cameras or video-cameras which sense and emit while in their trajectory. Another related technology are airships, such as balloons, with sensor pods mounted on them. The majority of airships are aerostats tethered to fixed sites or to vehicles, for long-term (days) or short-term (minutes) operations while others can be propelled. The above UAS terms are primarily used as sensors, but can be used in other roles such as air to surface attacks with guided missiles. Thus the term UAS is still misleading.
- Some organizations also use UAS to mean unmanned aerial systems, or unmanned aircraft systems. Selected sources have used one of these meanings as well as the one above the same paragraph, for the same system. Each meaning can exclude some aspect of the other or include one beyond the other. An aerial sensor may not be an aircraft, and an aerial system may have roles beyond that of a sensor. The OPFOR community should be wary of confusion between these two very different meanings for the same acronym.
- Because of the potential confusion with the acronym UAS, the OPFOR will avoid it. The WEG will use descriptions of specific technologies, such as UAVs, airships, etc., and generically precise categories like weapon-delivered aerial sensor munitions.

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Mini-UAVs and Micro-UAVs for Use in Military Forces

On the modern three-dimensional battlefield, military forces are developing missions for UAVs at all echelons and in many branches, for combat and supporting units. Tactical UAVs can be supplemented with lighter shorter-range UAVs at battalion and below. Air defense, anti-tank, artillery, theater missile, and other units with stationary facilities requiring security patrols can use these UAVs to execute the mission while reducing personnel and vehicle requirements.

System categories and descriptions can be vague and even contradictory. Producers, users, and publications use varied categorizations. For example, UAVs may be termed small UAV, short-range UAVs. International terms gaining the most use are mini-UAV (MUAV) and micro-aerial vehicles (MAVs). MUAVs are typically less than 25 kg and MAVs are typically less than 5 kg in weight. As UAVs have decreased in size, weight categorizations have also decreased.

Currently many MUAVs and the majority of MAVs are easily damaged. They must be low in cost and treated as disposable. A few, however, (e.g. rotary craft like the Russian Zala 421-12) offer stable flight control and designs with good survivability. The Zala 421-12 is used with security forces. Virtually all use electric motors for near silent operation and low heat signatures at altitudes of 300 meters or less. Initial costs, repairs and maintenance are factors. They must be integrated into communications schemes and air space restrictions. Some training is required. Nevertheless, as in the commercial sector, the military sector has found a growing need for them. Paramilitary and special-purpose forces use these and other UAVs.

There is also growing interest in the development of MAVs. Key reasons for the interest include a widespread need for inexpensive aerial sensors to observe small areas rapidly. Commercial and scientific applications have resulted in an increase in development programs. Many are hand-size; but most conventional designs with front-mounted propeller have problems in control, wind stability, payload, range, and crash worthiness. Slightly larger sized hand-launched, vertical take-off and landing (VTOL) craft like the Zala 421-21, or MAVs close to the 5 kg limit offer better capability. Battery powered rotary-engine designs, especially multi-motors, have the most potential. The 6-rotor MAV 421-21 is stable with a 15 km range; GLONASS navigational feed, and notebook display.

Some Tier 1 forces have MUAVs in tactical battalions and companies. By the near term, forces will have MUAVs or MAVs in platoons. Squads and teams will carry MAVs or other aerial sensors (e.g., weapon-delivered sensors). By mid-term vehicles and dismounted squads and teams will have their own MAVs and small attack munitions will be fitted or optional. In addition to regular forces there is also a growing use by irregular forces to use these type of UAVs. Recent use by ISIS has shown that they use MAVs not only for surveillance but also for targeting and propaganda video footage. It is predicted that other irregular forces will use these inexpensive MAVs for similar purposes.

RUSSIAN MICRO UNMANNED AERIAL VEHICLE ZALA 421-08



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Date of Introduction: 2007	2007	Wind speed at launch:	15 m/s
Proliferation:	At least one country	Recovery Method:	Parachute or Auto Return
Ground Crew:	2, backpack	System Composition:	
Engine: Electric	Electric	Number of UAVs	(2 X) UAVs
Propulsion:	2-blade propeller	Number of transport cases	(2x) transport cases
Weight empty (kg):	1.7	Video roll-stabilized cameras	(2x) Video cameras
Max Takeoff Weight (kg):	1.9	Infrared Camera (optional)	(1X) IR Camera
Max Payload (kg):	2.55	Catapult (optional)	1
Max Speed (level)(km/hr):	150	PAYLOAD TYPES	SPECIFICATIONS
Cruise Speed (km/hr):	65-130	Color Camera	10 (MPX) stabilized video
Maximum Ceiling (m):	3,600 Above Sea Level	Infrared Camera	Resolution Not Less Than 160x120
Minimum Ceiling (m):	15	Gas Detection Module	Chemical/Hazardous Emission
Operating:	3,600	SYSTEM COMPONENTS	SPECIFICATIONS
Endurance (min):	60	Ground Control Station (GCS):	
RPV Mode Range (km):	10	Transport Case	Ruggedized and Man Portable
Pre-programmed Mode Range (km):	40	Control Capability	UAV and payload controlled independently by GCS
Wing Span (cm):	81		
Length (fuselage) (cm):	42.5	GCS Power Supply:	120/220 V, 6 hr battery
Height (cm):	25	Setup Time (min):	5-10 min.
Launch Method:	Hand Launched, Self-powered		

RUSSIAN MICRO UNMANNED AERIAL VEHICLE ZALA 421-12



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative designations:	421-4M	Launch Method:	Elastic or pneumatic catapult
Date of introduction:	2001	Wind speed at launch:	10 m/s
Proliferation:	At least one country	Recovery Method:	Parachute (non-steerable)
Ground Crew:	Two, backpack	Dimensions (cm):	
Engine:	Electric, battery powered	Wing Span:	81
Propulsion:	2-blade propeller	Length (fuselage):	42.5
Max Takeoff Weight (kg):	4.8	Height:	25
Max Payload (kg):	1	PAYLOAD TYPES	SPECIFICATIONS
Max Speed (level)(km/hr):	130	Photo camera	10 Mpx
Cruise Speed (km/hr):	65-120	Color Video Camera	550 TVL
Maximum Ceiling (m):	3,600 Above Sea Level	Infrared Camera	160X120 (Optional)
Minimum Ceiling (m):	15	Hazard Gas Analysis Module	Hazardous Gas (Optional)
Operating Ceiling (m):	100-700	SYSTEM COMPONENTS	SPECIFICATIONS
Endurance (min):	130	Number of UAVs	(2 X) UAVs
RPV Mode Range (km):	25	Number of transport cases	(2x) transport cases
Pre-programmed Mode Range (km):	40	Ground Control Station (GCS)	(1x) man-pack, ruggedized
		GCS Power Supply:	120/220 V, 6 hour battery
		Setup Time (min):	5-10 min.
		Control Capability	UAV and payload controlled independently by GCS
		Video roll-stabilized cameras	(2x) Video cameras
		Infrared Camera (optional)	(1X) IR Camera
		Setup Time (min):	5-10 min.
		Elastic or Pneumatic Launcher:	(1x) (optional)

NOTES

PAYLOADS FIT IN THE STANDARD MOUNTING BLOCK THAT IS INTERCHANGEABLE WITH OTHER PAYLOADS AND IS A DUAL AXIS, GYRO-STABILIZED PAYLOAD. GLONASS/GPS SATELLITE NAVIGATION WITH CAPABILITY OF AUTONOMOUS OPERATION.

RUSSIAN MICRO UNMANNED AERIAL VEHICLE ZALA 421-21



SYSTEM	SPECIFICATIONS	PAYLOAD TYPES	SPECIFICATIONS
Alternative designations:	None	Photo camera	Single frame photo (color)
Date of introduction:	2010	Color Video Camera	INA
Proliferation:	At least one country	Infrared Camera (Optional)	INA
Ground Crew:	Two, backpack		All imagery is real-time transfer to ground control
Engine:	Electric, battery powered		
Propulsion:	6-two blade propeller, Vertical Take-Off and Landing (VTOL)	SYSTEM COMPONENTS	SPECIFICATIONS
		Number of UAVs	(2 X) UAVs
Max Payload Takeoff weight (kg):	.5	Number of transport cases	(2x) transport cases
Speed (km/h):		Ground Control Station (GCS)	(1x) hand-held, ruggedized
Maximum (level):	40	GCS Power Supply:	Independent 6 hour battery
Ceiling, Operational (m):	10-1,000	Setup Time (min):	5-10 min.
Endurance (min):	130	Control Capability	UAV and payload controlled independently by GCS
Range (km):	15	Roll-stabilized cameras Infrared Camera (optional)	(2x) Video and photo camera (1X) IR Camera
Launch Method:	Hand Launched		
Wind speed at launch:	INA	Setup Time (min):	5-10 min.
Recovery Method:			
Dimensions (cm):	Two fixed, skid landing gear		
Wing Span:	INA, See picture for est. scale		
Length (fuselage):	INA		
Height:	INA		
Launcher:	(1x) (optional)		

NOTES

PAYLOADS FIT IN THE STANDARD MOUNTING BLOCK THAT IS INTERCHANGEABLE WITH OTHER PAYLOADS. MULTI-SINGLE PHOTO/VIDEO/IR CAMERA SENSOR PAYLOAD IN DEVELOPMENT. 12/220 VOLT EXTERNAL CONNECTION FOR OPTIONAL POWER SOURCE FOR THE GCS.

CHINESE COMMERCIAL OFF THE SHELF (COTS) MICRO UNMANNED AERIAL VEHICLE DJI- PHANTOM



SYSTEM	SPECIFICATIONS	Operating Temperature (F):	32-104
Alternative designations:	Phantom	Power CONUS (dBm):	20
Date of introduction:	2013	Weight (g):	365
Proliferation:	Global	PAYLOAD	SPECIFICATIONS
		Gimbal Stabilized:	Yes
Ground Crew:	1	Camera Mega Pixel (MP):	12.4
Propulsion:	4-two blade propeller Vertical Take-Off and Landing (VTOL) Electric	Camera Range Video (m):	100-3200
		Camera Range Still (m):	100-1600
		Photography Modes:	
		Single Shot:	Yes
Motor (V):	15.2	3 Burst:	Yes
Gross Takeoff Weight (kg):	1.28	5 Burst:	Yes
Speed:		7 Burst;	Yes
Maximum(km/h):	57	Time Lapse:	Yes
Max Ascent Speed (m/s):	5	Video Modes:	
Max Descent (m/s):	3	Ultra High Def:	Yes
Ceiling, max (m):	6,000	Full High Def:	Yes
Operational Ceiling (m):	300	High Def:	Yes
		Secure Digital Card Max (GB):	64
Default Ceiling from Takeoff Point (m):	120	Video Bitrate Max (Mbps):	60
		File Formats:	
Endurance (min):	23	FAT 32:	Yes
Range LOS CONUS (km):	5	exFAT:	Yes
Range LOS OCONUS (km):	3.5	Photo Format:	JPG, DNG
Launch Method:	Surface Launched	Video Format:	MP4, MOV
Launcher:	No		

Wind speed at launch:	**INA**	**MOBILE APPLICATION**	**SPECIFICATIONS**
GPS/ GLONASS Enabled:	**Yes/Yes**	**Name;**	**DJI Go**
Recovery Method:	**INA**	**EIRP (mW):**	**100**
Dimensions (cm):	**35**	**Third Party Applications:**	**Yes**
Height:	**INA**	**Live View Working Frequency (GHz):**	**24**
CONTROLLER	**SPECIFICATIONS**	**Latency (ms):**	**220**
Operating Frequency (GHz):	**2.400 – 2.483**	**Required Operating System:**	
Power CONUS (dBm):	**20**	**iOS 8.0 or later:**	**Yes**
Power OCONUS (dBm):	**16**	**Android 4.1.2 or later:**	**Yes**
Endurance (btry pwr):	**10%**		

NOTES:

DJI PHANTOM AND ASSOCIATED APPLICATIONS ARE COMPATIBLE WITH APPLE, SAMSUNG, GOOGLE, ASCEND, HUAWEI, NUBIA, SONY, AND MI WIRELESS DEVICES.

THERMAL IMAGING CAN BE ACHIEVED BY ADDING A SEPARATE CAMERA TO THE UAV PAYLOAD. THE INCREASE IN WEIGHT CAN BE OFFSET WITH MODIFICATIONS TO THE POWER SUPPLY.

ISRAELI MINI UNMANNED AERIAL VEHICLE SPYLITE/SKYLITE



SYSTEM	SPECIFICATIONS	PAYLOAD TYPES	SPECIFICATIONS
Alternative designations:	Skylite	Combined, triple axis, gimballed, gyro-stabilized sensor. Single sensor provides day/night optical zoom lens with auto-tracker, infrared dual field of lens with auto zoom, and laser pointer.	
Date of introduction:	2003		
Proliferation:	At least 4 countries		
Engine:	Electric, battery powered		
Propulsion:	two blade pusher propeller	PAYLOAD TYPES	SPECIFICATIONS
Max Takeoff weight (kg):	6.3-8.0	Survivability/countermeasures: Lightweight, composite structure. Small profile with low radar/IR signature and very quiet engine. Excellent flight dynamics for use in all climates and severe weather, with winds of up to 35 knots, and gusts of up to 55.	
Max Payload (kg):	1.3		
Total System (kg):	39		
Cruise Speed (km/h):	70-100		
Max Altitude (m):	10,972.8		
Ceiling, Operational (m):	10,972.8	SYSTEM COMPONENTS	SPECIFICATIONS
Endurance (hr):	4	Number of UAVs:	(2-3) UAVs
Range (km):	50	Number of transport cases	(2x) transport cases
Wing Span (cm):	240	Ground Control Station (GCS)	(1x) hand-held, ruggedized
Length (cm):	110	VARIANTS	
Body Width (cm):	25	SkyLite A: Briefly called SkyLark, the SkyLite A was a vehicle or shoulder canister launched UAV for use in tactical units. No longer in production.	
Launch Method:	4-kg catapult launch	SkyLite A: Briefly called SkyLark, the SkyLite A was a vehicle or shoulder canister launched UAV for use in tactical units. No longer in production. SkyLite B: Variant upgrade has improved cameras, larger wings, longer endurance, and 1.5-kg added weight. Launched by catapult.	
Recovery Method:	Combined parachute and inflatable bag	SkyLite A: Briefly called SkyLark, the SkyLite A was a vehicle or shoulder canister launched UAV for use in tactical units. No longer in production.	
		SkyLite B: Variant upgrade has improved cameras, larger wings, longer endurance, and 1.5-kg added weight. Launched by catapult.	

ISRAELI MINI UNMANNED AERIAL VEHICLE SKYLARK I, IV, LE



SYSTEM	SPECIFICATIONS	PAYLOAD TYPES	SPECIFICATIONS
Alternative designations:	None	Optical Camera:	Color CCD 10x zoom lens
Date of introduction:	2003	IR Camera:	Night FLIR
Proliferation:	10 Countries with deployment in Iraq and Afghanistan	User Image Capabilities:	All images can be overlaid on a downlinked integrated map
Ground Crew:	2, backpack (30-40 kg each)	Uplink:	Analog, encrypted, UHF
Engine:	Electric, battery powered	Downlink:	D/E-band telemetry/video
Propulsion:	Two blade propeller	VARIANTS	SPECIFICATIONS
Max Launch Weight (kg):	5.5	Skylark I LE (Long Endurance):	(column will only list changes)
Max Speed (level) (km/hr):	111	Weight (kg):	2.8
Cruising Speed (km/hr):	65	Engine:	Electric, battery powered
Endurance (min):	1 hr 30 min	Tail Wings:	Modified to accept engine
Max Ceiling, normal (m):	455	Wing Span (m):	2.9
Ceiling, Service (km):	5	Max Launch Weight (kg):	6.3
Radius of Operation (km):	10	Operational Ceiling (km):	4.9
Wing Span (m): 2.4	2.4	Radius of Operation (km):	15
Overall Length (m):	2.20	Endurance:	3 hrs
Flight Control:	GPS positioning, autonomous preprogrammed flight	PAYLOAD TYPES	SPECIFICATIONS
		Controp T-STAMP Sensor:	Miniature triple sensor:
Ground Control:	Handheld, Mini Ground Control Unit, color console	Optical:	Color CCD 10x zoom lens
		IR:	8-12 microns with x4 continuous optical zoom lens
Flight Control Method:	Sprectralink data link		
Launch Method:	Hand or bungee launched	Laser Pointer	high resolution panoramic scan mode
Recovery/Landing Method:	One button auto return, steep stall, inflatable cushion		
		VARIANTS	SPECIFICATIONS
		Skylark I LE Block II	(column will only list changes)
		Development:	
		Type of Engine:	hydrogen fuel cell propulsion
		Flight Endurance:	7 hours or greater
		Flight Endurance:	7 hours or greater

Weapon-Delivered Aerial Sensor Munitions

Several aerial imaging munitions have been developed for launch from weapon systems. They offer capability for real-time or near real-time overhead view of an enemy within or close to weapon range, even when the enemy may be concealed behind cover.

Weapon-delivered aerial sensor munitions were developed as early as the year 2000. However, they are not yet widely fielded, due to cost, difficulty of miniaturization, lack of portability, need for precise target location data, and lack of clear imagery. Advancements in image resolution, radio transmission and miniature servo-motor systems, now permit design of sensor and guided attack munitions for delivery by grenade launchers, mortars and rocket launchers. Linking the downloaded image or video to a digital transmission system can also permit it to be shared with other users. Because the sensor uses munition propulsion, it can reach the target area well before launch and employment of a UAV or MAV.

Several munitions are offered for under-barrel grenade launchers (UBGLs), and shoulder launchers users those grenades. The munitions offer overhead imagery for infantry squads and teams at lower cost than UAVs. Users can employ laptop or PDAs as terminals. Examples include the Israeli FireFly 40-mm UBGL round with a camera eye and parachute, to give a top-down view of features beyond line-of-sight 600 m away. The image footprint is approximately 1,200 m. Another, the Israeli Reconnaissance Rifle Grenade (RRG) is launched from a rifle barrel, provides 6-7 seconds of image, and also has 600 m range. The Singaporean S407/Soldier Parachute Aerial Reconnaissance Camera System (SPARCS) fits a 40-mm UBGL, with 300-600 m range (est.) and offers a real-time image to PDA or other display.

A Pakistani firm has developed the Firefly (not the same FireFly as above) hand-launched camera reconnaissance rocket. The pistol-styled launcher will direct a plastic rocket to a range of 800-1000 m in 8 sec, with a digital data link to a PDA. It is called a “mini-rocket UAV.”

A few countries are developing mortar reconnaissance projectiles for 81 mm and 120 mm mortars. These are likely by the end of the near term (5 years). One developer predicts reconnaissance projectiles for 60 mm mortars. Prototypes and programs for 155-mm cannon fired reconnaissance projectiles are also underway and likely due by the mid-term (5-10 years).

One system developed in the 1990s is the Russian R-90 UAV rocket for launch by the 9A152 300-mm multiple rocket launcher. It is actually part weapon delivered sensor, part RISTA UAV, and part attack UAV. It reaches 70-90 km in less than a minute. On arrival the 42 kg UAV ejects, then loiters for 30 minutes to execute target confirmation, adjust MRL fires, and perform battle damage assessment afterward. As the UAV reaches the end of its flight time, it can acquire a remaining target for an impact kill. The attack option presages an increasing trend for UAVs and sensor projectiles - offering direct attack and munition launch options.

ISRAELI TACTICAL UNMANNED AERIAL VEHICLE SKYLARK II, III



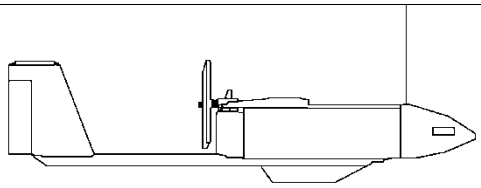
SYSTEM	SPECIFICATIONS	PAYLOAD TYPES	SPECIFICATIONS
Alternative designations:	None	Optical Camera:	HD Color CCD 10x zoom lens
Date of introduction:	2006	IR Camera:	Night FLIR thermal imaging
Proliferation:	At least 3 Countries	Laser:	Marker
Ground Crew:	2		Range Finder (optional)
Engine (hp):	5.4 hp, Electric, battery	User Image Capabilities:	All images can be overlaid on an integrated map
Propulsion:	Two blade propeller	VARIANTS	SPECIFICATIONS
Max Launch Weight (kg):	65	Skylark III:	(changes only)
Max Speed (level) (km/hr):	129	Alternative designations:	Skylark II LE
Cruising Speed (km/hr):	65	Weight (kg):	2.8
Endurance (hr):	5	Max Payload (kg)	10
Operating Altitude, (m):	150-1,525	Wings:	Curved wingtips
Ceiling, Service (m):	4,875	Wing Span (m):	4.8 mounted under fuselage
Radius of Operation (km):	60	Max Launch Weight (kg):	45
Wing Span (m): 2.4	6.5	Ceiling, Service (m):	4,600
Overall Length (m):	3.2	Max, Ceiling (km)	6.4
Ground Control:	Skylark dual station ground control, color console	Engine:	Electric, battery, rear mounted pusher engine
Launch Method:	Humvee class vehicle with mounted rail launcher, or can use optional rail launcher trailer	Endurance (hr):	6
		Launch Method:	Pneumatic launcher on Humvee class vehicle or launcher trailer
Recovery/Landing Method:	Parachute and airbag cushion	Recovery/Landing Method:	Parachute and airbag cushion
		Radius of Operation (km):	100

NOTES

SKYLARK II AND III ARE DESIGNED TO SUPPORT BRIGADE AND DIVISIONS. THEY ARE BASED ON THE SKYLARK IV BUT MUCH LARGER. THE GUIDANCE SYSTEM IS A STARLINK AIR TERMINAL WITH SECURE DIGITAL DATA LINKS, REDUNDANT AVIONICS, AND AUTONOMOUS FLIGHT MODES. THEY ARE INTEROPERABLE WITH OTHER SKYLARKS WITH REAL-TIME VIDEO TRANSFER RATE OF 1.5 MB PER SECOND, ENCRYPTED UHF UPLINK, D/E BAND DOWNLINK. TWO SKYLARK III VEHICLES CAN ALSO BE ASSIGNED THE SAME MISSION WHILE

SIMULTANEOUSLY USING A SHARED GROUND CONTROL STATION. FUSELAGE AND WINGS OF THE III MODEL HAS BEEN MODIFIED SIGNIFICANTLY TO INCREASE RANGE AND STABILITY. BOTH MODELS USE A TRIPLE SENSOR PAYLOAD THAT PROVIDES HIGH DEFINITION OPTICAL, THERMAL IMAGER, AND LASER CAPABILITIES.

FRENCH TACTICAL UNMANNED AERIAL VEHICLE FOX AT2



SYSTEM	SPECIFICATIONS	PAYLOAD TYPES	SPECIFICATIONS
Alternative designations:	None	Panoramic CCD color camera, low light television (with zoom), IR linescan CAMELIA camera, SAR camera, FLIR, multi-sensor gimbal platform (IR and visible), etc.	
Date of introduction:	1988		
Proliferation:	France and the U.N.		
Engine:	Limbach 22 hp L 275 E, 2 cylinder, 2 stroke, air-cooled		
Propulsion:	2 blade push propeller		
Take-off Weight (kg):	135		
Fuel and Payload (kg):	60		
Maximum (level)(km/h):	216	VARIANTS	SPECIFICATIONS
Cruising Speed (km/h):	145	Different versions are offered with varying ranges. The version selected for Tier 2 portrayal is the Fox AT2 (200), with 200km range.	
Endurance (hrs):	5		
Max Ceiling, normal (m):	3000		
Min Ceiling (m):	30		
RPV Mode Range (km):	50, 100, 150 (opt. 200)		
Program Mode Range (km):	350		
Wing Span (m):	4		
Overall Length (m):	2.75		
Overall Height (m):	0.25		
Flight Control:			
Launch Method:	Hydraulic or sandow ramp		
Recovery Method:	Parachute		
Landing Method:	Airbag		

NOTES

THE FOX AT2 UAV IS ONE OF A FAMILY OF LOW-COST UAVS DESIGNED BY THE FRENCH FIRM CAC SYSTEMES. EACH UAV SYSTEM IS COMPOSED OF A TRANSPORT AND LAUNCHING SYSTEM, A GROUND CONTROL STATION (GCS) MOUNTED ON A 4X4 TRUCK FRAME, AND FOUR UAVS. THE FOX AT2 (LIKE THE FOX AT1) IS LAUNCHED FROM A MOBILE LAUNCHING CATAPULT (TRANSPORTATION AND LAUNCHING SYSTEM) THAT IS MOUNTED ON A TRAILER WITH TRANSPORTATION COMPARTMENTS FOR 4 UAVS. NORMALLY TWO OF THE FOUR UAVS ARE EQUIPPED WITH CCD CAMERAS FOR DAYTIME MISSIONS AND THE REMAINING TWO ARE FLIR EQUIPPED FOR NIGHTTIME MISSIONS. UPON MISSION COMPLETION THE UAV CAN BE RE-SERVICED AND AVAILABLE FOR ANOTHER MISSION IN LESS THAN 30 MINUTES. THE FOX AT2 IS CAPABLE OF CARRYING 30 KILOGRAMS OF VARIOUS PAYLOADS. ADDITIONALLY, TWO UNDER-WING PODS ALLOW FOR TWO LOADS TO BE CARRIED AND DROPPED. NORMALLY THE GCS CONSIST OF A CREW OF THREE PERSONNEL: PILOT, OBSERVER, AND A TECHNICIAN. HOWEVER, TWO PEOPLE CAN DEPLOY THE UAV SYSTEM AND HAVE IT AVAILABLE FOR OPERATION IN LESS THAN 20 MINUTES. THE GUIDANCE AND CONTROL CONSISTS OF AN UHF DATA LINK WITH FOUR PROPORTIONAL AND EIGHT NUMERIC CHANNELS, OF WHICH FOUR CONTROL THE AUTOPILOT. TELEMETRY IS THROUGH A 12-CHANNEL DATA LINK.

IRANIAN TACTICAL UNMANNED AERIAL VEHICLE MOHADJER 4



SYSTEM	SPECIFICATIONS	PAYLOAD TYPES	SPECIFICATIONS
Alternative designations:	Mohajer, Hodhod, Shahin	Gimbal optical freeze frame or forward, fixed color and monochrome cameras. Latest versions can use both types at the same time with multichannel imager. Later versions have IR camera and digital processor to downlink sensor imagery.	
Date of introduction:	2003		
Proliferation:	at least 2 countries		
Engine:	50 hp Limbach L550, four-cylinder, two-stroke engine		
Propulsion:	pusher propeller	VARIANTS	
Max launch Weight (kg):	175	Mohadjer 4B: Revealed during a 2014 exhibition. Changes include: wings mounted mid-way, new landing skids, wider wings, improved engine cooling, forward fuselage changed for improved aerodynamics and expanded payload bays.	
Fuel and Payload (kg):		Armed Version: In 2014 a weaponized Mohadjer was shown with two QW-1 MANPADS. Primitive fire procedures. Operator uses the optics to line up the target and rely on the QW-1's IR system to acquire the target.	
Maximum (level)(km/h):	200		
Cruising Speed (km/h):			
Endurance (hrs):	3		
Max Ceiling, normal (m):	5400		
Min Ceiling (m):			
Range (km):	150		
Wing Span (m):	5.33		
Overall Length (m):	3.74		
Overall Height (m):			
Flight Control:	GPS, truck/trailer mounted system		
Launch Method:	Rail launch from PL3 Pneumatic Catapult		
Recovery Method:	Retractable landing skids on paved runway		
Landing Method:			

CHINESE MALE UNMANNED AERIAL VEHICLE (EW/ECM) ASN-207



SYSTEM	SPECIFICATIONS	PAYLOAD TYPES	SPECIFICATIONS
Alternative designations:	D-4	JN-1102 EW/ECM suite which can scan, intercept, analyze, monitor, and jam enemy ground to air communications at 20-500MHz. The system consists of a mounted intercept subsystem, mounted jamming subsystem, and a ground-based intercept and control subsystem.	
Date of introduction:	2002		
Proliferation:	At least 1 country		
Engine:	51 hp, 4 cylinder, 2 stroke		
Propulsion:	2 blade wooden push propeller		
Max Launch Weight (kg):	222		
Maximum (level)(km/h):	210	VARIANTS	SPECIFICATIONS
Cruising Speed (km/h):	150	ASN-206:	
Endurance (hrs):	6	An older version of the ASN-207, with less control range smaller payload capacity and shorter endurance	
Max Ceiling, normal (m):	5,000-6,000		
Ceiling, Service (m):	100		
Radius of Operation (km):			
Dimensions:			
Wing Span (m):	6		
Overall Length (m):	3.8		
Overall Height (m):	1.4		
Flight Control:			
Launch Method:	Solid rocket booster on a zero length launcher		
Recovery Method:	Parachute (non-steerable)		
Landing Method:	2 spring loaded skids		

NOTES

THE UAV IS LAUNCHED FROM A ZERO-LENGTH LAUNCHER USING A SOLID ROCKET BOOSTER THAT IS JETTISONED AFTER TAKE-OFF.

RUSSIA UNMANNED AERIAL VEHICLE SHMEL-1, PCHELA-1K



Pchela-1K modernized version of Shmel-1. Note the lack of turned down wingtips

SYSTEM	SPECIFICATIONS	PAYLOAD TYPES	SPECIFICATIONS
Alternative designations:	Bumblebee, Pchela-1, Malakhit	Video Camera, TV, IR linescan	
Date of introduction:	1991	TV Field of view (degrees):	3-30
Proliferation:	At least 6 countries	IR Linescan:	
System:	Launch vehicle, ground station, transporter/loader, tech support vehicle, and 3-10 UAVs	Length:	3 to 4 times aircraft altitude
		Resolution (milliradians):	3
Launch Vehicle:	BTR-D		
Aerial Vehicle:			
Engine:	32hp 2-cylinder 2-stroke gasoline		
Propulsion:	3 blade shrouded pusher propeller		
Takeoff Weight (kg):	130	VARIANTS	SPECIFICATIONS
Payload Weight (kg):	70	Pchela-1K:	
Maximum (level) (km/h):	180	Upgrade design. It has 3.5 hrs endurance, 100km RPV-mode range, and 100-3,500 m altitude. Gyro-stabilized sensor ball has LLL TV, IR imaging for night, and earlier sensor options.	
Cruising Speed (km/h):	140		
Endurance (hrs):	2		
Max Ceiling, normal (m):	2,500	Pchela-1T:	
Ceiling, Service (m):	100-2,500 Range	System includes GAZ-66 truck launcher and varios Pchela-1 versions.	
Radius of Operation (km):	100 RPV Mode		
Wing Span (m):	3.25	Pchela-2:	
Overall Length (m):	2.78	Developing upgrade with 62-hp engine, greater payload, and 100-km range.	
Overall Height (m):	1.11		
Flight Control:		Stroi-P:	
Launch Method:	Rocket-assisted catapult	Military UAV complex with Shmel-1 mounted on a tracked BTR-D launcher.	
Recovery Method:	Parachute (non-steerable)		
Landing Method:	4 Spring loaded landing legs	Stroi-PD:	
		Modern complex, with Pchela-1K,-1T, or -1S launched from a GAZ-66 truck.	

NOTES

THE TRANSPORTER-LAUNCHER-CONTROLLER (TLC) HAS POSITIONS FOR TWO UAV OPERATORS. AUTOMATIC PRE-LAUNCH MONITORING, LAUNCH, FLIGHT CONTROL, AND DISPLAYING OF THE RECEIVED DATA IS CONDUCTED FROM THE TLC. THE DISPLAY IN THE TLC INDICATES AIRCRAFT POSITION OVERLAID ONTO THE TELEVISION IMAGE. GIVEN THE SYSTEM'S DIGITAL DOWNLINK, THE IR IMAGE COULD ALSO BE RECORDED ON MAGNETIC TAPE OR DISPLAYED ON A VIDEO MONITOR. HOWEVER, THE DATA IS ALMOST CERTAINLY RECORDED ON ELECTRONIC MEDIUM FOR PLAYBACK. THE DESCRIPTION OF THE SYSTEM MAY INDICATE A PROBLEM INVOLVING THE INABILITY OF THE OPERATOR TO TRANSLATE AIRCRAFT COORDINATES TO THOSE OF THE TARGETS BEING LOCATED. A LASER RANGEFINDER OR DESIGNATOR COULD EASILY ACCOMPLISH THIS, BUT SUCH A CAPABILITY IS NOT INDICATED FOR THE SHMEL-1. THE CURRENT SYSTEM REQUIRES COORDINATE CONVERSION FROM MAP ASSOCIATION OR PHOTOGRAPHIC INTERPRETATION WITH A LASER CAPABILITY TO BE ADDED LATER.

THE AREA COVERAGE OF THE SENSOR PAYLOAD IS EXCELLENT. ANALYSIS INDICATES THAT THE CAMERA, AT AN ALTITUDE OF 1500 METERS AND A FIELD OF VIEW OF 30º, CAN IMAGE AN AREA OF APPROXIMATELY 500,000 M2 OR A CIRCLE WITH A RADIUS OF 400 METERS. THE IR LINESCAN AT THE SAME ALTITUDE WOULD SEE A STRIP APPROXIMATELY 5,100 METERS LONG AND 4.5 METERS WIDE. GROUND RESOLUTION WOULD DECREASE SIGNIFICANTLY AT THE ENDS OF THE SCAN. AT A NOMINAL SPEED OF 120 KM/H AND FLYING THE MAXIMUM ALTITUDE, THE AIRCRAFT COULD OBSERVE A MAXIMUM OF 192 KM2/H WITH THE TELEVISION SYSTEM, OR 1,200 KM2/H WITH IR LINESCAN.

CIVILIAN VERSIONS INCLUDE FOREST, PIPELINE, AND COASTAL PATROL VERSIONS. MILITARY VERSIONS ARE OFTEN USED WITH ARTILLERY UNITS.

ISRAELI MALE UNMANNED AERIAL VEHICLE HERMES 450



SYSTEM	SPECIFICATIONS	PAYLOAD TYPES	SPECIFICATIONS
Alternative designations:	450S	MOSP, high end: TV day/night, auto-tracker, auto-scan	
Date of introduction:	1997	FSP-1 mid-high end: FLIR with 3-FOV telescope	
Proliferation:	At least 8 countries	POP, low-mid-range: CCD Television day and/or night	
Ground Crew:	2	ESP-600C low end: Television, color, day only	
Engine:	70 hp gasoline UEL AR-80-1010 rotary engine	DSP-1: TV with recognition range of 10km and FLIR camera range of 3+km. Detection range is 25 km.	
Propulsion:	2 blade pusher propeller	Other options: MTI radar and SAR (combined sensor pod ability with sensors types described above).	
Take-off Weight (kg):	450-500	SURVIVABILITY/COUNTERMEASURES	
Payload (kg):	150	Light composite structure, low radar signature	
Maximum (level) (km/h):	175		
Cruising Speed (km/h):	130		
Endurance (hrs):	24-30		
Max Ceiling, normal (m):	6200-7000		
Ceiling, Service (km):	5.4	VARIANTS	SPECIFICATIONS
Radius of Operation (km):	200	Hermes 450S:	
Wing Span (m):	10.5	The original UAV had a weight of 450 kg, UEL 52-hp rotary engine, and flight duration of 20 hours.	
Overall Length (m):	6.1		
Overall Height (m):	2.36	Hermes 450 LE:	
Flight Control:	Ground control station vehicle	Has an improved engine, two payload bays, and two wing mounted fuel tanks with a longer duration of 30 hours. 13.2 gallons in two fuel tanks. It uses the DSP-1 sensor pod.	
Flight Control Method:	Preprogrammed/in-flight reprogram		
Launch Method:	Wheeled take-off	Hermes 450 Watchkeeper (WK):	
Recovery Method:	Conventional landing	Developed for the British Army. Fielded in 2014 to a British Artillery unit in Afghanistan. Has wing embedded into fuselage and ruggedized undercarriage for landing on semi-improved runways. Has the ability to mount underwing fuel tanks or can be weaponized using the underwing mounts.	
Landing Method:	3-wheeled, w/arrest cable		

NOTES
AN AVAILABLE OPTION IS DIFFERENTIAL GLOBAL POSITIONING SYSTEM (DGPS) AUTOMATIC TAKE-OFF AND LANDING. RECOMMEND THAT THIS OPTION BE PLAYED IN SIMULATIONS. AN ATTACK VERSION OF THE HERMES WITH MISSILES WAS ESTIMATED TO BE EMPLOYED IN THE SUDAN AGAINST IRANIAN TARGETS. THE MIKHOLIT, ISRAELI 10-KM VARIANT OF NIMROD LONG-RANGE MISSILE, IS ESTIMATED TO BE LAUNCH CAPABLE FROM THE HERMES. ANOTHER VERSION OF THE HERMES 450 WITH MISSILES HAS REPORTEDLY BEEN EMPLOYED AGAINST HAMAS AND HEZBOLLAH TARGETS. IT HAS ALSO BEEN REPORTED THAT RAFAEL SPIKE MISSILES HAVE BEEN INTEGRATED ONTO THE HERMES 450.

ISRAELI HALE UNMANNED AERIAL VEHICLE HERMES 900



SYSTEM	SPECIFICATIONS	PAYLOAD TYPES	SPECIFICATIONS
Alternative designations:	INA	Gabbiano T200: long ranage surveillance radar, x band (8-12.5 GHz), 407km maritime range, MTI and SAr, >200 target Track-While Scan (TWS)	
Date of introduction:	May 2010		
Proliferation:	At least 5 countries and the U.N.		
Ground Crew:	INA	DSP-1: TV with recognition range of 10km and FLIR camera range of 3+km. Detection range is 25 km.	
Engine:	105hp gasoline Rotax 914 turbocharged engine	Tadiran Skyfix: COMINT DF and Elisra AES-210: ELINT	
Propulsion:	1 blade pusher propeller	Elop DCoMPASS (digital compact multi-purpose advanced stabilized system); stabilized turret incorporating thermal imager, color TV, dual-band laser designator rangefinder, inertial measurement unit and laser spot tracker	
Take-off Weight (kg):	970		
Payload (kg):	300		
Maximum (level)(km/h):	222		
Cruising Speed (km/h):	130-175	SURVIVABILITY/COUNTERMEASURES	
Endurance (hrs):	36	Light composite structure, low radar signature	
Max Ceiling, normal (m):	30,000		
Ceiling, Service (m):	INA		
Radius of Operation (km):	INA		
Wing Span (m):	15.3		
Overall Length (m):	6.1	VARIANTS	SPECIFICATIONS
Overall Height (m):	2.36	An attack version of Hermes 900 may be possible. Each wing has two external hardpoints similar to the weaponized Hermes 450. The Mikholit, Israeli 10km variant of Nimrod long-range missile, is designed for launch from the Hermes 450. Rafael missiles such as the Spike are also possible.	
Launch Method:	Wheeled take-off		
Recovery Method:	Conventional landing		
Landing Method:	3-wheeled, retractable landing gear; independent take-off and landing		
Flight Control Method:	Preprogrammed/in-flight reprogram; Secure redundant Line of Sight data link and redundant satellite communications beyond line of sight		
Flight Control:	Ground control station vehicle; can control two Hermes simultaneously		

NOTES
AN AVAILABLE OPTION IS IATOL (INDEPENDENT AUTO TAKEOFF AND LANDING) SYSTEM FOR AUTOMATIC TAKE-OFF AND LANDING ON NON-INSTRUMENT RUNWAYS. RECOMMEND THAT THIS OPTION BE PLAYED IN SIMULATIONS.
FIRST USE BY THE ISRAELI AIR FORCE IN COMBAT OCCURRED IN JULY 2014 DURING OPERATION PROTECTIVE EDGE IN GAZA.
ALSO IN USE BY THE UNITED NATIONS IN 2016 TO SUPPORT THE MULTIDIMENSIONAL INTEGRATED MISSION IN MALI (MINUSMA).

AUSTRIAN UNMANNED AERIAL VEHICLE CAMCOPTER S-100



SYSTEM	SPECIFICATIONS	PAYLOAD TYPES	SPECIFICATIONS
Alternative designations:	Al-Saber	IAI/Elta POP-3000 gimbaled ball with TV and FLIR for night use, IAI/Tamam POP200 gimbaled ball with FLIR, 3km night acquisition range, (UAE version is projected with TV and high zoom for 20 km daytime acquisition)	
Date of introduction:	2006		
Proliferation:	At least 4 countries		
Engine (hp):	55 Diamond aviation engine		
Propulsion:	2 blade rotary wing propeller	PicoSAR: Synthetic aperture radar for MTI surveillance and ground mapping	
Take-off Weight (kg):	200		
Payload (kg):	55+	Other options: Laser target designator (LTD), CBRN monitors, laser imaging radar (LIDAR), ground-penetrating radar (GPR), and signals intelligence sensors.	
Maximum (level)(km/h):	223		
Cruising Speed (km/h):	102		
Endurance (hrs):	6	SURVIVABILITY/COUNTERMEASURES	
Max Ceiling, normal (m):	6000	Light carbon fiber structure for low radar signature. It is very quiet, with narrow profile for low visual signature. It has auto-return and recovery mode for lost control signal. Inertial and GPS navigation: <1 meter accuracy.	
Ceiling, Service (m):		SURVIVABILITY/COUNTERMEASURES	
RPV mode (km):	130	Light carbon fiber structure for low radar signature. It is very quiet, with narrow profile for low visual signature. It has auto-return and recovery mode for lost control signal. Inertial and GPS navigation: <1 meter accuracy. VARIANTS	
Relay/Programmed (km):	130		
Wing Span (m):	1.24		
Overall Length (m):	3.09		
Overall Height (m):	1.04	An Unmanned Combat Aerial Vehicle (UCAV) attack version was developed and displayed in 2008, with 2 x Lightweight Multi-role Missiles (LMMs, see Vol 2, pg6-55). Missiles can engage light armored vehicles, aircraft, and other ground targets.	
Hover Capability:	Yes	VARIANTS	SPECIFICATIONS
Launch Method:	DGPS autonomous vertical launch from vehicle/ground base	An Unmanned Combat Aerial Vehicle (UCAV) attack version was developed and displayed in 2008, with 2 x Lightweight Multi-role Missiles (LMMs, see Vol 2, pg6-55). Missiles can engage light armored vehicles, aircraft, and other ground targets. The UCAV version could also mount guided rockets, machineguns, or automatic grenade launchers as needed for attack roles or self-protection. Small launchers for aerial rockets with homing devices could fit on the S-100 with a LTD for deep attack.	
Recovery Method:	DGPS autonomous		
Landing Method:	3-Vertical to vehicle/ground		
Flight Control Method:	Pre-programmed or in-flight re-program.		

Flight Control:	**Ground Control Station (GCS) inside vehicle Image processing: Real-time UAV video feed can also be routed to other subscribers.**	

NOTES
USED FOR VARIETY OF MILITARY ROLES, INCLUDING FIRE CONTROL AND OBSERVATION FOR FIRE AND STRIKE SYSTEMS, BORDER PATROLS, DE-MINING AND NAVAL SHIP-BASED ROLES. IN THE AIR DEFENSE ROLE, IT CAN BE USED FOR OBSERVATION OF LIKELY FLIGHT ROUTES, OR FOR HELICOPTER ATTACKS IN UCAV CONFIGURATION. A NOTED ROLE IS USING A LASER TARGET DESIGNATOR TO SELECT TARGETS AND DIRECT SEMI-ACTIVE LASER-HOMING MUNITIONS TO THE TARGET FOR A KILL. THE SYSTEM COULD ALSO CARRY A JAMMER, INCLUDING GPS JAMMING.

Unmanned Aerial Vehicles Used in Attack Missions

More modern forces are employing UAVs directly with fire support units. They offer responsive rapid fire observation with less risk to personnel and fewer terrestrial limitations to direct observation. Roles, capabilities, and configurations for integrated fires and strikes continue to expand. Range requirement for these tactical UAVs is 60+ km; and operational is 120+ km.

Abilities of UAVs to reconnoiter the battlefield, identify targets, give precise locations of targets, and provide fire correction depend on responsiveness stable viewing, and precision location. Improvements in GPS, stabilized sensor balls, and laser range-finders can now permit locations within 1-m accuracy, and stand-off viewing to 20+ km daytime and 3+ km at night. The image can be sent in real-time, and can be retransmitted with minimal delay. Some UAVs use SATCOM to extend the distance. Several forces use UAVs specifically designed for specific digital integrated fire and strike systems, for image and target location display at the battery or weapon monitor. The Russian Pchela-1K is designed for this target display with the 2S19M1. The South African Vulture UAV also directly links with the AS2000 fire control system.

Rotary-wing UAVs offer superior capabilities for fire support roles. Because they can hover, they can approach targets at nap-of-the-earth level (8 meters or level), between trees. They can also mount fairly hefty payloads of robust sensors (up to 55 kilograms for Camcopter S-100), in order to execute stand-off observation. Rotary aircraft generally offer better stability for precision viewing. All of these factors mean better all-weather capability with less risk of detection.

Other UAV missions include direct attack of fleeting targets. There are many programs to develop attack UAVs or convert UAVs for attack roles by mounting explosive warheads for an impact kill. The application goes back to WWII, with explosive-filled unmanned U.S. bombers directed by radio against German targets. UAV costs and limited fielding have limited use in attack roles. An exception is the Israeli Harpy attack UAV (see next page), specially designed as an attack UAV against high-value targets. This system can be called both a UAV and a cruise missile, as it can be piloted and/or programmed. The Russian R-90 UAV rocket is launched from 9A152 MRL, and has an attack option. Since MUAVs and MAVs have been fielded, their lower cost means that more attack versions will be likely. The Russian Pustelga MAV is noted to have an attack option. In the near term, weapon-launched sensor munitions will also have warheads and guidance for attack. UAVs, armed or not, can be used to harass and attack enemy RW aircraft. More attack UAVs or attack configurations will continue to increase world-wide. Russia, China, Iran, and a growing number of European countries already have or will have UAVs with attack configurations.

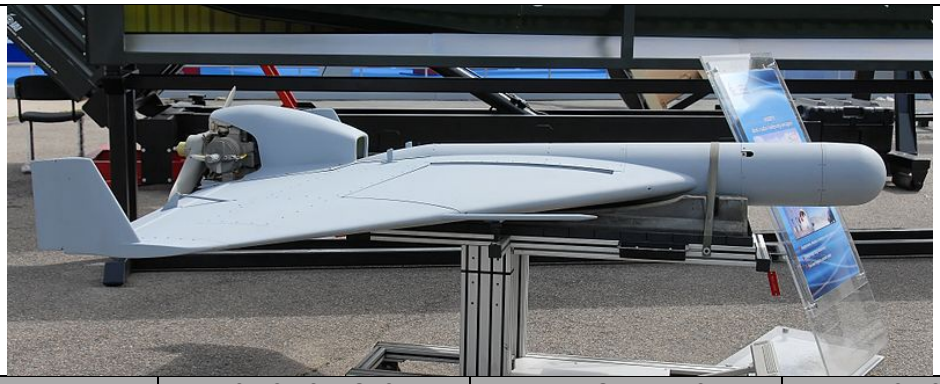
The U.S. has demonstrated another UAV design for direct attack by mounting ATGMs UAVs as unmanned combat aerial vehicles (UCAVs). UAV-based UCAVs operate similarly to larger aircraft-based UCAVs. They can fire guns or grenades or launch missiles against air and ground targets. Israel has also weaponized their UAVs with ATGMs such as the Hermes 450 in conflicts with Hezbollah and Hamas. The ATGMs were possibly Rafael Spikes or Mikholits, a Nimrod variant designed for UCAVs.

Emerging attack UAVs/CAVs will compete with cruise missiles against deep-strike NLOS targets to 200+ km. Nevertheless, the most effective use of UAVs for attack remains in precision location and guidance. Best use is mounting a laser target designator to guide semi-active laser-homing munitions (from a UCAV



mount or delivered by artillery, tanks, aircraft, mortars, and ships) against targets otherwise inaccessible to ground-based designators.

ISRAELI UNMANNED AERIAL VEHICLE HARPY, HARPY NG



SYSTEM	SPECIFICATIONS	PAYLOAD TYPES	SPECIFICATIONS
Alternative designations:	Harpy 1	Passive Radar Seeker Sensor	Wide Range of Frequencies, 2-18 GHz, pulse and constant wave frequencies
Date of introduction:	1988	Optical Camera:	Electromagnetic/Optical
Proliferation:	At least 5 countries	User Image Capabilities:	Receive images on possible targets via datalink
Ground Crew:	1-3 per truck launcher	Missile:	HE Fragmentation warhead
Engine (hp):	27.5, 2 cylinder, 2 stroke	Max Payload w/Warhead (kg):	32
Propulsion:	Two blade pusher propeller	VARIANTS	SPECIFICATIONS
Weight (kg):		Harpy NG:	
Max Launch Weight (kg):	135	Weight (kg):	135
Speed (km/h):		Wing Span (m):	INA
Maximum (level):	260	Max Launch Weight (kg):	160
Cruising Speed:	185	Service Ceiling (m):	4,572
Endurance (hrs):	6	Radius of Operation (km):	INA
Max Ceiling, normal (m):	INA	Cruising Speed km/h):	120
Ceiling, Service (m):	2,438	Endurance (hrs):	9
Radius of Operation (km):	500	Max Level Range (km):	1,080 (Estimated)
Dimensions:		PAYLOAD TYPES	SPECIFICATIONS
Wing Span (m):	2	Missile:	HE Fragmentation warhead
Overall Length (m):	2.4	Warhead Weight (kg):	15, Same as Harpy 1
Overall Height (m):	.36	Missiles per Launcher	12, Simultaneous fire ability
Flight Control:	GPS and inertial backup geo positioning, autonomous preprogrammed flight	Launcher Trucks per Battery	1 Ground Control Truck with 3 Launcher Medium Trucks
Launch Method:	Booster rocket launched from truck launcher	Radio Frequency (RF) and Electro-Optical Sensor	Combined sensors can be used. Expanded lower RF.
Recovery/Landing Method:	Not applicable, terminal strike	Data Link (direct LOS) (km):	INA
Launcher Trucks per Battery	3 4X4 or 4x6 Medium trucks		
Missiles per Launcher:	18		
Total Missiles per Battery:	54		

NOTES

THE PURPOSE OF THE HARPY DEVELOPED BY ISRAELI AEROSPACE INDUSTRIES (IAI) IS TO ACQUIRE TARGETS WITH A PASSIVE RADAR SENSOR IN ORDER TO DESTROY THE RADARS ASSOCIATED WITH SURFACE TO AIR MISSILES OR OTHER GROUND TARGET ACQUISITION RADARS. HARPY CAN BE USED AS A LOITERING CRUISE MISSILE IN PREPROGRAMED MODE. IT CAN ALSO BE CONSIDERED A UCAV, USING PREPROGRAMMED OR HOMING ATTACK MODES AND OPERATE DAY OR NIGHT. IF THE TARGETED RADAR IS TURNED OFF BEFORE THE HARPY MAKES ITS TERMINAL DIVE IT HAS THE ABILITY TO AUTOMATICALLY CANCEL THE STRIKE AND CONTINUE SEARCHING FOR OTHER TARGETS.

THE COMBAT UNINHABITED TARGET LOCATE AND STRIKE SYSTEM (CUTLASS) WAS A DIFFERENT DESIGN THAT IAI ATTEMPTED IN 2000. IAI WORKED WITH RAYTHEON TO ACQUIRE A DOD CONTRACT. SIMILAR IN MISSION BUT MUCH SMALLER THAN THE HARPY AND TUBE LAUNCHED FOR USE ON U.S. NAVAL SHIPS. HOWEVER, IAI AND RAYTHEON WERE NOT ABLE TO ACHIEVE A PRODUCTION CONTRACT FROM DOD AND THE JOINT VENTURE WAS TERMINATED. IT IS THEREFORE NOT LISTED ON THE WEG SHEET.

THE NEW HARPY NG VARIANT WAS RECENTLY REVEALED AT THE 2016 SINGAPORE AIR SHOW. AMONG MANY IMPROVEMENTS THE HARPY NG GROUND CONTROL CREW CAN PREPROGRAM MULTIPLE, SEPARATE TARGET PROFILES FOR AUTONOMOUS STRIKES. THIS ENHANCEMENT ALSO ALLOWS THE NG VARIANT TO AUTOMATICALLY SWITCH FROM PRIMARY TO SECONDARY TARGET PROFILES IF THE PRIMARY TARGET IS NO LONGER AT THE DESIGNATED AREA. ITS HIGHER ALTITUDE CAPACITY ALLOWS IT COVER A WIDER AREA AND AVOID DIRECT FIRE WEAPONS AS WELL AS ACOUSTIC SENSORS. ANOTHER SIGNIFICANT IMPROVEMENT IS AN EXPANDED FREQUENCY OF ITS RADAR SENSOR FROM THE ORIGINAL HARPY AT 2-18 GHZ TO THE LOWER END OF 0.8-18 GHZ IN ORDER TO DETECT LOW END FREQUENCY RADAR EMITTERS.

CHINESE UNMANNED AERIAL VEHICLE WING LOONG



https://en.wikipedia.org/wiki/zh:Baiweiflight

SYSTEM	SPECIFICATIONS	PAYLOAD TYPES	SPECIFICATIONS
Alternative designations:	Yilong, Wing Loong 1, Pterodactyl 1	IR and laser designator:	Contains both, INA
Date of introduction:	2008	Electronic Counter Measures	ECM capable, INA
Proliferation:	At least four countries	Optical Camera:	Electro-Optical
Ground Crew:	INA	Missiles: Two small underwing guided air to surface missiles	Two AR-1/BA-7 laser guided or two LS-6 satellite guided
Engine (hp):	100, Rotax 914, Piston, Turbo	Max Payload (kg):	90 or 220
Propulsion:	Three blade pusher propeller	VARIANTS	SPECIFICATIONS
Weight (kg):		Wing Loong II:	
Max Launch Weight (kg):	1,100	Height (m):	4.1
Speed (km/h):		Wing Span (m):	20.5
Maximum (level):	280	Max Launch Weight (kg):	4,200
Cruising Speed:	INA	Max Ceiling, normal (m):	9,000
Endurance (hrs):	20	LOS link radius (km):	200 (Without Satellite)
Max Ceiling, normal (m):	7,010	Maximum level Speed km/h):	370
Ceiling, Service (m):	5,000	Endurance (hrs):	20
Radius of Operation (km):	4,000 (With Satellite)	Max External Payload (kg):	480
Dimensions:		PAYLOAD TYPES	SPECIFICATIONS
Wing Span (m):	14	Missiles:	12
Overall Length (m):	9	Missile Weight (kg):	26.5
Overall Height (m):	2.7	Name of Missile	Norinco Blue Arrow 9
Flight Control:	Line of sight and satellite	Type of Missile	Air to Surface guided missile
Recovery/Launch Method:	Runway, Automatic take-off and landing, Runway 600 m.	Recovery/Launch Method:	Runway, Automatic take-off and landing, Runway 1,200 m.
Baseline Number of UAVs:	4	Sensors: Advertised sensor payloads include electro-optical, synthetic aperture radar (SAR), radar warning, IR imaging video, ground motion target Indicator, communications relay, and an array of various electronic warfare (EW) including jamming and intercept. Not all sensors listed can be flown. Exact details on sensor performance or weight is unknown.	
Ground Transport Vehicles	4 UAV Large Transport Trucks		
Ground Control Station, Logistics and Payloads	2-3 Medium Trucks with Shelters and Trailers		
Fuel Capacity (kg)	270		

NOTES

THE WING LOONG I IS A DUAL PURPOSE SURVEILLANCE AND COMBAT AERIAL VEHICLE (UCAV) ROLE. THE FUSELAGE RESEMBLES THE PREDATOR B AND HERMES 900. THE ADVERTISED WING LOONG CHINESE MISSILES CONSIST OF AIR TO GROUND MUNITIONS. THEY INCLUDE THE BA-7 AND YZ-212 LASER GUIDED MISSILES, THE LS-6 SMALL SATELLITE DIRECTED BOMB, AND YZ-102A MINIATURE ANTI-PERSONNEL BOMBS. HOWEVER, THE MOST CONSISTENT MISSILE DEMONSTRATED BUILT FOR UAVS IS THE AR-1 WHICH IS A DERIVATIVE OF EARLIER HJ/AKD-10 MISSILES. NAVIGATION FOR THE AR-1 IS GPS/INERTIAL GUIDANCE AND HAS A RANGE ADVERTISED AT 10 KM WITH A WEIGHT OF 10 KG. THE WING LOONG I CAN CARRY TWO AR-1S WITH ONE ON EACH WING.

THE WING LOONG II VARIANT WAS RECENTLY REVEALED AT THE 2015 CHINA AVIATION EXPOSITION. LIMITED TO A MODEL AND BROCHURES OF THE WING LONG II DURING THE SHOW IT IS NOW ESTIMATED TO BE IN EARLY STAGES OF TESTING AND DEVELOPMENT. UNLIKE THE PREVIOUS WING LOONG THE II MODEL WILL BE PRIMARILY A UCAV. MUCH LARGER, IT CAN CARRY THREE HEAVIER NORINCO BLUE ARROW (BA) 9 WITH THREE MISSILES ON EACH WING. EACH MISSILE WEIGHS 25 KG WITH A RANGE OF 6 KM. IT CAN ALSO CARRY A MUCH LARGER SENSOR SUITE WITH MUCH MORE CAPACITY IN ITS FUSELAGE.

THE WING LOONG I, DESIGNED BY CADI, IS OFTEN TIMES CONFUSED WITH THE CHINESE CAAA RAINBOW CH-4B WHICH HAS A SIMILAR FUSELAGE AND IS ALSO CAPABLE OF CONDUCTING BOTH SURVEILLANCE AND AIR TO SURFACE MISSILE ATTACKS. THE CH-4B CAN ALSO CARRY SIX MISSILES, LIKE THE WING LOONG II, WITH AN ESTIMATED RANGE OF 4,000 KMS WITH A SIMILAR ALTITUDE OF THE WING LOONG I. IT IS ALSO PROLIFERATED TO AT LEAST 3 COUNTRIES INCLUDING IRAQ.

ISRAELI MISSILE/ATTACK UNMANNED AERIAL VEHICLE HAROP



SYSTEM	SPECIFICATIONS	Dimensions:	
Alternative designations:	Harpy 2	Wing Span (m):	3
Date of introduction:	2009	Overall Length (m):	2.5
Proliferation:	At least 6 countries	Overall Height (m):	.3
Ground Crew:	3-4 (EST)	Flight Control:	Mission Control Shelter (MCS) controls vehicle with a "man-in-the-loop" able to engage or abort the attack in real time. In event of an abort, reverts to loiter mode until attack is restarted.
Engine (hp):	38	Launch Method:	Solid-propellant booster rocket from ground-based storage container
Propulsion:	Rotary engine driving a 2-blade pusher propeller	Recovery/Landing Method:	Intentionally expendable, non-recoverable
Weight (kg):		Launcher Trucks per Battery	INA
Max Launch Weight (kg):	135	Missiles per Launcher:	12
Speed (km/h):		Total Missiles per Battery:	INA
Maximum (level):	INA	PAYLOAD TYPES	SPECIFICATIONS
Cruising Speed:	185	Passive Radar Seeker Sensor	Wide Range of Frequencies
Endurance (hrs):	6	Electro Optical	Color CCD, FLIR (IAI Tamam POP-200)
Max Ceiling, normal (m):	INA	User Image Capabilities:	Images received via satcom datalink.

Ceiling, Service (m):	3,000	Missile:	HE Fragmentation warhead
Range (km):	1,000	Max Payload w/Warhead (kg):	23

NOTES

HAROP RESEMBLES AN EARLIER ISRAEL AEROSPACE INDUSTRIES (IAI) 'SUICIDE DRONE' KNOWN AS HARPY. THE MAIN DIFFERENCES ARE THE OUTER WING EXTENSIONS, THE LONGER NOSE, AND CANARD FORE PLANE. LIKE HARPY, HAROP IS LAUNCHED FROM A VEHICLE-MOUNTED CONTAINER. IT AUGMENTS THE HARPY'S RF SEEKER WITH AN ELECTRO-OPTICAL SENSOR, ALLOWING IT TO ACQUIRE AND PURSUE NON EMITTING TARGETS AND MOVING TARGETS AS WELL AS 'QUIT' TARGETS SUCH AS SHUT-DOWN RADARS. IT CAN BE LAUNCHED AT ANY ANGLE AND AT HORIZONTAL OR VERTICAL TRAJECTORIES.

BECAUSE OF ITS DUAL PURPOSE AS A UAV AND A MISSILE, THE HAROP CAN ALSO BE FOUND IN WEG VOLUME 2, CHAPTER 6: THEATER MISSILES.

Dec
2016

Worldwide Equipment Guide

Chapter 4: Equipment Upgrades, Countermeasures, and Emerging Technology Trends



TRADOC G-2 ACE–Threats Integration
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Chapter 4: Equipment Upgrades, Countermeasures, and Emerging Technology Trends

EQUIPMENT UPGRADES

Armed forces worldwide employ a mix of legacy systems and selected modern systems. In the current era characterized by constrained military budgets, the single most significant modernization trend impacting armed forces worldwide is upgrades to legacy systems. Other factors impacting this trend are:

- A need for armed forces to reduce force size, yet maintain overall force readiness for flexibility and adaptiveness
- Soaring costs for modern technologies, and major combat systems
- Personnel shortages and training challenges
- Availability of a wide variety of upgrade packages and programs for older as well as newer systems
- New subsystem components (lasers, GPS, imaging sensors, microcircuits, and propellants) which permit adaptation of new technologies to platforms, weapons, fire control systems, integrated C2, and munitions
- An explosion of consortia and local upgrade industries that have expanded worldwide and into countries only recently modernized or still in transition.

The upgrade trend is particularly notable concerning aerial and ground vehicles, weapons, sensors, and support equipment. From prototype, to low-rate initial production (LRIP), to adoption for serial production, minor and major improvements may be incorporated. Few major combat systems retain the original model configuration five or more years after the first production run. Often improvements in competing systems will force previously unplanned modifications.

Upgrades enable a military to employ technological niches to tailor its force against a specific enemy, or integrate niche upgrades into a comprehensive and well-planned modernization program. Because of the competitive export market and varying requirements from country to country, a vehicle may be in production simultaneously in many different configurations, with a dozen or more support vehicle variants concurrently filling other roles. In light of this trend, OPFOR equipment selected for portrayal in simulations and training need not be limited to the original production model of a system, but may also employ other versions that incorporate the armed force's strategic and modernization plans, along with likely constraints that would apply.

The adaptive OPFOR will introduce new combat systems and employ upgrades on existing systems to attain a force structure which supports its plans and doctrine. Because the legacy force mix and equipment were selected in accordance with past plans and options, upgrading an existing system will often present an attractive alternative to costly new acquisitions. A key consideration is the planned fielding date. For this document, the OPFOR planning time-frame is current to near-term. Thus, only upgrades currently available (or marketed, with production capability and fielding expected in the near term), are considered. Also, system costs and training and fielding constraints should be considered.

The following tables describe selected upgrades currently available for system modernization. These lists are not intended to be comprehensive. Rather, they are intended to highlight major trends in their respective genres. With armored combat vehicles, for instance, the focus is on upgrades in mobility, survivability, and lethality.

The category of survivability upgrades includes countermeasures (CM). Depending on their applicability and availability within the contemporary operating environment, the CM upgrades can apply not only to systems associated initially with specific branches (tanks, IFVs, and air defense guns), but over time to other systems that are vulnerable to similar threats. An example of this is the proliferation of smoke grenade launchers tailored for use with artillery and air defense vehicles.

Implementation of all upgrade options for any system is generally not feasible. Because of the complexity of major combat systems and the need for equipment subsystem integration and maintenance, most force developers will chose a mix of selected upgrades to older systems, augmented with limited purchases of new and modern systems. Please note that systems featured in this document may be the original production system or a variant of that system. On data sheets, the **VARIANTS** section describes other systems available for portrayal in training and simulations. Also, equipment upgrade options (such as night sights) and different munitions may be listed, which allow a user to consider superior or inferior variants. Within the document chapters, multiple systems are listed to provide a range of substitution options. Of course there are thousands of systems and upgrade options worldwide that could be considered for adoption by an innovative OPFOR.

OPFOR trainers have the prerogative to inject systems or upgrade packages not included in the OPFOR Worldwide Equipment Guide (WEG), in order to portray an adaptive, thinking OPFOR. In future WEG updates, we will expand the upgrade tables to include by-name descriptions of upgrade options and specific systems applications that have been noted elsewhere throughout the document. Our functional area analysts are available to assist OPFOR planners in selecting reasonable upgrade options that tailor system configurations to specific force portrayals. Questions and comments on tables and data contained in this chapter should be addressed to the respective POCs designated for corresponding individual chapters placed throughout all three volumes of the WEG.

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OPFOR AIR DEFENSE SYSTEMS UPGRADES

AIR DEFENSE GUN/GUN-MISSILE SYSTEM	MANPORTABLE AIR DEFENSE SYSTEM	SURFACE-TO-AIR MISSILE SYSTEM
Light AD vehicle: Combat support vehicle with light armor and TV, thermal sights, AD machine gun. Add encrypted voice and digital data capability, azimuth plotting board alert system and overhead launch turret or MANPADS. MMW radar for detection and possible fire control. High velocity laser beam rider MANPADS ranges to 7+ km, 0-5 km alt Armored AD vehicle: See IFV upgrades, e.g. Improved armor and suspension, 2-man turret. CM, e.g. multi-spectral smoke grenades, LWR Upgraded FCS: Cdr's independent viewer, 2-plane stabilized TV, auto-tracker, FLIR, multi-mode targeting (TV/radar, day/night modes). Dual-mode (TA/FC) low probability of intercept radar with longer range. Reduced radar mean-time to detect and system response time. Links to AD network, encrypted voice, digital data transmission capability, computer display GPS, and inertial land navigation, IFF. Improved multiple auto-cannons to 30 mm, with stabilized guns and fire-on-the-move capability. Improved rounds, e.g. electronic-fuzed HE, APFSDS-T, and frangible or canister rounds. Two-stage high-velocity laser beam-rider AD missiles with MMW radar, to out-range helicopter launch missile systems. Kinetic-energy missiles for use in AD role, and against ground vehicle targets. Altitude is 0-6 km. Range 0-8 km. Jam capability is 0.	Vehicle, ground platform, helicopter mounts, missiles in disposable launch tubes Early warning datalinks and alert display boards for mount on launcher. Upgraded IFF capabilities. FLIR night sight Improved missiles and seeker heads with better counter-countermeasure resistance. Proximity/PD fuze. Thrust-vectoring capability, all-aspect engagement capability, strap-on imaging infrared or thermal sights Improved larger warheads and blast/frag effects, base fuzing or propellant for increased blast Increased range to 7 + km. Improved aerodynamics, fuels, and materials, for increases in speed, reduced smoke signature, maneuverability, and accuracy ½ of missiles are high velocity ADAT missiles with laser beam rider KE missile and 3 LBR sub-missiles to 7 = km, 0 – 5 km altitude, and nil countermeasure vulnerability. Integrate AD defense with anti-helicopter mines	Improved vehicle or platform launcher for rapid emplacement/displacement CM e.g. multi-spectral smoke, LWR Upgraded FCS: 2-plane stabilized TV gunner sights, 1 – 2 gen FLIR, multiple target engagement capability, All-weather fire control, multi-mode targeting, with TV and radar, day and night. Improved EW and target acq radars, longer range, low probability of intercept, and signal processing in radars Reduced radar mean-time to detect, and system response time Links to AD network, encrypted voice, digital data transmission capability, computer display GPS and inertial land navigation, and graphic display battle management system, IFF Missiles with SACLOS, ACLOS radar, IR or multi-band terminal seekers, more lethal warheads, longer range, maneuverability with improved counter-countermeasure resistance Vertical missile launch

AIR DEFENSE GUN/GUN-MISSILE SYSTEM	MANPORTABLE AIR DEFENSE SYSTEM	SURFACE-TO-AIR MISSILE SYSTEM
UPGRADE PRIORITY Improved day/night optics and radar Light AD/MANPADS and MG Battalion AD fire support vehicle with HV launcher and MANPADS dismount teams Armored brigade AD vehicle with overhead turret and: High-velocity missiles 30-mm stabilized auto-cannon MMW TA radar Automated secure links to AD network	**UPGRADE PRIORITY** Improved sights and warning display boards Prox Fuze MANPADS with Strap-on II/FLIR, improved seekers, warheads, propulsion, wider FOV, IR CCM/Flare rejection capability Add ½ High velocity ADAT missiles MMW radar	**UPGRADE PRIORITY** Improved FCS with day/night optics and radars, and multi-target capability and modes Automated secure links, digital AD network Improved missiles and guidance CM protection from jamming and ARMs

OPFOR AERODYNAMIC SYSTEM UPGRADES

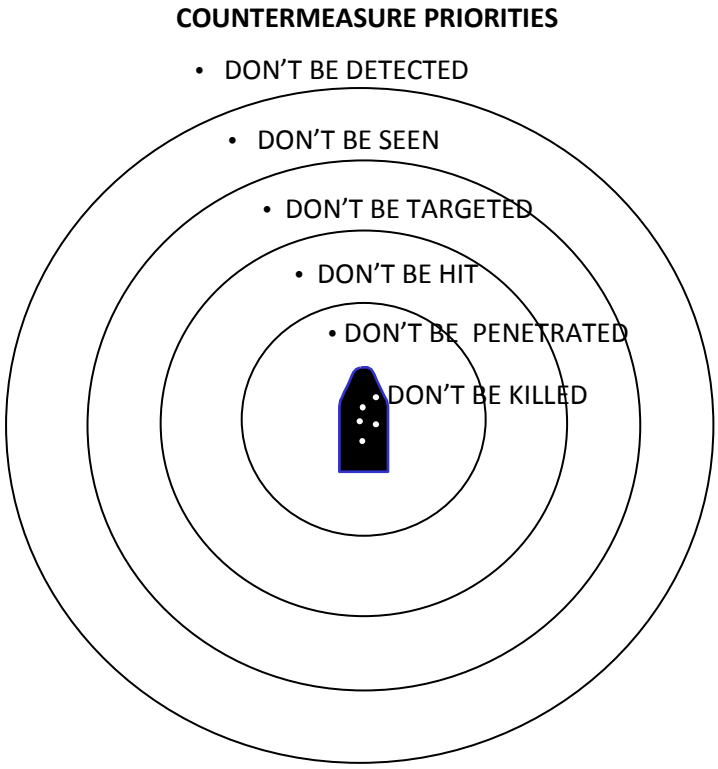
ROTARY-WING AND FIXED-WING AIRCRAFT	UNMANNED AERIAL VEHICLE (UAV)	THEATER MISSILES
Older airframes and utility helicopters can add upgraded sensors and weapons. Service life extension programs Western upgraded avionics, fire control computers, sights, and technology readily available to retrofit into existing older airframes Emerging belief in upgrade of existing platforms rather than developing new airframes, primarily due to financial constraints Two-seat conversions for adding weapons officers and multi-role use Development of quieter, more efficient main and tail rotor blades and more powerful engines to increase performance and load capacity Digital data-linking with ground systems and air defense networks Increased use of millimeter wave, FLIR, and NVG technologies to allow greater night/ weather weapons delivery and mission completion Self-protection jammers and IIR vs pyrotechnic IR seeker decoys Laser altimeters replace radar altimeters to reduce RF detectability Added weapon mounts to increase mission load capacity Improved weapons and munitions, including ATGMs, air-to-surface missiles, rockets and precision bombs Laser seekers and designators for missile/rocket/bomb conversion GPS course-corrected munitions (bombs and missiles)	Extend operational radius and endurance Reduce sensor-shooter timeline Continued development of micro-UAVs dwell time and image quality Advanced imagery fusion from multiple UAVs Real-time teaming between manned/unmanned fixed-wing aircraft Enhanced third-generation image intensifiers and second-generation thermal imagers may be available to limited countries. Multiple sensors will be employed on the same platform for enhanced target detection under all-weather conditions and may be linked to weapon delivery platforms. Integrated laser target designators for smart munitions in priority target areas Multiple sensors for chemical and biological agents will be employed on this platform and may be linked to comms platforms. Precision attack variants, such as anti-radiation UAVs for radar attack SATCOM stand-off navigation and sensor communications Miniaturization and reduced weight of munitions	Ballistic missile Improved launchers (swim capability, multiple missile capability, reduced signature) Reduced preparation time, emplace and displace times, shoot and scoot operation Launcher countermeasures: decoys, missile non-ballistic launch trajectory, smokeless solid fuel Autonomous operations or increased interval between launchers Missile countermeasures (e.g., non-ballistic trajectory, penetration aids, separating warhead, multiple maneuvering re-entry vehicles) Automated secure digital C2 network, linking with artillery, air, EW, and reconnaissance units Navigation system with GPS/inertial update, linked to automated net, and homing options Extended range missiles, some to 500+ km Multi-sensor or other improved homing, especially GPS with increased accuracy (10-50 m CEP) Advanced munitions (cluster munitions, FAE, jam, thermobaric munitions, biological, electro-magnetic pulse, anti-radiation missiles), larger payloads Cruise missiles (CMs) with pre-programmed multiple waypoints, and manned guidance option CM multi-seeker modes, including GPS, loiter and radar/IR homing, SAL-H, cluster PGM warheads

ROTARY-WING AND FIXED-WING AIRCRAFT	UNMANNED AERIAL VEHICLE (UAV)	THEATER MISSILES
UAV launch capability, permits them to precede aircraft or replace them in high threat areas **UPGRADE PRIORITY** MMW, FLIR, and NVG technologies GPS and SAL-H munitions Upgraded avionics Service life extension programs Conversion to multi-role systems	**UPGRADE PRIORITY** Extend operational radius and endurance Obtain improved EO capability Reduce sensor-shooter timeline Laser target designator integration	**UPGRADE PRIORITY** 10-50 CEP with GPS Improved smokeless solid fuel Separating warhead and larger payloads Decoys

COUNTERMEASURES

Countermeasures (CMs) are survivability measures that enhance the protection of assets and personnel by degrading enemy sensors and weapons effectiveness. These measures often fall under the rubric of the US Army term CCD (camouflage, concealment and deception) or within the OPFOR term C3D (camouflage, cover, concealment and deception). Decoys used by tactical units within branch operations are designed to aid survivability, and are considered to be countermeasures. Countermeasures can take the form of tactical CMs (also called reactive measures), or technical CMs. The various types of tactical CM change, alongside new unit tactics techniques and procedures (TTP), allowing adaptation to a given situation in compliance with prescribed rules of engagement. This document focuses on technical CMs. In certain specialized branches the development of new technical CMs is persistent and ongoing.

Modern forces will upgrade existing systems by augmenting them with selected force protection countermeasures. Many CMs noted are intended to protect combat vehicles from anti-armor sensors and weapons. Although the CMs shown below can be used to counter precision weapons, many were originally developed for use against conventional weapons. Priorities for countermeasures are dictated by the goals of survival, mission success, and maintaining effectiveness. The first CM priority is to avoid detection until you can control the events. Among goals for using countermeasures, mission success is the most important.



Survival ("Don't Be Killed") encompasses the following prerequisites in order of priority: operating system or network survival, vehicle survival, vehicle avoidance of major damage, crew survival, and vehicle avoidance of minor repair. A compatible suite of countermeasures may be limited to a more modest goal, to preserve a measure of effectiveness, even at the cost of system survival. Effectiveness in this context could be defined as: ability to successfully execute the immediate and subsequent missions, until system or subsystem failure interrupts this process. Effectiveness includes: crew effectiveness, crew fitness, mission success, operating system effectiveness, and vehicle/soldier readiness for employment.

Several factors must be considered when selecting countermeasures.

- Countermeasures should be fielded and mounted on systems with a holistic and rational approach to assure survivability. The rational developer will focus his countermeasures, assigning the highest priority to protection against the most likely and most lethal threats. However, evolution of threat capabilities over time, in combination with conflicting priorities, can prevent success of the current CM mix. Most CM are responses to specific perceived threats, and limited by prohibitive costs and budget constraints. With the modern reliance on precision weapons, military forces may seek out complex and expensive countermeasure "suites" to degrade their opponents' capabilities.
- Some countermeasures can diminish or neutralize the effects of numerous sensors and weapons. These CM can be categorized based on generic types of threats, such as artillery or ATGM. Others are more adversary technology-specific, and may only become available once the technology in question makes its appearance in the Operational Environment. Pressure from new and threatening technologies may compel designers to launch short-response programs to expedite the fielding of adaptive countermeasures.
- The R&D process has led to the development of counter-countermeasures, intended to negate the effects of CMs. However in a certain context these too fall under the rubric of CMs. To avoid confusion with semantics, the WEG regards all of them as countermeasures.
- When countermeasures are added to a vehicle or in close proximity to it, they must be mutually compatible and also compatible with other relevant subsystems. Accordingly issues like electromagnetic interference and self-blinding with smokes should also be taken into account.
- Although a variety of countermeasures are now marketed, many technical and financial factors can negate their advantages. Countermeasure development may be restricted due to limitations in resources, technology, and fielding capacity. All will vary by country and time frame. At times budget limitations may compel fielding of CM that fall short of desired standards. For instance, active protection systems can counter some weapons; but they are expensive, hazardous to soldiers, and ineffective against many weapons. Thus they may be unsuitable for application to many systems. OPFOR users should consult the appropriate WEG chapter POC if assistance is needed to adopt CMs against a specific system.
- Countermeasures will not replace the need for armor protection and sound tactics.

LETHALITY COMPONENT VERSUS COUNTERMEASURE RESPONSES

The intent of this table is to assist in selecting CM and understanding the categories used in upgrade schemes. Many of the more widely-fielded countermeasures are designed to degrade a variety of sensors and munitions, for minimal cost. Thus, countermeasure types may be replicated across several functions. Because new technologies are emerging rapidly, and systems are being applied throughout several CM modes, the placement of CMs can be somewhat arbitrary. CM uses against artillery, ATGMs, and mounted ground vehicle weapons systems will vary in type. The following list of CM can be used for artillery, air defense, antitank, armor, aircraft, theater missile, and other systems, depending on the platform, gun, sensor, and munition configuration of the system.

Capability to Be Degraded	Type of Countermeasure
Detection and location	Camouflage: nets, paints, fasteners for added natural materials Cover: entrenching blades, hole-blast device, underground facilities Concealment: screens, skirts, thermal engine covers, scrim, other signature reduction Deformers, engine exhaust diversion, other signature alteration measures Aerosols: smoke and flares, water spray systems Decoys, clutter, and acoustic countermeasures Counter-location measures: GPS jammers, laser and radar warning systems
C2/sensor-shooter links	See Information Warfare (IW) Chapter
Platform or weapon	Counterfire: directional warning systems, laser radars, for rapid response Directed energy weapons (DEW), such as high-energy lasers System prioritization for hard-kill, e.g., anti-helicopter mines
Weapon sensors and fire control	CCD as noted above. Directed energy weapons, such as low-energy lasers (LEL) Electro-optical countermeasures (EOCMs)
Submunition dispensing/activation	Global positioning system (GPS) jammer Fuze (laser/IR/RF), RF barrage jammers, acoustic jammers
Precision munition and submunition sensors	CCD as noted above. False-target generator (visual, IR, RF/acoustic) Electromagnetic mine countermeasure system, to pre-detonate or confuse Fuze jammers (laser/IR/RF), RF barrage jammers, acoustic jammers
Munition/submunition in-flight, and its effects	Sensors to detect munitions: MMW radars, RF/IR/UV passive sensors Air watch and air defense/NBC warning net, to trigger alarm signal Active protection systems, for munition/submunition hard kill Cover, additional armor to reduce warhead effects
Other System Effects	Miscellaneous CM (See below)

COUNTERMEASURES AGAINST SENSORS

Type Countermeasure	Countermeasure	Example	Application
Camouflage	Camouflage nets, Camouflage paints, IR/radar/and laser-absorptive materials/paints Fasteners, belts for attaching natural materials	Russian MKS and MKT Salisbury screen rubber epoxy Chinese “grass mat” set	Variety of vehicles Variety of systems Uniforms and vehicles
Cover	Natural and manmade cover, civilian buildings Entrenching blade to dig in vehicles Hole-blast devices for troop positions, spider holes Underground facilities, bunkers, firing positions	Tree cover, garages, underpasses T-80U tank, BMP-3, IFV, 2S3 arty Hardened artillery sites, bunkers	TELs, vehicles, troops IFVs, tanks, SP arty Infantry, SOF Iraqi and NK sites
Concealment	Screens, overhead cover for infantry (conceal IR/visible signature) Canvas vehicle cover, to conceal weapons Thermal covers, vehicle screens Scrim, side skirts, and skirting around turret	Colebrand netting Cover on Chinese Type 90 MRL Kintex thermal blanket over engine French “Ecrim” track cover scrim	Infantry, weapon, sensor Truck-based weapons For combat vehicles Combat vehicles
Deformers/signature modification	“Wummels” (erectable umbrellas to change/conceal shape/edges) Exhaust deformers (redirect exhaust under/behind vehicle Engine and running gear signature modification (change sound) IR/radar deformers (in combination with RAM and RAP, etc.)	Barracuda RAPCAM/TOPCAM Russian exhaust deflectors Track pads, road wheel/exhaust change Cat-eyes, Luneberg lens	Vehicles, sites, weapons Combat vehicles Tracked, other vehicles Tracked, other vehicles
Aerosols	Visual suppression measures, smokes, WP rounds Multi-spectral smokes for IR and/or MMW bands Flares, chaff, WP, to create false targets, disrupt FLIR Toxic smokes (irritants to disrupt infantry and weapons crews) Water spray systems (to reduce thermal contrast)	Smoke generators, fog oil, S-4, RPO-D ZD-6 Smoke grenades (visual/IR) WP rounds, Galix 6 flare system Adamsite and CN in smoke mix Add-on kits for vehicles	Blinding, screening Vehicle protection Combat vehicles, arty Smoke generators Recon, C2, AD, arty

Type Countermeasure	Countermeasure	Example	Application
Decoys	Clutter (civilian/military vehicles, structures, burning equipment	Log site, truck park, tank farm, derricks	Artillery, combat vehicles
	Low to high-fidelity (multi-spectral) decoys	Shape International decoys	TBMs, SAMs, radars
	Radar/IR decoy supplements (to add to visual/fabricated decoys)	Corner reflectors, KFP-1-180 IR heater	Vehicle/site decoys
	Acoustic countermeasures (to deceive reconnaissance sensors)	Acoustic tape/speaker systems	Vehicles, sites
Counter-location measures	Degrade GPS by jamming to reduce precision location capability	Aviaconversia GS jammer	Infantry and others
	Jam radars/IR sensors	SPN-2 truck-borne jammer set	Tactical/operational area
	Laser, IR, and radar warning systems (to trigger move/CM)	Slovenian LIRD laser warner	Combat vehicles

COUNTERMEASURES AGAINST WEAPONS AND WEAPON SENSORS

Type Countermeasure	Countermeasure	Example	Application
Added protection (supplements to armor in reaction to specific capability	Armor supplements (ERA, screens, bar or box armor, sand bags) Armor skirts over road wheels Mine rollers, plows, and flails Vehicle belly armor, raised or redesigned belly design, skirt Vertical smoke grenade launchers (to counter PGM top attack)	Barracuda, SNPE ERA KMT-5, KMT-6	
EOCM	Use EOCMs such as IR jammer/IR searchlights to redirect ATGM	KBCM infrared CM system	Combat vehicles
False-target Generators	Acoustic jammers and directed acoustic countermeasures Laser false-target generator (against semi-active laser homing) Electromagnetic mine countermeasure system, counters, fuzes	In development, can be improvised In development	To distract acoustic seekers Combat vehicles
Jammers	Altimeter jammer (counters submunition dispersion altimeter) Fuze jammers (to spoof RF proximity fuzes on munitions) Incoherent infrared jamming (to jam IR fuzes on munitions) GPS jammers to confuse navigation and course correction systems	 SPR-1 armored ECM vehicle	 High priority sites, CPs, etc.
Active Countermeasures	Active protection systems, for munition hard kill High energy laser weapons to destroy munitions or sensors Low energy lasers to blind or dazzle Radio-frequency weapons to burn electronics and detonate munitions Directed MGs	Arena hard-kill system ZM-87 laser weapon VEMASID counter-mine system	Tanks, recon vehicles, IFVs AT, AD systems

Type Countermeasure	Countermeasure	Example	Application
Counterfire/Threat response warners	Directional warning system (locate laser/radar, to direct weapons) Employ sensors (RF/IR/UV –to detect munitions) Acoustic directional systems (to detect munitions) Laser radars (laser scanner to locate optics and direct weapons) Directed energy weapons (against optics) Anti-helicopter mines (against aircraft) Employ air watch/security, AD, NBC, nets to trigger alarm signal Dazzle grenades (temporarily blind personnel)	Pilar acoustic detection system Star-burst grenades	Infantry
Miscellaneous CM	Optical filters to degrade effect of battlefield lasers Pulse code/thermal CCM beacons on SACLOS ATGMs (to counter EOCM)	HOT-3 ATGM	

COUNTERMEASURES BY FUNCTIONAL AREA AND TYPE SYSTEM

Functional Area	System	Type Countermeasure	Countermeasure
Air Defense, Artillery, Radar units, Theater Missile units, Aviation, Headquarters	Command and communications vehicles, radars, missile launchers, aircraft (High value targets)	Camouflage	Camouflage paints, IR/radar/and laser-absorptive materials/paints
		Cover	Entrenching blade to dig-in vehicles
			Underground facilities, bunkers, firing positions
		Concealment	Canvas vehicle covers, to conceal weapons when not in use
			Thermal covers, vehicle screens
		Deformers/signature modification	Scrim, side skirts, and skirting around turret
			"Wummels" (erectable umbrellas to change/conceal shapes/edges
			Exhaust deformers (redirect exhaust under/behind vehicle
			Engine and running gear signature modification (mask sound)
			IR/radar deformers (in combination with RAM and RAP, etc.)
		Aerosols	Visual suppression measures, smokes, WP rounds
			Multi-spectral smoke grenades for IR and/or MMW bands, flares, chaff, WP, to create false targets, disrupt FLIR
		Counter-location measures	Degrade GPS by jamming to reduce precision location capability
			Jam radars/IR sensors
			Laser, IR, and radar warning systems (to trigger move/CM)
			Clutter (civilian/military vehicles, structures, burning equipment)
		Decoys	Low to high-fidelity (multi-spectral) decoys
			Radar/IR decoy supplements (to add to visual/fabricated decoys)
			Acoustic countermeasures (to deceive reconnaissance, sensors)



Functional Area	System	Type Countermeasure	Countermeasure
		CM Operational Technologies	Anti-helicopter mines (against aircraft)
			Beyond line-of-sight modes Non-ballistic launch modes Anti-radiation missiles Low energy lasers to blind/dazzle optics on designators/aircraft Encoded laser target designators to foil false target generators Radio-frequency weapons – burn electronics/detonate munitions High energy laser weapons to destroy munitions or sensors Laser false-target generator (against semi-active laser homing) Altimeter jammer (counters submunition dispersion altimeter) Fuse jammers (to spoof RF proximity fuzes on munitions) Incoherent infrared jamming (to jam IR fuzes on munitions) GPS jammers to confuse navigation and course correction systems Optical filters to degrade effect of battlefield lasers
Aircraft Units Reconnaissance UAVs Theater Missile Units	Helicopters Fixed-wing aircraft UAVs Attack UAVs Missiles	Camouflage Decoys Counter-location measures CM Operational Technologies	Camouflage paints, IR/radar/and laser-absorptive materials/paints Launcher decoys Flares, chaff, WP – decoy seekers, create false targets, disrupt FLIR Clutter (civilian/military vehicles, structures, burning equipment) Jam Radars Stealth materials and coatings GPS jammers to confuse navigation and course correction systems Jam IR sensors and seekers with laser/IR devices

Functional Area	System	Type Countermeasure	Countermeasure
			Fuze jammers (to spoof RF proximity fuzes on munitions) Radio-frequency weapons – burn electronics/detonate munitions Laser, IR, and radar warning systems (to trigger move/CM) Low energy lasers to blind or dazzle Optical filters to degrade effect of battlefield lasers Encoded CCM beacons on SACLOS ATGMs (to counter EOCM) Stand-off precision munitions (maneuvering) Beyond-line-of-sight and over-the-horizon modes Non-ballistic launch modes for missile launcher/missile survival Anti-radiation missiles to counter radars and aircraft Maneuvering re-entry vehicle (with warhead) for ballistic missiles
Information Warfare/ Deception Units	IW vehicles	Camouflage Cover Deformers/signature modification Aerosols Counter-location measures	Camouflage paints, IR/radar/and laser-absorptive materials/paints Natural and manmade cover, civilian buildings Underground facilities, bunkers, firing positions “Wummels” (erectable umbrellas to change/conceal shapes/edges) IR/radar deformers (in combination with RAM and RAP, etc.) Visual suppression measures, smokes, WP rounds Multi-spectral smoke grenades for IR and MMW bands; flares, chaff, WP, to create false targets, disrupt FLIR Degrade GPS by jamming to reduce precision location capability Jam radars/IR sensors Laser, IR, and radar warning systems (to trigger move/CM)

Functional Area	System	Type Countermeasure	Countermeasure
All Units	Combat support vehicles (Light strike vehicles, Tactical utility vehicles, Motorcycles, ATVs, Armored CSVs, etc.), Trucks	Decoys	Clutter (civilian/military vehicles, structures, burning equipment)
			Low to high-fidelity (multi-spectral) decoys
			Radar/IR decoy supplements (to add to visual/fabricated decoys)
			Acoustic countermeasures (to deceive reconnaissance, sensors
		Camouflage	Camouflage paints, IR/radar, and laser-absorptive materials/paints
			Fasteners, belts for attaching natural materials
		Cover	Natural and manmade cover, civilian buildings
			Underground facilities, bunkers, firing positions
			Armor supplements (ERA, screens, bar or box armor, sand bags)
		Concealment	Thermal covers, vehicle screens
		Deformers/signature modification	Engine and running gear signature modification (change sound)
			IR/radar deformers (in combination with RAM and RAP, etc.)
		Aerosols	Multi-spectral smoke grenades for IR and/or MMW bands;
			Flares, chaff, WP to create false targets, disrupt FLIR
		Decoys	Clutter (civilian/military vehicles, structures, burning equipment
		CM Operational Technologies	Air watch/security, AD, NBC, nets to trigger alarm signal
			Acoustic-directed counter-fire system

EMERGING TECHNOLOGY TRENDS

In order to provide a realistic OPFOR for use in Army training simulations, we must describe a spectrum of contemporary and legacy OPFOR forces that currently exist, as well as capabilities in emerging and future operational environments (OEs). Instead of trying to predict the future, this chapter notes known emerging adversary capabilities which can affect training.

The timelines for emerging OPFOR covered by this document are: 2015-2020 (Near Term) and 2021-2025 (Mid-Term). Time frames after 2025 would apply to "future" OPFOR that are considered beyond the scope of this WEG. Time categories were selected in part to facilitate building OPFOR systems and equipment well suited for Army training simulations. The timeframes are practical for use in focusing on and linking various technological trends. However, they also generally align with emerging force structures throughout the U.S. Army, as well as those known to be appearing among potential adversary nations with advanced technologies. These new technologies will pose a range of challenges to OPFOR planners and developers.

Within the designated Near Term and Mid-Term time frames, the mix of forces will continue to reflect tiered capabilities. The prevailing trend will most likely reflect an eclectic blend of forces that in large measure continue to rely heavily on legacy systems (see OPFOR tier tables). New OPFOR systems and an array of new technologies are bound to make their appearance between now and 2025. The most notable difference between the OPFOR force mix and U.S. forces is that the OPFOR will have a broader mix of older systems and a lower proportion of state-of-the-art systems. To compensate for disadvantages, OPFOR will rely more on adaptive applications, niche technologies, and selected proven upgrades to counter perceived capabilities of their adversaries. Force developers for OPFOR will retain expensive legacy systems, selectively adding affordable upgrades drawn from niche technologies. A judicious mix of equipment, strategic advantages, and sound OPFOR principles can enable even lesser (lower-tier) forces to challenge U.S. military force capabilities.

The OPFOR systems must represent reasonable responses to U.S. force developments. A rational thinking OPFOR would study force developments of their adversaries as well as methods used by the world's most technologically advanced militaries, then exploit and counter them. Thus equipment upgrades made by the world's major military powers will provide OPFOR with examples to follow in modifying their own equipment and tactics to deter, match, overmatch, or neutralize advantages enjoyed by their adversaries.

OPFOR TECHNOLOGIES AND EMERGING OPERATIONAL ENVIRONMENTS

As noted earlier in this chapter, the adaptive OPFOR will introduce new combat systems and employ upgrades on existing systems to attain a force structure which supports its plans and doctrine. Because a mix of legacy forces and equipment were selected earlier in conformance with past budgets, upgrades versus costly new acquisitions will always be an attractive option. A key consideration is the planned fielding date. To project OPFOR capabilities into the future, we should look at the technologies in various stages of research and development today, as well as those still in the conceptual stage, for applications in the future OPFOR time frame. Military engineering experience has demonstrated that the processes for identifying military requirements, and budgeting to fund research and development geared toward meeting future threats, can dramatically affect production timelines for equipment modernization programs. In addition, scientific discoveries and breakthroughs in the civilian sector have greatly accelerated the so-called "Revolution in Military Affairs," and have increased the capabilities for battlefield awareness, systems integration, and lethality. The table below shows OPFORs in emerging and future OEs, and offers some considerations relating to the impact and deployment of advanced technologies.

CONSIDERATIONS IN DETERMINING EMERGING OPFOR TECHNOLOGIES BY TIME-FRAME

OPFOR Considerations	Near-Term (2015-2020)	Mid-Term (2021-2025)
Challenging OPFOR	Emerging OPFOR	Objective OPFOR
Technology Source	Current marketed/fielded systems and subsystems	Recent major weapons, upgrade applications
Budget	Constrained but available for selected technologies	Improved, some major system acquisitions
Implications for OPFOR equipment	Many subsystem upgrades, BLOS weapons, remote sensors, countermeasures	More costly subsystems, recent major weapons, competitive in some areas
Implications for OPFOR tactics and organization; Implications for U.S.	COE tactics with contingency TTP updates. Slight subunit changes add BLOS and AT systems for integrated RISTA and strikes	Integrated RISTA with remotes. Strikes all echelons. Combined arms capacity within small units allows increased lethality and autonomy

The information revolution has also decreased the amount of time military system developers have to acquire a new technology, and either apply it to new systems or adapt it for use with older systems, before it presents a threat to friendly forces (see Equipment Upgrades section). The following technologies, and potential applications of those technologies, will influence R&D efforts as well as decisions related to future force modernization. They will, in turn, play a role in determining which OPFOR capabilities should be portrayed in future training environments.

TECHNOLOGIES AND APPLICATIONS FOR USE BY OPFOR: NEAR AND MID-TERM

TECHNOLOGY CATEGORY	TECHNOLOGY	TECHNOLOGY APPLICATION
Psychological Operations	Mood altering aerosols Reproductive terrorism Non-lethal technologies	Military and civilian targets, for short-term and long-term goals
Information Operations: Sensors	Higher-resolution multispectral satellite images New sensor frequencies for acquisition New sensor frequencies for operational security Use of light spectrum bandwidths (ultraviolet, etc.) Passive detection technologies and modes Auto-tracking for sensors and weapons Image processing and display integration Micro-sensors/imaging system miniaturization Unmanned surveillance, target acquisition/designation Multispectral integrated sensors and Multispectral integrated transmission modes Precision navigation (cm/mm three-dimension) Undersea awareness (sensors, activity) Underground awareness (sensors/mines)	High-intensity use of LITINT (Internet, periodicals, forums) Increased use of information from commercial, industrial, scientific, and military communities Increased adoption of dual-use technologies
Information Operations: Computers and Comms	Low-Probability-of-Intercept communications New power sources and storage technologies: Micro-power generation and Energy cells Advanced Human/Computer Interface Automatic Language Translators	New communities (Blogs, flash mobs, etc., to coordinate and safeguard comms) Secure encryption software New communications tools (Internet, social media and subscriber links)
Electronic Attack	Anti-Satellite weapons for RF, EMP, Hard kill Wide-area weapons (EMP, graphite bombs, etc.) EMP Precision (small area) weapons Computer Network Attack (worms, viruses, Trojan horses)	Attack electronic grid or nodes at critical times

TECHNOLOGY CATEGORY	TECHNOLOGY	TECHNOLOGY APPLICATION
	Net-centric warfare (spoofing sensors, spoofing/intercepting data stream/spyware)	
Chemical/Biological/Radiological Attack	Dirty bombs Genetic/Genomic DNA tagging to assassinate Genetic/Genomic/DNA targeting for Bio attack Designer Drugs/Organisms/Vectors Biologically based chemicals (Mycotoxins) Anti-materiel corrosive agents and organisms	Agricultural attack (animal and plant stocks and supplies) Use of tagging to eliminate political leaders
Physical Attack	Mini-cruise/ballistic missiles for precision, surgical strikes and widespread use Attack UAVs (land, sea, undersea UUVs) Micro-aerial vehicles-widespread use Swarming for coordinated attack Notebook-command semi-autonomous links Vehicle launch for NLOS attack/defense Multi-mode guidance systems: preprogrammed/guided/homing New types of warheads (wider area/different effects; tailorable warhead effects) Precision Munitions: Course-corrected/guided/homing; widespread – almost all weapons; Loiter/IFF Directed Energy Weapons (DEW): Blinding/high energy lasers; RF weapons against electronics; RF against people, vs. structures or systems; Directed acoustic weapons	
Sustainment, Protection	New battery/power cell technologies Neurological performance enhancers Better lightweight body armor Personal actuators, exoskeletons, anti-RF suits Active armor & protection systems Countermeasures to defeat rounds and sensors Counter-precision jammers, especially GNSS All-spectrum low-observable technologies Anti-corrosives Biometric prosthesis & cybernetics	Battlefield fabrication of spare parts Airborne/shipborne refineries Potable water processing systems Transportable power generation systems

TECHNOLOGY CATEGORY	TECHNOLOGY	TECHNOLOGY APPLICATION
	Robot-assisted dismounts/sensors/logistics Robotic weapons systems	

PROJECTED OPFOR CAPABILITIES: NEAR-TERM AND MID-TERM

The next table provides projected OPFOR systems descriptions and capabilities that may confront US and coalition forces in future operating environments. Data for the first timeframe (2015-2020) reflects systems and subsystems already known to exist, and assumes their introduction to the emerging OPFOR adversary force. Timelines reflect capability tiers for systems which may already be fully fielded (not Interim Operational Capability or First Unit Equipped) in brigade and division-level units during the respective time frames indicated.

The systems projections are not comprehensive, and represent shifting forecasts. They may accordingly shift further as we approach the specified time frames. Because clarity diminishes as projections attempt to discern enemy capabilities beyond the turn of the present decade, current views on future trends become less specific for the out-years . Accordingly, the second column (Mid-Term 2021-2025) focuses more on technologies, and less on defined systems.

The columns can be treated as capability tiers for OPFOR operating within specified time frames. Please note: ***No force in the world possesses all systems at their most modern tier.*** The OPFOR, as with all military forces worldwide, is a mix of legacy and modern systems. Thus the emerging OPFOR force comprises a mix of COE time frame Tier 1-4 systems and newer systems. One would expect that some Near- or Mid-term adversaries with lower military technology capabilities could move up one or two capability tiers from (for instance) current COE capability Tier 4, to COE Tier 2. The most likely upgrade for emerging OPFOR used in most training simulations would be to move the OPFOR from COE Tier 2 to Tier 1, selectively adding some new systems that reflect emerging niche technologies.

We have previously stated that an OPFOR can portray a diverse force mix by separating brigades and divisions into different tiers. The OPFOR also has the option of incrementally adding higher tier systems to lower tier units, as selective upgrades. Because most of the systems shown below in the 2015-2020 column are currently fielded, an adversary might also incrementally upgrade COE Tier 1 or 2 units by adding fielded assets from 2015-2020 as described in that column. However, as time progresses through that period, we cannot be sure beforehand when and if all of those technologies will come online. Again, the tables are not predictive. The OPFOR force designer may choose a middle road between current Tier 1-4 and future systems; in many countries they are upgrading legacy and even recent systems to keep pace with state-of-the-art improvements. Thus they may look to subsystem upgrades discussed earlier in this chapter.

If a specialized system for a specific role is missing from the table below, continue to use the OPFOR system noted in Tiers 1-4. Please remember that these projections reflect "possible" technology applications for future systems. They incorporate currently marketed systems and emerging technologies and subsystems, and thus may be combined in innovative ways. The table below is not a product of the U.S. intelligence community, and is not an official U.S. Army forecast of future "threats". It is approved only for use in Army training applications and simulations.

Future OPFOR (2025 and after) is described in various media, but is generally FOUO or classified and is not included in the WEG.

RECONNAISSANCE, INTELLIGENCE, SURVEILLANCE, TARGET ACQUISITION

SYSTEM	NEAR-TERM OPFOR (2015-2020)	MID-TERM OPFOR (2021-2025)
Smart Dust	Rocket/UAV/aircraft emit signals for ½ hour that neutralize sensors	Scattered dust attaches to metal; acoustic/crush/seismic. Emits 1 hour
Acoustic sensor vehicle	Vehicle mounts microphones or dismount array, DFs/acquires aircraft, vehicles, or artillery. Rapid queuing and netted digital display. Range 10 km, accuracy 200m. Three-vehicle set can locate artillery to 30 km with 1-2% accuracy in 2-45 sec. DF/queuing rate 30 targets per minute.	Range extends to 20-30 km with 10 m accuracy. Micro-UAVs with microphones to supplement the network in difficult terrain. Tracks and engages multiple targets. Hybrid electric/diesel engine.
Ground or Vehicle Launched Mini-UAV and Micro UAV	Dual backpack system. Man-portable ground launcher, and laptop terminal. Vehicle-launch from rail or canisters. TV/FLIR. Range 35 km, 3-hour endurance.	IR auto-tracker. Laser designator. Cassette launcher for vehicles. Signal retransmission terminal. Dispenses micro-UAVs, UGSs mines.
Micro-UAV	Hand-launched 4-rotor, 4kg, 5 km/1 hr, GPS map/view on PDA/netbook. Atk grenade.	< 1kg for dismounted sqd/team, 2 km range. Add grenade for atk UAV.
Airborne (Heliborne) MTI Surveillance Radar	Range 200 km, endurance 4 hrs.	SAR mode added. Range to 400 km.
Commercial Satellite Imagery	Resolution 5 m for IR, SAR also available. < 2 days for request. Terminal on tactical utility vehicle at division. Can be netted to other tactical units.	Response time reduction (to , 6 hours). 1-m resolution.

ANTI-TANK

SYSTEM	NEAR-TERM OPFOR (2015-2020)	MID-TERM OPFOR (2021-2025)
Manpack Air Defense and Antitank (ADAT) Kinetic-Energy Missile Launcher (also listed in Air Defense)	Co/Bn substitute for ATGMs and AD. Targets helicopters and LAVs. Shoulder launched missile with 3 KE LBR submissiles 8 km, 0 m altitude. Submissiles have 25-mm sabot/HE warhead. Nil smoke. Mounted on robotic launcher (below). FLIR night sight.	Fits into 45-100-mm gun-tubes. Defeats all targets up to 135 mm KE. Range 8 km, time-in-flight 6 sec. Fused FLIR/II sight 10 km. Launch from enclosed spaces. Can mount on robotic ADAT launcher or ADAT Robot vehicle (below)
Robotic ADAT Launcher ADAT Robot Vehicle	Pintle mounted, shoulder/ground/ATV/vehicle launched. Robotic launcher-60 m link. Twin auto-tracker. Operator in cover/spider hole. MMW/IR absorbent screen and net for operator, launcher, and surrounding spall. CPS/ATS.	Masted 4-missile, hybrid drive. Self-entrenches, moves to launch point. Fused FLIR/II sight 10 km. Remote link to 10 km. Most AD and AT vehicles have 2 control stations, 2 robots. ATGM is SAB. CPS.
Attack UAV	Hit-to-kill system. Day/night 60+ km, up to 2 hours. GNSS/inertial navigation, TV/FLIR, Frag-HE warhead. They include an anti-radiation variant.	Cargo UAV 100 km dispenses IR/MMW/SAL DP (600-mm HEAT) submunitions, EMP munitions, SAL ATGMs – UAV LTD 30 km.
Attack UAV Launcher Vehicle	Hit-to-kill UAV launched from modular launcher, 18 UAVs.	Hybrid drive. Bus reusable UCAV with 4 ATGMs to 10 km, SAL-H

SYSTEM	NEAR-TERM OPFOR (2015-2020)	MID-TERM OPFOR (2021-2025)
	GPS/inertial nav, to 500 km. First version anti-radiation homing. Added TV guided and multi-seeker attack (hit-to-kill) UAV. Laser designator range 15 km. CPS/ATS.	bombs, or bus dispensing 16 terminally-homing submunitions (with MMW/IR seekers, or laser-homing DP submunitions). CPS. LTD.
Micro-Attack UAV	Hand or canister-launched UAV with TV and FLIR guidance to 10 km, 100-600 m altitude, with .25-.5 kg warhead.	Cassette/smoke grenade launcher launch for tactical vehicles. Recon and attack (top-attack) UAVs.
Mini-Attack UAV	Hand or vehicle canister-launched UAV with TV and FLIR guidance to 35 km, 100-600 m altitude, 1-4 kg warhead.	Cassette launcher launch for tactical vehicles. Recon and attack (DP with tandem 600 mm top-attack).

ENGINEER

SYSTEM	NEAR-TERM OPFOR (2015-2020)	MID-TERM OPFOR (2021-2025)
Scatterable Mines	Deliver by artillery, cruise missile, UAV, rotary or fixed-wing aircraft. Non-metallic case, undetectable fill, resistant to EMP and jammers, with self-destruct.	Advanced multi-sensor mines with wake-up and target discrimination. Prox fuze mines. Controlled mine-fields and intelligent mines.
Off-Route Mines (Side-Attack and Top-Attack)	Autonomous weapons that attack vehicles from the side as the vehicles pass. 125-mm Tandem HEAT (900+ mm). Target speed 30-60 km/h, range 150m, acoustic and infrared sensors.	Sensor-fuzed EFP 600mm KE top attack. Remote or sensor-activated (controller turn-on/off), 360-degree multi-sensor array. Hand/heli/UAV/arty/ATGL mortar emplace.
Controlled Mines and Minefields	AT/AP, machine emplace able. Armed, disarmed, detonated by RF command. Chemical fills and non-metallic cases are undetectable. With CM and shielding, can negate jammers/pre-detonating systems.	Control may be autonomous, based on sensor data and programmed into decision logic, or by operators monitoring with remote nets.
Smart Mines	Wide-area munitions (WAM) smart autonomous, GNSS, seismic/acoustic sensors. AT/AV top-attack, stand-off mine. Lethal radius of 100 m, 360 degrees. Hand-emplaced.	Can discriminate among targets. Reports data to monitor, evaluates target paths, built-in logic. Uses GNSS to arty/heli-emplace. Non-nuclear EMP or HPW options.

INFORMATION WARFARE

SYSTEM	NEAR-TERM OPFOR (2015-2020)	MID-TERM OPFOR (2021-2025)
Electronic Warfare Radio Intercept/DF/Jammer System, VHF	Intercepts, DF, tracks & jams FH; identifies 3 nets in non-orthogonal FH, simultaneously jams 3 fixed freq stations (Rotary/fixed wing/UAV capable)	Integrated intercept/DF/jam for HF/VHF/UHF
Radio Intercept DF/HF/VHF/UHF	Intercept freq range 0.1-1000 MHz. (Rotary/fixed wing/UAV capable)	Wider Freq coverage. SATCOM intercept. Fusion/cue wuth other RISTA for for target location/ID

SYSTEM	NEAR-TERM OPFOR (2015-2020)	MID-TERM OPFOR (2021-2025)
Radio HF/VHF/UHF Jammer	One of three bandwidths; 1.5-30/20-90/100-400 MHz, intercept and jam. Power is 1000W. (Rotary/fixed wing/UAV capable)	Increased capability against advanced signal modulations. UAV abd mini-UAV Jammers
Portable Radar Jammer	Power 1100-2500W. Jams airborne SLAR 40-60 km, nav and terrain radars 30-50 km. Helicopter, manpack.	UAV and long range fixed wing jammers
High-Power Radar Jammer	Set of four trucks with 1250-2500 watt jammers at 8,000-10,000 MHz. Jams fire control radars at 30-150 km, and detects to 150 km.	UAV jammer and airship jammer. Hybrid electric/diesel drive.
Portable GPS jammer	4-25 W power, 200 km radius. Man-portable, vehicle & airborne GPS jammers, airship-mounted jammers.	Man-portable, vehicle & airborne (UAV) GPS jammers-increased range and power, and improvements in antenna design.
Missile and UAV-delivered EMP Munition	Cruise missiles and ballistic missile unitary warhead and submunition	Increased capability against advanced signal modulations
Cruise Missile Graphite Munitions and Aircraft “Blackout Bombs”	400-500 kg cluster bombs/warheads with graphite strands to short-out transmission stations and power grids	Rocket precision and UAV-delivered munitions

COMMAND AND CONTROL

SYSTEM	NEAR-TERM OPFOR (2015-2020)	MID-TERM OPFOR (2021-2025)
Radio, VHF/FM, Frequency-hopping	30-88 MHz, 100 hps, channels: 2,300; mix of analog and digital radios, tactical cellular/digital phone, all nets digitally encrypted. Burst trans. UAV Retrans	Digital radios, tactical cellular/digital phone, and satellite phones, all nets encrypted

DECEPTION AND COUNTERMEASURE SYSTEMS

SYSTEM	NEAR-TERM OPFOR (2015-2020)	MID-TERM OPFOR (2021-2025)
Air Defense System Decoy	Manufactured and improvised decoys used with decoy emitter. Covered by AD systems in air defense ambushes	Multispectral simulators of varied gun and missile systems mounted on robotic chassis
Air Defense System Decoy RF Emitter	Expendable RF remote emitters with signal to match specific nearby radars, to trigger aircraft self-protection jammers	Mounted on robotic chassis

ROTARY WING AIRCRAFT

SYSTEM	NEAR-TERM OPFOR (2015-2020)	MID-TERM OPFOR (FY 2021-2025)
Attack Helicopter	30-mm auto-cannnon, 8 NLOS FOG/IIR-homing ATGMs, range 8 km. Two pods semi-active laser homing (SAL-H) rockets 80mm (20x 8 km) or 122mm (5x 9 km). 2x LBR KE ADAT msl (warhead w/3 KE sub-missiles, 8 km range). Laser designator 15 km. UAVs to 30 km. 2nd gen FLIR auto-tracker. Radar and IR warners and jammers, chaff, flares	Tandem cockpit, coax rotor, 30-mm auto-cannon. 8 x RF/SAL-H ASMs to 40 km (28+kg HE=1300+mm), 2x SAL-H rocket pods (80mm or 122mm), 2 ADAT KE msl 8 km, and 2x MANPADs. 1/3 have ASM to 100 km. Fire control fused II/FLIR to 30 km, and MMW radar, link to ground LTD. Radar jammer. Atk and LTD UAVs to 30 km
Multi-role Medium Helicopter and Gunship	24 troops or 5000kg internal. Medium transport helicopter. Range 460 km. 30-mm auto-cannon, 8 FOG-M/IIR ATGMs to 8 km, 40 x 80 mm laser-homing rockets, 4 AAMs. ATGM launchers can launch mini-UAVs and more AAMs. Mine pod option. Day/night FLIR FCS	Fused FLIR/II to 15 km. 6x SAL-H ATGMs 18 km, 2 AAMs, 2 x 80/122-mm SAL-H rocket pods (20 or 5 ea). Laser designator to 15 km, and link to ground LTD. Aircraft survivability equipment (radar jammers and IR countermeasures).
Multi-role Helicopter and Gunship	12 troops (Load 400 kg internal, 1,600 external). Range 860 km. 23 mm cannon, 2 AAM, 4 SACLOS ATGMs to 13 km, TV/FLIR, day/night. Mine delivery pods	Launches 6x SAL-ATGM to 18 km, 28+kg HE warhead. 2 x AAM, Air-to-surface missile to 100 km. Pod w/7x SAL-H 90-mm rockets. Fused FLIR/II to 15 km. ASE
Light Helicopter and Gunship	3 troops (Load 750 kg internal, 700 external). Range 735 km. 20 mm cannon, 1 x 7.62mm MG, 6 SAL-H ATGMs to 13 km, 2 AAMs. FLIR night sight. Laser target designator. Mine pods	4xSAL-H ATGMs, 18 km range. Fused FLIR/II to 15 km
Helicopter and Fixed-Wing Aircraft Mine Delivery System	Light helicopter pod scatters 60-80 AT mines or 100-120 AP mines per sortie. Medium helicopter or FW aircraft scatters 100-140 AT mines or 200-220 AP mines per sortie.	Controllable and intelligent mines for aircraft delivery. Larger aircraft can hold multiple pods.

FIXED WING AIRCRAFT

SYSTEM	NEAR-TERM OPFOR (2015-2020)	MID-TERM OPFOR (2021-2025)
Intercept FW Aircraft	30-mm auto-gun, AAM, ASM, ARMs TV/laser guided bomb. 8 pylons Range 3,300 km. Max attack speed: Mach 4.	Stealth composite. ASE. Max G12+ All weather day/night. Unmanned option.
Multi-Role Aircraft	30-mm gun, AAM, ASM, ARM pods, guided, GNSS, sensor fuzed bombs, 14 hardpoints. Thrust vectoring. FLIR.	Improved weapons, munitions. Unmanned option. ASE all radars. Max G12+ All weather day/night.
Ground-Attack Aircraft	Twin 30-mm gun, 8 x laser ATGMs 16 km 32 kg HE, 40 SAL-H 80mm rockets, ASMs, SAL-H and GNSS sensor fuzed bombs, AA-10 and KE	Stealth composite design. ASE. Unmanned option. Max G12+ 80-mm/122-mmrockets SAL-H, SAL-H ASM (28+kg HE=1300+ mm, to 40

	HVM AAM. 10 hardpoints.Range 500+km. FLIR.	km, 2 gen FLIR, radar jammer, day/night.

OTHER MANNED AERIAL SYSTEMS

SYSTEM	NEAR-TERM OPFOR (2015-2020)	MID-TERM OPFOR (2021-2025)
High-altitude Precision Parachute and Ram-air Parachutes	High-altitude used with oxygen tanks. Ram-air parachute includes powered parachute with prop engine.	Increased range and portability. Reduced signature. Increased payload.
Ultra-light Aircraft	Two-seat craft with 7.62-mm MG, and radio. Folds for carry, 2 per trailer.	Rotary-winged, two-seat, MG, 1/trailer. Auto-gyro, more payload.

UNMANNED AERIAL VEHICLES

SYSTEM	NEAR-TERM OPFOR (2015-2020)	MID-TERM OPFOR (2021-2025)
UAV (Brigade) It may also be employed in other units (e.g. artillery, AT missile, and naval)	Rotary wing, TV/FLIR/auto-tracker, with LRF and LTD acquires targets to 15 km. Flies 180 km/6 hours, 220 km/hr, 2-5,500 m alt, 100kg payload. Can carry 2 AD/anti-armor missiles +MG for attack.	Range extends to 250 km. Increased payload. Attack version can carry 2 SAL-H ATGMs (12 km range) or 1+4 70-mmSAL-H rockets (7 km, defeats 200 mm).
UAV (Divisional)	Day/night recon to 250 km. GNSS/inertial nav, digital links, retrains. SLAR. SAR, IR scanner, TV, ELINT, ECM suite, jammer/mine dispensers. Laser designator 15 km.	Increased range, endurance. Diff GNSS. Composite materials, lower signature engine. SATCOM Retrans/relay links. Attack sub-munitions.
UAV (Operational)	Day/night recon to 400+km. GNSS/inertial nav with digital links. SLAR, SAR, TV, IR scanner, ELINT, ECM suite. Jammer option. Mine dispensers. Laser target designator 15 km. Retrans/relay.	Increased ranges, endurance. Diff GNSS. High altitude ceiling- 35 km option. Retrans/relay/SATCOM links. UAV attack sub-munitions. Laser target designators.
Unmanned Combat Aerial Vehicle (on Operational UAV platform)	Medium UAV with 4 ATGMs (range 10 km), laser-guided bombs. Laser designator 15 km. Mine dispensers. GNSS jammer, EW jammers. Range 400+ km.	Stealth composite design. ASE. Twin dispensers (pylons) with 16 terminally-homing sub-munitions, MMW/IR seekers. Range 500+ km.

THEATER MISSILES

SYSTEM	NEAR-TERM OPFOR (2015-2020)	MID-TERM OPFOR (2021-2025)
Short-Range Ballistic Missile and Cruise Missile Launcher	Twin launch autonomous vehicle (GNSS/inertial nav, self-emplace and launch). Range 450 km. Non-ballistic launch, separating GPS corrected reentry vehicle (RV) with decoys, CCD, 10-m accuracy. ICM, cluster, nukes. EMP warhead. EMP warhead. Some convert to 6-Cruise missile launch capability (500 km, 3-m accuracy, below radar). Vehicle decoys. Vehicle has visual/MMW/IR signature of a truck	Improved missile range (TBM 800 km, cruise 1,000) with 1-m accuracy. TBM has GNSS-corrected maneuvering RV. Warheads for both: terminal-homing sub-munitions, precision cluster munitions, EMP. Cruise missiles pre-program or enroute waypoint changes. Countermeasures include penaid jammers.
Medium-Range Ballistic Missile	Autonomous vehicle. Separating maneuvering warhead to 1300 km. GNSS 10-m CEP. Warheads: ICM, cluster, EMP, and nukes. Penaids include decoys, jammers. Truck visual/MMW/IR signature.	Range 2,300 m, 1-m CEP, Diff GNSS, terminal homing, separating warhead. Warheads include EMP, terminal-homing cluster munitions. Non-ballistic launch and trajectory.
Cruise Missile Cassette launcher vehicle	Off-road truck, GNSS for autonomous ops. 16/lchr. Range 470 km; preprogram GNSS inertial guidance, with in-course correction, 10 CEP. Munitions include cluster, chemical, thermobaric, DPICM, and scatterable mine sub-munition	Launcher fire direction. Supersonic missile Diff GNSS/inertial nav, 1-m CEP. Range 900km. EMP warhead option. Warheads include homing cluster munitions. Penetration aids-countermeasures.
Cruise Missile/AD Missile (Multi-role) Launcher Vehicle Category includes specialized cruise missiles, long-range ATGMs, and SAM systems to engage targets at 12+ km.	Truck with 24 launchers. Range 100 km. 28-kg Frag-HE warhead = 1300 mm. AT Preprogrammed GNSS/inertial nav phase. LTD veh range 25 km. Thermal camera to 10 km. Radar 40 km. Support UAV with LTD. FW/ship/anti-ship versions. Anti-heli RF guided MMW radar.	Penetration aids (countermeasures). IR Terminal-homing warhead or IR-homing sub-munitions can be used. MMW lock-on before/after launch.
Land-attack SAM system (secondary role for system)	The SAM system uses its EO sight and LRF (short/med range, strat “hittiles”).	Range extends with SAM ranges. Passive operation with TV/FLIR.

AIR DEFENSE

SYSTEM	NEAR-TERM OPFOR (2015-2020)	MID-TERM OPFOR (2021-2025)
General Purpose and Air Defense Machinegun	12.7 mm low recoil for ground tripod. Chain gun light strike vehicle, ATV, motorcycle, etc., on pintle. TUV/LAV use RWS. Remotely operated ground or robot option. Frangible rd 2 km, sabot 2.5 km. RAM/RAP/IR camouflage/screens. TV/FLIR fire control. Lightweight MMW radar 5 km. Display link to AD azimuth warning net. Emplace 10 sec. RF/radar DF set. ATS control option.	Stabilized gun and sights. Remotely operated computer FCS with PDA/laptop. Fused II/FLIR 5 km. Frangible, sabot rds to 3 km. Laser dazzler blinds sights. Robot mount and micro-recon/heli atk UAVs. Some light/AD vehicles replace gun with 30-mm recoilless chain gun on RWS firing a HEAT round 4 km; add-on ADAT missile launcher.
Improvised Multi-role Man-portable Rocket Launcher (AD/Anti-armor)	4-tube 57-mm launcher with high-velocity dual-purpose rockets. EO day/night sight. Blast shield. Range 1,000 m. Penetration 300 mm, 10 m radius.	Prox fuze, 1,500 m range. Penetration 400 mm, 20 m radius.
Man-portable SAM launcher	6 km day/night range/ 0-3.5 km altitude all aircraft, velocity mach 2.6. Thermal night sight. Proximity fuze, frangible rod warhead (for 90% prob hit and kill). Approach/azimuth link to AD warning net. Twin launcher vehicle quick mount. Nil smoke. Mount on robotic AD/AT launcher. RF/radar DF set on helmet.	Warhead/lethal radius increases for air/ground targets. Improved seekers – cannot be decoyed by IR decoys/jammers. Fused II/FLIR 10 km. Launch from enclosed spaces. Laser dazzler. Optional AD/AT LBR KE warhead missile – 8 km. Mounted on AD/AT robot vehicle.
MANPADS Vehicle Conversion Kit (Lt, Stryker, vans, recon TUV, truck etc.)	Twin launcher and ADMG on improvised IR SAM vehicle. Day/night IR auto-track FCS, MMW radar. Display link AD net. RF/radar DF set to 25 km. Camouflaged.	Launcher replaced with 3-missile launcher: 2x ADAT KE SAMs, 1x IR SAMs. Total 6 missiles (3 & 3)
Manpack Air Defense and Antitank (ADAT) Kinetic-Energy Missile Launcher (also listed in Anti-tank)	At company/battalion, can replace ATGMs and SAMs. Targets helicopters and LAVs. Missile has 3 KE LBR darts (sub-missiles), 8 km, 0 m altitude. Camo screen. Dart is 25-mm sabot with HE sleeve. Nil smoke. Fits on robotic ADAT launcher. Helmet RF/radar DF.	Larger sabot kills all targets up to 200 mm (KE) armor. Range 8 km, time of flight 5 sec. Fused II/FLIR 10 km. Launched from enclosed spaces. Can mount on 3x remote launcher w/ IR auto-tracker, which fits on AD/AT robotic vehicle.
Towed/Portaged/Vehicle Mounted AA Short Range gun/missile system	2x23mm gun. MMW/IR camouflage/screen. Frangible round, range 3,000 m (17mm pen). Onboard radar/TV FC with ballistic computer, 5 km MMW radar, thermal night sight, auto-tracker, net azimuth warner. Twin MANPADS. RF/radar DF set, 25 km. RWS on veh hull/turret. CPS/ATS.	Replaced with twin 30mm recoilless chain gun. Frangible, sabot, AHEAD rnds to 4 km. TV/fused II/FLIR auto-tracker 10 km. MMW radar, twin MANPADS/ADAT KE missile (8 km) launcher. APU for self-relocating or robotic mount. Laser dazzler.
Air Defense System Decoys (visual decoy, decoy emitter)	See DECEPTION & COUNTERMEASURE SYSTEMS	

SYSTEM	NEAR-TERM OPFOR (2015-2020)	MID-TERM OPFOR (2021-2025)
Brigade gun/missile turret for mount on tracked mech IFV, wheeled mech APC, truck (motorized) chassis	Twin 30-mm gun, APFSDS/frangible rds, 4 km. 30-mm buckshot rd for UAVs. Mounts 4x hyper-velocity LBR-guided SAMs to 8 km, 0m min altitude. Passive IR auto-tracker, FLIR, MMW RADAR. 2 per battalion. Track/launch on the move. Targets: air, LAVs, other ground. RF/radar DF set 25 km range. CPS/ATS.	Dual mode (LBR/radar guided) high velocity missile, 12 km, 0m min altitude. Auto-tracker (launch/fire on move). Phased array radars. Fused II/FLIR 19 km. Twin 30-mm recoilless chain gun with AHEAD type rds to 4 km. Micro recon/heli atk UAVs. TV/IR attack grenades.
Divisional gun/missile system on tracked mech IFV, wheeled mech APC, truck (motorized) chassis	Target tracking radar 24 km. TV/FLIR. 8x radar/EO FCS high velocity missiles to 18 km/12 at 0 m min altitude. Auto-track and IR or RF guided. 2 twin 30 mm guns to 4 km. 30-mm buckshot rd for UAVs. RF/radar DF. CPS/ATS.	Hybrid drive. Missile 18 km at 0 m, and kill LAVs. Fused II/FLIR auto-tracker, launch on move. Radar 80 km. Home on jam. Twin 30-mm recoilless chain gun, electronic fuzed air-burst rds to 4 km. Micro-recon/heli-atk UAVs. TV/IR atk grenades.
APC Air Defense/AT Vehicle in APC Bn (Company Command Vehicle, MANPADS Vehicle in Bn/Bde)	1-man turret on 8x8 chassis. 30 mm gun, 30-mm buckshot rd for UAVs. 100-X TV 2 gen FLIR. 2x LBR ATGM lchrs 6 km, 2x veh MANPADS lchrs. 2 dismount teams. 1xMANPADS lchr, 1xADAT KE lchr. Total 18 missiles. 12.7-mm MG. RF/radar DF to 25 km. CPS/ATS.	10x10 whld hybrid drive, box armor. 30-mm recoilless gun RWS. Add AHEAD-type 4 km, 2 veh launchers for 5 AD/AT KE LBR HV SAM 8 km. Anti-helicopter surveillance/atk micro-UAVs. Fused II FLIR 10 km. MMW radar. TV/IR atk grenades.
IFV, HIFV, or Tank ADAT Vehicle in Bn/Bde MANPADS	Vehicle on IFV, HIFV, or tank chassis with above features and weapons.	See AIR DEFENSE, APC ADAT above for weapons and upgrades.
Towed Medium Range AA gun/missile system	35mm revolving gun 1,000 rd/min. Rds: frangible, HE prox, electronic-fuzed. 4 SAMs/lchr, 45 km, 0 m min alt. Radar 45 km, 4 tgts. Resists all ECM. 2 gen FLIR auto-tracker 20 km. RF/radar DF 25 km. SAM includes active homing, home-on-jam. RAP/RAM/IR camo. CPS/ATS.	Hybrid-drive auxiliary power unit short moves. Improved FCS, radars phased array low probability of intercept acq to 80 km. Fused II/3rd gen FLIR auto-tracker to 35 km in day/night all-weather system. Track and engage 8 targets per radar.
Medium-range ground SAM system	Tracked lchr. Radar to 150 km. 4x radar-homing SAMs to 45 km, 0 m min altitude (4 targets at a time). Home on jam. Use as cruise missile – priority ground tgts to 15 km, water 25km. Fused 3rd gen FLIR auto-track. RF/radar DF. CPS/ATS.	Hybrid drive. Improved FCS with radars and EO, fused II/3rd gen FLIR day/night all-weather system to range 50 km. Radar range 200 km.
Strategic SAM System	Cross-country truck launchers, 1 x track-via-missile SAMs 400 km, at Mach 7. 1x ATBM/high maneuver missile to 200 km. Also 8 x “hittile” SAMs to 120 km. Modes are track-via-missile and ARM (home-on-jam). All missiles 0 m 50 50 km altitude vs stealth aircraft, UAVs, and SAMs. All strat/op missiles in IADS. Local IADS all AD. Battery autonomous option. Over-the-	Off-road trucks or tracked with hybrid drive. Most units, launchers have 2 big missiles+8 small “hittile” missiles ranging 200 km, altitude 0 m – 50 km. All missiles Mach 7. OTH radars operate on the move 600 km range. Targets include all IRBMs. Increased target handling capacity (100/battery in autonomous operations).

SYSTEM	NEAR-TERM OPFOR (2015-2020)	MID-TERM OPFOR (2021-2025)
	horizon (OTH) TA radar vehicle to 400 km. Mobile radar 350 km. Site CM, decoys.	
Operational-Strategic SAM System	Same as above on tracked chassis. Mobile FOs all batteries. AD radars on airships.	Same as above on tracked chassis
Anti-helicopter Mines (Remote and Precision Launch)	In blind zones force helos upward or deny helo hides and landing zones. Range 150m. Acoustic and IR fuse, acoustic wake-up, or cmd detonation. Directed fragmentation. Precision-launch mines use operator remote launch, proximity fuze for detonation. RF/radar DF.	Stand-alone multi-fuse systems. Remote actuated hand-emplaced mines with 360-degree multi-sensor array, pivoting/orienting launcher, 4-km IR-homing missile. Operator monitors targets and controls (turns on or off) sections, mines or net.
Helicopter Acoustic Detection System	Early warning of helicopters. Acoustic sensors to 10km, 200m CEP. IR sensors can also be linked to air defense net.	Range 20 km, 50 m CEP. Track and engage multiple targets. Digital link to AD net, AD unit, IADS.



MILITARY TECHNOLOGY TRENDS FOR VOLUME 2 SYSTEMS IN 2025

Year 2025 is a demarcation line for focusing on future military technologies. Even with the "Revolution in Military Affairs", most major technology developments are evolutionary, requiring one or more decades for full development. Most of the technologies noted below are in conceptual or early developmental stages, or fielded at this time. Many exist in limited military or commercial applications, and can be easily extrapolated to 2025 and the near future time frame. Throughout this period and beyond, military forces will see some legacy systems become obsolete, then either be replaced, or relegated to lesser roles with lower priorities. Most will be retained and updated several times. New technologies will emerge and be widely adopted, only to be overtaken by still more modern technologies that will drive OPFOR modernization. Additional technologies/adaptations not yet conceived will surface with little warning, be quickly adopted, and significantly impact OPFOR force structure.

SENSORS

- Multi-spectral immediate all-weather sensor transmission with real-time display
- Remote unmanned sensors, weapon-launch and robotic sensors and manned sensors
- Sensor nets integrated and netted from team to strategic and across functional areas

AIRCRAFT

- Continued but selective use of FW and rotary wing for stand-off weapons, sensors
- Aircraft critical for transport, minelaying, jamming, other support missions
- Light aircraft and UAVs adapted with multi-sensor pods for real-time fused intelligence and laser target designation

OTHER AERIAL SYSTEMS

- High-altitude UAVs, long-endurance UAVs, and UCAVs seamlessly integrated with other intelligence and support systems
- Recon/attack low-signature UAVs and UCAVs and stand-off munitions at all levels down to squads
- Ballistic missiles with non-ballistic trajectories, improved GNSS/homing re-entry vehicles, precision submunitions, EMP
- Shift to canister launchers of tactical cruise missiles with precision homing and piloted option, cluster warheads, EMP
- Airships and powered airships for long-endurance and long-range reconnaissance, and variety of other roles



• Increased use of ultra-lights and powered parachutes

AIR DEFENSE

• Integrated Air Defense System with day/night all-weather RISTA access for all AD units

• Improved gun rounds (AHEAD/guided sabot) and missiles (anti-radiation homing, jam-resistant)

• Autonomous operation with signature suppression, counter-SEAD radars and comms

•Shoulder-launch multi-role (ADAT) hypervelocity missiles/weapons immune to helicopter decoys and jammers,

• UAVs and airships for multi-role use includes air defense recon and helicopter attack

• Acquisition/destruction of stealth systems and aerial munitions and ground rockets to 500+ km

INFORMATION WARFARE

• Jammer rounds most weapons, electro-magnetic pulse rounds, weapons of mass effects

• UAVs, missiles and robots carry or deliver jammers/EMP/against point targets and for mass effects

• Multi-spectral decoys for most warfighting functions

• Computer network attack and data manipulation

ACCESS DENIAL

• Use of nuclear/bacteriological/chemical weapons to deny entry, access to areas or resources

• Use of media and public opinion for access denial

• Remotely delivered RF-controlled, smart and sensor-fuzed mines and IEDs defeat jamming

NON-LETHAL WEAPONS

• EMP/graphite/directed energy weapons to degrade power grid, information networks, and military systems

• Space-based data manipulation to deny adversary use of satellite systems

• Population control effects (acoustic devices, bio-chemical and genetic weapons, resources attack, dirty bomb)

• Anti-materiel agents and organisms (microbes, chemicals, dust, and nanotech)

• Countermeasures, tactical and technical, in all units to degrade enemy sensor and weapon effectiveness.

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Worldwide Equipment Guide

Chapter 5: Unconventional and SPF Aerial Systems





TRADOC G-2 ACE–Threats Integration

Ft. Leavenworth, KS

Distribution Statement: Approved for public release; distribution is unlimited.

Chapter 5: Unconventional and SPF Aerial Systems

Chapter 5 includes information on unconventional and SPF aerial systems.

The conflict spectrum in the Contemporary Operational Environment includes forces across the capability spectrum. They will use specially-designed military technologies, as well as improvised weapons and other systems. They will also employ all available assets for innovative applications.

That creativity will also extend into the vertical dimension. Increasingly, as modern forces are able to gain air superiority, adversaries will seek innovative ways to deny airspace, while operating in that airspace. They will increasingly turn to innovative and improvised systems. Aerial roles will include reconnaissance for ground forces and for air defense and air attack.

Improvised air and ground systems will also be used for air defense. Creativity in air defense includes decoy and camouflage arrangements. The threat from rotary-wing aircraft has led to responses such as obstacle systems in likely landing zones, use of mines, and improvised explosive devices (IEDs). New technologies such as unmanned aerial vehicles (UAVs) can be used in counter-helicopter roles. The list of improvised weapons available is limited only by human imagination.

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Airships in Military Applications

Airships ("lighter-than-air" craft) have been used in warfare since the 1800s, when balloons offered elevated platforms for military observers. Airships are increasingly used in civilian venues and offer capabilities for military use. Primary roles are:

- Communication support
- Support to electronic warfare (EW) and artillery units
- Surveillance platforms
- Air defense support

With their low cost, low upkeep, commercial availability, and ability to stay aloft with minimal signature for substantial periods, they will offer more and wider uses for military forces.

Airships can be categorized as non-rigid, semi-rigid, and rigid. Non-rigid describes balloons and blimps. ***Balloons*** can be of various shapes but without internal structure except air pockets for shaping. Most are round. ***Blimps*** (see right) generally fit the characteristic shape. Blimps can orient better in wind than round craft. Airships which are moored to a winch on the ground or on a vehicle are also ***aerostats***. Semi-rigid airships have some struts or framing, but use inflation to fill part of the structure. Rigid airships have their overall structure supported with framing. Some aerostats, especially larger ones, are semi-rigid or rigid. ***Dirigibles*** are airships powered by electric or internal combustion engines, and are rigid or semi-rigid. Their max speed varies up to70 km/hr. ***Zeppelins*** are special-designed airships trademarked by a German company.



Airships come in various shapes and sizes. They are made of varied materials, mostly PVC or UV-treated nylon. Wind speed should not exceed 25-35 km/hr during flight. Although they can be filled with hydrogen, hot air, etc., the vast majority use helium. Helium can be produced by generators in ground stations or in trailers, compressed in tanks, and distributed to airship users. Helium tanks will sustain a small airship for days. Most airships can absorb several hits while remaining aloft. Most rips and bullet holes can be easily and quickly repaired. An electric hoist can be vehicle-mounted for stationary launch, frequent relocation, and re-launch.



Support to Communications. Balloons can be used in a manner similar to ancient use of pennants and mirrors, to passively signal change in conditions or start an action, while avoiding intelligence and jamming systems. Commercial users often use balloons to trail streamers behind or stretched to the ground to draw attention and mark location of an activity. They can mark location of an LZ, flight corridor, or a registration point for navigation or fires.



Balloons can be used for rescue missions. The below helikites are offered for military uses. A jungle backpack includes aerostat, valve, helium bottle, line, handle, strobe light, bag, and instructions.









Some signal intelligence and communications units have the option of using aerostats to raise antennae for increased operating range. British Allsopp developed the Mobile Adhoc Radio Network (MANET), with three steerable Low Visibility Skyhook Helikites bearing ITT Spearnet radios to 65-m height. They demonstrated that an infantry radio, usually limited to 1 km range, can send video data (with a 15 kg helikite backpack) to a receiver 10 km away. The set can also be used to retransmit, or to control UAVs in almost any terrain. The company claims that antenna altitude could rise up 500 m.

Electronic warfare units can use aerostats to raise antennae on jammers and recon systems. A simple method would be to attach a jammer round on a cable. A GPS jammer could be mounted on a vehicle-based aerostat or on a dirigible moving within protected zones. Artillery units have long used weather balloons in meteorological units to supply data for calculating fire adjustments. Those units also have helium generators for supplying the gas.

The most widely-used role for airships is reconnaissance. In the U.S. Civil War, balloon gondolas were used by some military observers. Today some military and civilian forces use large aerostat balloons with cameras for border and aerial surveillance. Some sporting events use blimps and dirigibles to feed TV imagery for real-time broadcast. Survey, engineering, and land use organizations also use airship sensor products. The elevated view offers a long-range unobstructed field of view, and extended viewing duration. With the proliferation of small and medium-size commercial balloons, stabilized and gimbaled sensor mounts, and smaller high-resolution optical systems, use of improvised systems is expanding.



Technologies developed for commercial and recreational video-photography, and for remote military sensors and robot systems can be readily adapted to airships. Thus airship-mounted sensor arrays vary

from a simple camera or camcorder hung underneath to day/thermal video-camera or TV transmitting real-time to a palm pilot or laptop, or over a digital net. Gondolas can have a camera bar, stabilized mount, or even a gimbaled sensor ball with multiple sensors, laser-rangefinder (LRF), auto-track, and 60+ power digital/optical zoom. Navigation can include GPS location, ground-based location with a LRF, or inexpensive in-viewer display.

The easiest and most numerous applications would be to attach a camera or camcorder underneath. On page 7-7 is a demonstrated sensor set for RC aircraft. It can be mounted on aerostat balloons less than 1-m for quick over-the-hill surveillance. A separate cord can be attached to the camera or balloon to orient it in the desired direction.



Controllable Camera Mount



Mount on a Camera Bar



Gimbaled Ball

Manufacturers such as Inflateable4less offer small aerostat blimps (3-m, below) which can carry a camera. Range for an HF transmitter can limit distance to a ground station (2 km for a low-cost unit); but a hand-held display unit can operate from a vehicle.









Mini-zepp blimps come in sizes 6-13 m, for use as aerostats or as dirigibles. The dirigibles include 2 electric motors and a gas-powered motor. Options include a video head and HF transmission system. In event of a power failure, a cable drops to the ground for recovery.



The Skymedia Pro aerostat system is offered for $4,999. It includes:





- 2.4-m urethane-coated ripstop nylon balloon
- Highly precise camera bar (210° tilt pan, 2 x 360° zoom shoot carbon fiber camera platform)
- HF transmitter on the platform (2 km range)
- A remote control unit, system integrated (HF receiver patch antenna LCD color display 13 cm) -- a suitcase with all necessary chargers, battery, etc.

As airships become better-controlled and more stable, other sensors can be added to the payload. An airship could be used in tactical reconnaissance units to mount a small light-weight radar antenna, such as on the FARA-1E (Vol 1, pg 4-29). The Israeli Speed-A stabilized payload system with automated EO/thermal imager and laser rangefinder fits on lightweight airships.



Air defense units will use airships in above roles. Airship antennae can extend the range of tactical AD radio nets. Airship-mounted camera systems can detect helicopters flying at low altitudes (using forest canopy for cover) earlier than their ground-based counterparts. Airships could also raise a cordon of light-weight radar antennae over obscured approaches for early detection of helicopters and other threats.

Another air defense use can be resurrected from the World War II era using modern airships as barrage balloons. They can deny low-level airspace to enemy aircraft by:

- Forcing aircraft to fly at higher altitudes, thereby decreasing surprise and attack accuracy,
- Limiting direction of attack, permitting more economical use of AD assets, and
- Presenting definite mental and material hazards to pilots by cables and airships.

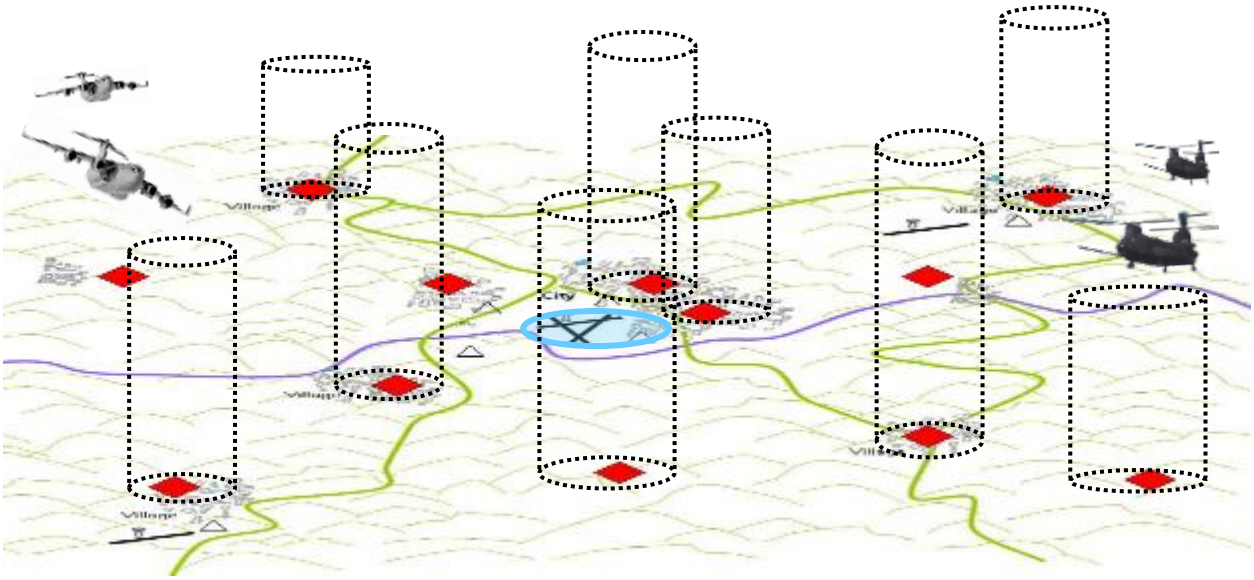
During WWII in 1944, the UK had 3,000 aerostats operating. During the Blitz, 102 aircraft struck cables (66 crashed or forced landings), and 261 V-1 rockets were downed. The blimps were 19 m long. Modern more compact airships offer more flexible options, with fast vehicle-mount winches, powered dirigibles, and lighter and stronger cables. Although modern aircraft have better sensors (such as thermal sights for night use), most airships have no thermal signature and can be camouflaged and concealed for rapid rise with minimal visual signature. Latest recorded catastrophic collision of an aircraft with aerostat cable was 2007 in the Florida Keys. The Iranians have demonstrated air mines, barrage balloons with explosive charges.



The tether cable and loose lines are the main threat to low- flying aircraft. Tether cables are next to impossible to detect in either day or night conditions, and can be steel, Kevlar, PBO or nylon. Type and length of tether material is determined by lift capacity of the balloon. Multiple loose lines and/or tethers may be suspended from the balloon. Short-notice balloon fields can be emplaced in 10-20 minutes, and raised or lowered with fast winches in 1-5. Netting, buildings, and trees can be used to conceal inflated balloons between uses. Smaller (e.g., 1-m) inflated shaped balloons can be used in target shaping, altering appearance of buildings, vehicles, weapons, etc. They can also be raised as AD aerostats.



Although some balloons will use concealment, others will be clearly displayed to divert aircraft, or trigger a response and draw aircraft into air defense ambushes. Captured marker balloons can divert search and rescue aircraft into ambushes. Balloons can be used in deception as decoys to draw aircraft away from high-value targets.



Two areas where airships are most effective in air defense are urban and complex terrain.





Remote-Controlled Aircraft and Micro-UAVs for Military Use

A wide variety of unmanned aerial vehicles are available in commercial and military sectors for use in military roles. However, cost can be a limiter for wide use. Some forces have turned to use of ***micro-UAVs***, in order to more widely distribute assets for close-in aerial surveillance. There is a burgeoning array of commercial and military options for these aerial systems. The term micro-UAV is open to wide variation, from palm size, to 1-2 meters. They can be almost as costly as mini-UAVs (up to $150,000 per set), or can cost only a fraction of that ($10,000 per set for a Russian Pestulga set). For even lower cost (and reduced capability), some forces turned to remote-controlled (RC) aircraft.



These aircraft can be used for several roles, including reconnaissance, surveillance, electronic warfare, and attack. Some use gas engines; but others are battery-powered. Most are composed of wood, plastic, or composite materials, with almost no radar signature. With camouflage and a flying altitude of more than 100 meters, most have almost no acoustic, visual, or thermal signature, and would be very hard to shoot down with current weapons. The greatest threat to them is shotguns. The surveillance role is obvious, with range of 1 or 2 km and flight range varying from a 0.5 kilometer (RC aircraft) to 10-100 km for some micro-UAVs. Beyond surveillance, other roles include electronic warfare (mounting a pocket-size GPS jammer onboard), and attack (with onboard IED charges or grenades). They have also been used to help guide suicide bombers to their target. Piloted aircraft do not like to fly where UAVs may operate. Thus micro-UAVs can be used in air defense to challenge/attack incoming aircraft. Micro-UAVs can fly harassing flights over military and civilian targets in a PSYOPS role. Low cost of the systems means that they can be used as reusable or disposable assets, with ample re-supply.

Hobbyists have been flying RC aircraft for decades. In the last decade, camera technology has advanced to the point that commercial applications for the technology have been used. They permit acquisition of affordable aerial views of buildings, wildlife areas, industrial sites, and terrain, which otherwise would require expensive use of aircraft. Military applications have been used. Tamil Tigers in Sri Lanka were found to have two aircraft with small cameras mounted inside.

A recently demonstrated RC aircraft conversion with video camera showed potential of this technology. The aircraft had a 20-km 900MHz telemetry link and 32-km flight path. Navigation data from GPS permitted precise aircraft location and image orientation. Sharp PDA for display and flight recording was used. The same imagery system could be used with airships.





The Nokia N95 camera was displayed in an RC aircraft system described as "your personal Google Earth". It features the Multiplex EasyStar battery-powered RC aircraft with a 1.37-m wingspan, weighing 680 grams. With a GPS display unit and hand-held Optic 6 RC terminal, the system is ready to use in 10 minutes. Initial system assembly from kit, set-up, and training time is 2 hours. Pict'Earth software is used to download imagery.



There are now clubs and internet forums for radio-controlled UAVs. More robust recreational aircraft are being marketed. An example is the E2 Electronic Surveillance Infrared UAV from Imaging1. The battery-powered craft (with pusher prop) is a flying wing configuration 1.85 m wide, weighing 2.7 kg. It can fly 3 hours (up to 160 km) and 1,500 m in altitude. Standard payload (up to 2.7 kg) is a CCD camera. It features autonomous take-off and landing. Thermal camera is optional. Cruise speed is 30 knots. With graphite construction, this craft offers durability for military and law enforcement applications.

A Russian micro-UAV is the Pustelga, which they call a “flying micro-vehicle” (FMV). The composite aircraft weighs less than 0.3 kg, and is hand launched. The whole system, with battery-powered UAV weighs less than 5 kg. It features a TV camera, laptop terminal, inertial/GPS navigation, digital map and azimuth display. With a skeletal frame, it has virtually no visual or acoustic signature. The “strike version” can mount a charge for attack missions.



Other micro-UAV programs are underway. These will yield even smaller systems for military applications. Most MAVs are intended as disposable sensors, for hand or canister launch from ground units or vehicles. Attack versions are being considered, with hit-to-kill attack profiles. Use of loiter and “swarm” behaviors have been demonstrated for MAV control.

Powered Parachutes, Paragliders, Hang Gliders, and Wingsuits

Often military, paramilitary, and insurgent forces will attempt to operate in areas where they do not control the skies. At key times forces will attempt to surreptitiously emplace teams behind enemy lines. To do so quickly may require the use of aircraft. But aircraft flying beyond unit can be detected, and perhaps engaged, endangering the mission and exposing inserted teams.

Aids for airborne insertion permit troops to more accurately land at the intended point and at the same time mask their landing location. Assets include the use of rotary-wing aircraft, and low-flying low-signature fixed-wing aircraft (see, An-2/Colt, pg 3-35). Terms ***parachute, paraglider,*** and ***hang glider***, are not standardized, and are used indiscriminately. They are sometimes classed as ultralight aircraft; but the link is random and due in part to sharing of facilities and the sky.



Parachuting has greatly advanced with development of the cruciform shaped (rectangular) steerable canopies, which can stay aloft longer and offer glide ability (3-4:1 glide angle) to veer from the aircraft flight path and land precisely at selected landing points. Their superior lift permits them to launch from heights, e.g., cliffs, bridges, or balloons. These parachutes can take off from the ground at lower speeds as well as descend at a slower rate than older round chutes with a soft landing, usually erect and without injury. With their drogue-type pilot chute to open the main chute, they can launch from a towing boat or vehicle. An unattached cart can bear the chutist in a tow launch. Without propulsion, parachutes lack the lift and glide ability to stay aloft for a prolonged period after launch. Chutes tethered to a towing system are called ***Parasails.***



A spin-off technology is the ram-air parachute, also commonly known as a ***Paraglider.*** The airfoil design has two layers of fabric with an open front to catch air and inflate the semi-rigid structure. Like parachutes, paragliders use nylon, which is subject to UV ray degradation. Medium performance canopies are rectangular, whereas high-performance canopies are elliptical, weighing 55-139 kg. Some are triangular wing structures, with greater glide angles (5-6:1) to extend flight distance for longer range and stay aloft longer. For experienced users, the technology offers capabilities beyond those of parachutes. They are also more subject to mishap. Poor wind can limit performance. User mistakes, and wind turbulence can result in catastrophic results, such as spin or canopy collapse. Another phenomenon is “cloud suck”, which can carry the chutist to 9 km or more, where temperatures can drop to -40 ° Fahrenheit. A chutist can also carry a reserve parachute. In most cases, a collapsed paraglider will recover on its own in about 100 m. Glide speeds can mean faster landing speeds with paragliders.



An adjunct to parachuting or paragliding is ***powered parachuting*** or ***powered paragliding***. This can involve a backpack ***paramotor,*** which can propel and steer troops. Units for parachutists generally require 40 to 70 hp. ***Powered parachutes (PPC)*** convert parachutes into aerial vehicles. With them, troops can stay aloft for long periods and long distances. The paramotor is mounted on the chutist's back, and is surrounded by a cage. A user can launch from a stationary standing position, and land erect. Most use a gasoline engine, and weigh 20-37 kg. With easily assembled cages, the motors can be transported in the trunk of a car. A Chinese electric paramotor, the Yuneec ePAC, is in pre-production testing and will likely soon be marketed.



When linked with paragliders, paramotors transform them into ***powered paragliders (PG)*** to fly 100 kilometers on a tank of gas. Paramotors for paragliders need a power range of only 15 to 30 hp. The equipment can be set up in 15 minutes. Disassembly into 3-4 parts takes about 3 minutes. Flight speed is 32-40 km at 150-5,500 meters altitude. They generally cannot launch from standstill.



An efficient design for military units is to suspend a ***trike*** under the canopy and mount the paramotor onto it. Then the operator is freed to fly the craft; and can suspend combat gear to the frame. Some are erected at launch site, whereas others are solid welded structures. Trikes require larger parachutes than for parachutists or paragliders (discussed below). The chutes have 30 cells, compared to a normal design with 13. Wind and gust should not exceed 10-15 mph in flight. Paragliders and parachutes with trikes usually take off and land from paved surfaces; however, parachute versions have lower stall speeds, and can use unpaved areas as well. One example of a commercial trike is the Powrachute Sky Rascal. The one-seat craft weighs 105/117 kgs, with 40 or 52-hp engine, max payload of 136/159 kgs, and air speed of 67-90 km/hr. Typical trike specifications are as follows:



- Continuous flight capability: ~3hrs w/ 10gal fuel tank
- Take off distance: < 30 meters
- Flight speed: 40 – 111 km/hr
- Flight elevation: up to 5,500 m AGL (150-450 typical)
- Range: Approx. ~185 km round trip
- Glide Ratio: 4-5:1
- Cost: Single Seat $6000 - $10000 USD, Two Seat: $15000 - $20000 USD
- Payload: Up to 1,100 kg (varies by engine type, GVW, and canopy)
- System Assembly / Disassembly: ~10 min w/ 1 person
- Training: 5 – 7 days



Various other structures have been added to powered paragliders, including rubber inflatable boats (RIBs, Vol 3, pg 3-11), pontoons (right) , and wheeled cab designs. A new feature for PPC is Rapid Launch Amphibious Powered Parachute, a rectangular ram-air canopy with helium-filled chambers forming a balloon. The rigid canopy lifts even at standstill, permitting launch from stationary position. Various mounts are permitted, but the one displayed with Rapid launch is a catamaran boat.

Missions with these craft include reconnaissance, insertion, and delivery of critical materials. Trikes can also be used to launch parachutists. With night vision goggles, GPS, coordination with ground support, and nighttime illumination along flight routes, they can operate at night. Illuminated areas are safer for take-off and landing. For powered PPCs and PGs,



most of the time, altitude is low (less than 500 m) to reduce likelihood of detection. Flight time is about 2-2.5 hours between refills. With refills and ground support, the craft can fly hundreds of kms. A passenger on a trike could use a laptop or PDA controller to operate small UAVs to fly ahead or conduct area surveillance along the flight path. A paramotor FARP can be as simple as a pickup truck with communications and 5-gallon fuel cans at a pre-coordinated point. Powered parachutes and paragliders are similar to ultra-light aircraft in that reliability, operator errors, wind conditions, and landing/take-off conditions can cause accidents and injuries. However, because of their slower speed and superior lift, consequences of PPC and PG accidents are usually less severe than with ultra-light aircraft.

Powered parachutes and paragliders are an inexpensive alternative to UAVs, or they can be used in conjunction with them. Iran, India, Pakistan, China, Cuba, and Lebanese Hezbollah have all demonstrated either a PPC or PG capability. In 2002 Beijing's China Central Television showed members of Special Forces reconnaissance militia using trikes and a powered paraglider with a small rubber boat similar to a small Zodiac RIB. In 2014 Hamas had plans to use Paragliders as "flying suicide bombs". Authorities in Spain, India, and Norway have also uncovered plots to use paragliders as weapons or to transport fighters into restricted territory.

Hang gliders can be classified as paragliders. Some hang gliders use rectangular parachutes or paragliders, or paraglider wings to bear them when aloft. Higher performance hang gliders use erectable Dacron rigid wings or triangular structures, with bars underneath. The operator lies prone underneath. Hang gliders offer glide angles of up to 20:1, for long flight times and distances. The wing above can block the user's skyward view; so some use transparent material to expand viewing area. Many hang gliders use erectable struts, which can be disassembled and fit into a tube 6 m long, for vehicle mount. A few makers, such as Wills Wing and Finsterwald, offer structures which can fit into 2-meter tubes and inside of vehicles.

Triangular wing paragliders with paramotors are often included in the category of ultra-light aircraft, and operate with similar capability and vulnerabilities.



Another recreational development with possible application to military actions is the ***wingsuit*** (aka ***jumpsuit***). Developed for base jumping, the suit permits a user to glide to earth, and then pop a parachute for a safe landing. Obviously, there is risk associated with this arrangement, with flight speeds of 80-200 km/h and glide ratios of 2-3:1. Training is critical. With schools, clubs, and competitions, designs vary greatly. Brands include Phoenix-Fly, V3, and many others, plus experimental and privately made creations. The jet-powered Go Fast has demonstrated a safe landing without parachute. Wingsuits permit SOF to insert personnel with less visible signature and shorter vulnerability time than those on paragliders. Wingsuits can deploy from 2-man ultralights or trike-powered paragliders, enabling insertion personnel to exit the aircraft quickly. Military designs include the German Gryphon, which has been demonstrated and displayed at exhibitions. With rigid wings and jets, it is intended to offer 40 km range and payloads for military missions. In the Near Term, more composites and inflatable sections may add rigidity for stabilization. It is likely that military versions will offer safer and practical designs for tactical roles.



Ultralight Aircraft and Military Uses

Recreational use of ultralight aircraft has generated a myriad of activities and flying organizations worldwide. Their designs are much less regulated than conventional aircraft, which has led to thousands of makes and designs. They require much shorter and less developed airfields than other aircraft, with few organizational procedures, with primary focus on operational procedures to fly the aircraft.

Many operate on water, to ease dangers of takeoff and landing. In many cases, these are the only craft that can operate in some remote areas. At right is one of several craft operating in the Nepalese mountains. Ultralight aircraft are generally cheap to operate and operators can be trained in a matter of days. The craft can travel for thousands of kms, stopping only for refueling. A number of them can hold more than two persons as well as several hundred kilograms of cargo.



Key descriptors that set ultralights apart from other aircraft are that they are manned, are smaller than conventional aircraft, and are powered. The most common configurations are the following:

- Hang-glider type with a paramotor and seat,
- Smaller conventional wing-over-cab design, and
- Rotary-wing design.



Powered hang-glider type ultralights are easy to produce, maintain, and fly. They were an outgrowth of the expansion in recreational hang-gliding. Designs widely differ; but they usually use Dacron fabric, and a triangular wing design. Similar versions employ conventional wings with swept angles. They are light and require less fuel than other designs. If the paramotor were to fail, the craft can glide to a landing.





Most ultralights have rigid structures; but many combine those structures with fabric wings and shock units. Many are fitted for water take-off and landings. The Italian Polaris FIB (left) has sold more than a thousand units in several models throughout Asia, Europe, and in the U.S. The FIB 2001 Flying Inflatable Boat is an upgraded design using a Lomac RIB hull and weighting 58 kg. It is fitted with a 48-hp Rotax 503 twin-cylinder 2-stroke engine selected for noise suppression. Other FIBs include the 503 (right), with a tandem overhead wing.



Conventional tandem wing-over-cab designs vary from finished craft with attractive designs, dashboard gauges, and shocked retractable landing gear, to Spartan frame structure. The Fotos Seamax is an example of the former. For military use, the craft are apt to be closer to the latter, but with additional features. Military craft are apt to have an open cockpit design with two seats, light weight, ample cargo capability for military gear, and ruggedized for long use and wear and tear of possible combat conditions in difficult weather and terrain. The craft should also be able to accommodate night missions. An example of this kind of craft is Quicksilver Sport 2S (see data sheet next page).



Ultralight helicopters are made mostly in the U.S., Russia, and European countries. They have been sold in other areas. Many are often referred to as gyrocopters and rotorcraft. Most are built from kits, and are 1-seater designs. The Russian K-10 (left) was an early craft used to support Naval icebreakers. An example of a more finished design is from the Italian firm Elisport. The Kompress (Angel CH-7) is a single-seat craft with a 65-hp Rotax 582 engine. It weighs 1,078 lbs, with 2.5 hrs endurance. There are a few 2-seaters available. Civilian and military roles for these rotorcraft include ambulance duty, surveillance, search and rescue, agricultural spraying, etc. Some military versions are equipped to fly unmanned.





Ultralight aircraft vary widely in their reliability and capabilities. All are more subject to weather and terrain considerations than conventional craft. Recently a Hamas-operated ultralight craft broke up off the coast of Israeli in the Mediterranean Sea. Even well-designed craft are subject to adverse events. Nevertheless, these craft offer cost-effective aerial use by civilian and military organizations.

Today ultralight craft are employed in military operations. Most common military missions are insertion of special operating forces, reconnaissance, patrol and quick-reaction units, and delivery of materiel in difficult terrain. They generally have reduced signatures. They can fly low (below radars), and land in areas where conventional fixed-wing aircraft cannot land. Military versions of these craft are used in various countries, including India, Iran, and China. Iran produces ultralight aircraft in a variety of designs. The Iranian Saba Airline Company ultralight is offered for sport flying, short-haul freight, crop dusting, fire fighting, urban taxi service, police patrolling, as well as military roles. The Saba Company offers an unmanned version of its craft for military surveillance. Ultralights could also launch small UAVs, conduct jamming missions, retransmit signals, and attack targets. Craft useable for crop dusting could also deliver chemical agents.



US ULTRALIGHT AIRCRAFT QUICKSILVER SPORT 2S






SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Min crew:	1	Minimum sink rate:	660 ft/min
Seats:	2	Required Distances:	Takeoff, ground roll – 240 ft
Blades:	Propeller - 68in x 36 (less noise)		50 ft obstacle – 660 ft
Engine:	Rotax 582, 2-stroke, 64 hp+		Landing with brake – 220 ft
	No. of Cylinders: 2	Design: Tapered stabilizer, tubular-braced tail	
	Displacement: 580.7cc	Double Surface wings	
	Dual CDI Electronic Ignition	Aluminum steerable nose wheel	
	Dual Carburetor Engine	Main wheel brakes	
Dimensions:	Length: 18ft 1/2 in	Conventional 3-axis controls	
	Height: 8 ft	Kit Assembly Time:	40-60 hours
	Wingspan: 31 ft	Breakdown for Transport:	Considered “quick”
	Wing area: 174.1 sq ft	VARIANTS	
Weight:	Empty: 430 lbs	An amphibious version of the Sport 2S is available. Similar modification with pylons could be made with most ultralights; but factors such as endurance and performance on takeoff and landing in water can vary.	
	Max takeoff: 996 lbs		
	Useful payload: 556 lbs		
Fuel Capacity:	6 US GAL		
Speed:	Cruise: 70 mph	A Quicksilver cab aircraft offers 65 mph spray speed. It has 94 liter and 140 liter fiberglass spray tanks. Spray rate is 6 acres (2.5 hectares)/min, flying at 3.7-4.7 meters altitude. Spray mixtures can vary for different spray rates. Similar ultralite craft could be used in military roles for dispensing chemical agents.	
	Max: 87 mph		
	Sea Level: 69 mph		
	Landing Approach: 46 mph		
Rate of Climb:	500 ft/min		

NOTES

THERE ARE MANY SYSTEMS OF SIMILAR DESIGN, WITH DIFFERENT FEATURES AND PERFORMANCE LEVELS. THIS CRAFT HAS A REASONABLE CAPABILITY LEVEL TO EXPECT IN A KIT ULTRALIGHT. MOST ULTRALIGHTS CAN BE MODIFIED TO FIT SPECIFIC USES, SUCH AS ADDING CAGE FOR ADDING CARGO, MORE GAUGES (SUCH AS GPS

FOR NAVIGATION), RADIO, AND EVEN MOUNTING A WEAPON PINTLE (FOR MG OR GRENADE LAUNCHER), OR WEAPON CRADLE FOR QUICK DEPLOYMENT. ACCESSORIES JUST AS NVGS COULD BE USED. NONE OF THESE MODELS ARE MARKETED BY THE MANUFACTURER FOR USE IN MILITARY ROLES; BUT THEY COULD BE USED FOR THEM.

Dec
2016

Worldwide Equipment Guide

Chapter 6: Theatre Missile Systems



TRADOC G-2 ACE–Threats Integration
Ft. Leavenworth, KS

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Chapter 6: Theatre Missiles

In an era of increased emphasis on lethality and protection against manned aerial forces, military forces world-wide are seeking to extend their deep-attack capabilities by means other than manned aircraft. Thus, new missile systems are being fielded. The trend among military forces for acquisition of theater missiles has expanded with the growth of regional rivalries and the strategy of using long-range strike capability to gain regional leverage. Theater missiles are generally categorized among two types - ballistic missiles (BMs) and cruise missiles (CMs). They are launched from ground launchers, aircraft, or naval vessels. These systems are designed for deep strike missions—beyond those of close battle assets. Where missiles are subordinate to the ground force commander, they will be used as another strike asset to support his plan. They may be used for purposes other than execution of conventional strike missions, such as delivery of mines, and information warfare missions.

Theater ballistic missiles (TBM) are an expanding threat to U.S. soldiers, allies, and interests in regions where military forces are deployed, such as South Korea, Japan, Iraq, or Afghanistan. The trend among military forces for acquisition of theater missiles has expanded along with the growth of regional rivalries and the strategy of using long-range strike capability to gain regional leverage. TBM provide the OPFOR commander the ability to strike a target(s) 3,000 km (1,864 mi) away with a nuclear warhead or with an array of conventional warheads.

The role of cruise missiles (CMs) has changed. Prior to the 1990s, fielded designs were generally limited to ***anti-ship missiles*** **(**WEG Naval Vol 3, Littoral Chapter). Improvements in guidance systems, propulsion, warhead options, launch platforms, and affordable designs have vaulted CMs to the role of the first option for deep attack against point and small area targets.

New missile systems have been developed which do not fit in the BM or CM category. These are long-range missiles flying non-ballistic trajectories with a mix of pre-programmed phase and options for manned guidance, loitering in the target area, as well as separate homing by GPS, radar or passive RF seeker, and/or IR/MMW homing. These systems may also be categorized as non-line-of-sight antitank guided missiles (NLOS ATGMs), or as unmanned combat aerial vehicles (UCAVs). They can be launched from ground vehicle launchers, ships, and/or aircraft. Some are developed as anti-ship missiles. Most have high-explosive warheads for multi-role use; and are large enough to kill armored targets and bunkers. They will supplement lethal strikes against high-value targets, including moving targets.

Systems featured in this chapter are the more common systems, or represent the spectrum of missile systems which can threaten US Army forces or interests within an operational environment. Questions and comments on data in this specific update should be addressed to:

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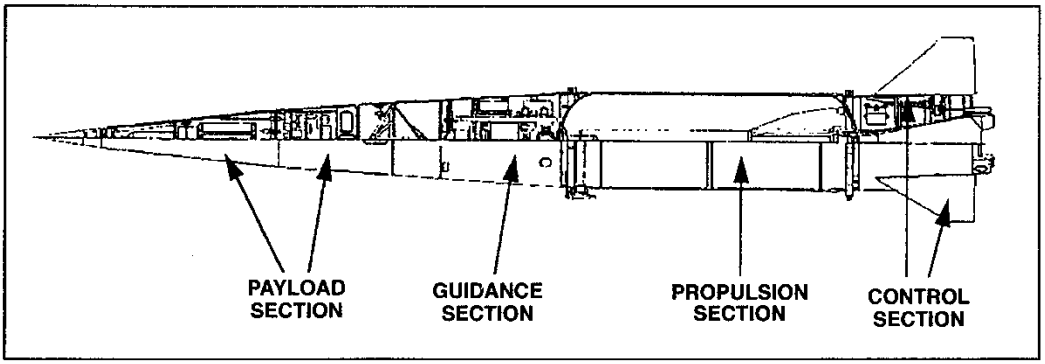
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THEATER BALLISTIC MISSILES

Theater ballistic missiles (TBMs) employ a high-atmosphere or exo-atmospheric ballistic trajectory to reach the target. Because of the high cost and limited numbers of these systems compared to artillery, they will be used against high-priority targets at critical phases of a conflict, or against political targets. Selected OPFOR forces with limited numbers of missiles may hold them in a separate missile unit at echelons above the supported ground force commander. The most critical component of a theater ballistic missile system, which defines its capabilities and limitations, is the missile. Unlike rockets, all missiles have guidance or homing for precision strikes. Missiles are generally classified according to their range—

- Short-range ballistic missile (SRBM), 0-1,000 km.
- Medium-range ballistic missile (MRBM), 1,001-3,000 km.
- Intermediate-range ballistic missile (IRBM), 3,001-5,500 km.

Numerous countries are adding technologies to extend range and improve accuracy of ballistic missile systems. Approaches for improve range include increased use of solid fuel, lengthening missiles for increased fuel and longer burn time, improving motors (in the propulsion section), using more efficient solid fuel motors, and employing smaller and lighter warheads. Key additions for precision are maneuvering re-entry vehicles (RVs), and GPS. Below is an example of a modern missile (Russian Tochka-U SRBM) and its major components.



Mobility. These missiles employ a high-atmospheric or exo-atmospheric ballistic trajectory to reach the target. Most TBMs follow a set course that cannot be altered after the missile has burned its fuel. However some have the capability for non-ballistic trajectories and precision maneuver. Ballistic missiles have three categories of propellant for engines, which are liquid, hybrid, or solid, effect the distance a missile can travel and the CEP, or accuracy.

The majority of TBMs are able to launch from the ground, or naval assets. Missile ground launch platforms vary from fixed ground launchers, trailer launchers, mobile launch complexes (numerous vehicles) and transporter erector launcher (TELs). Fixed ground launchers may include hardened underground sites. Mobile ground launchers vary from older systems with simple modifications, to specialized vehicles designed for operation in all types of terrain. Newer launchers may incorporate improved mobility to reduce vulnerability to location by terrain analysis and intelligence preparation of the battlefield.

Lethality. Critical lethality considerations for TBMs include range, precision, munitions options, and responsiveness. The missile system is selected for a mission based on its ability to reach the target within targeting timelines, and its ability to deliver effective lethality on the target. Improved heavy multiple rocket launcher systems with course correction and increased-lethality warheads have replaced TBMs as preferred strike systems against selected deep targets. For instance, a Russian 9A52 MRL can deliver twelve 300-mm rockets 70-90 km with near-missile precision and minimal preparation time. However, a modern TBM can deliver twice the payload a farther distance with better precision against critical heavy targets.

The warhead (within the payload section) is the munition, the lethality mechanism which is selected for that strike mission and around which the system is designed. Many countries acquired ballistic missiles specifically to deliver weapons of mass destruction (WMD) against civilian targets such as urban centers. For such a mission, a less accurate system with a large payload capacity is sufficient for the mission. A substantial proportion of SRBM and some MRBM designs are copies or variants of the former-Soviet SCUD-B/SS-1c. Although these systems lack accuracy and responsiveness of some the newer systems, they can deliver large lethal payloads against fixed targets or targets whose limited mobility permits them to be stationary long enough for the TBMs' operational timelines.

Warhead developments include separating warheads, multiple warheads, maneuvering reentry vehicles (RVs), navigating and homing warheads, varied lethal and electronic warhead fills, warhead buses (e.g., submunitions), and warheads with countermeasures (penaids). Improved precision, in-flight targeting updates, warhead seekers, penaids, and other upgrades will further challenge theater missile defense assets to prevent strikes against priority targets.

Newer TBM designs with improved range, accuracy and operational considerations have been fielded. All missiles have some type of inertial guidance. Accuracy ranges 300 - 500m CEP for older systems, to less than 50m CEP for some advanced systems. These include several missiles with 10 m CEP. Some missiles add global navigation satellite systems (GNSS, e.g., GPS) for improved precision. Thus, older design systems can see immediate upgrades with that change. Further precision (5-9 m) is added with infrared (IR) or radiation-homing seekers.

Another critical consideration for effectiveness of TBMs is their responsiveness. Keys for timely delivery include target location, fire mission calculation and transmission, launcher and missile operational timelines. Therefore, modern missile system support equipment can include computerized fire control, location/navigation system (such as global positioning systems), as well as dependable secure communications. A key technology for increased TBM responsiveness is the use of solid fuel propellant, which removes the need for fueling a liquid fuel missile prior to launch. That step can increase preparation time at the firing point, and delay use or compel use when changing battlefield situation changes the mission. Solid fuel missiles are more consistent and reliable; and the modern trend is toward solid and away from liquid.

Operational timelines for missile crews of fixed launchers as well as mobile TELs are addressed in three phases: (1) time from leaving the hide to launch, (2) time from launch to leaving launch point, (3) and missile trans-loading time prior to next launch. These times are based on technology requirements as well as sound tactics. Steps in the launch sequence based on technology include surveying the launch site, launch coordination, emplacing the launcher, preparing the launcher and missile for launch, initiating safety measures, and the launch. Post-launch sequence includes displacement of the launcher, and displacement of support equipment. Missile transloading is executed far from the launch site; therefore time includes travel time, service to the launcher, fueling liquid-fuel missiles for the next launch if the next launch is less than 24-48 hours, planning coordination, then movement time to the next launch area (but

not to the launch point). Additional time is included in TBM operational time lines because of survivability tactics, as noted below.

The warhead (within the payload section) is the munition, the lethality mechanism, which is selected for that strike mission and around which the system is designed. A number of newer TBM designs with improved range, accuracy and operational considerations including maneuvering reentry vehicles (RVs) have been fielded. Modern warhead developments include nuclear and chemical warheads, separating warheads, and multiple warheads. TBM can also deliver a wide variety of conventional munitions. Some examples are HE, anti-radiation (ARM), fuel-air-explosive (FAE), DIPCM, ICM cluster munition, varied lethal and electronic warhead and EMP fills, warhead buses (varied submunitions), precision navigating and homing warheads (such as IR homing). Countermeasures, including separating and maneuvering warheads, penaids, and other technical measures will further challenge the capability of theater missile defense assets to prevent strikes against priority targets.

Survivability. Technologies for increased missile reliability include almost total conversion from liquid to solid fuel. Some missiles are canisterized to protect them prior to use and permit easier handling and loading. With increased use of GPS correction and computer digital loading of propulsion system commands, possibilities of misfire and guidance failure are greatly reduced.
The high lethality of the missiles and their launchers means that both are considered by their adversary to be high priority targets for defeat and destruction. Therefore, the OPFOR can be expected to employ a variety of tactical and technical countermeasures to protect them. Tactical countermeasures include: using the missile's long range to outrange most adversary systems, use of hides (such as hardened artillery sites and terrain near the launch point or at trans-loading points to reduce exposure time, high mobility (high speed or all-terrain chassis) to move rapidly and reduce exposure time, use of OPSEC and deception operations (decoys, launch site emission control measures, movement in clutter, surge operations, etc.), and reduced launch sequence timelines (pre-surveyed site, pre-arranged communications, etc. These steps may sacrifice accuracy for reduced exposure time. More modern launchers will have a minimal preparation time between emplacement and execution of a fire mission.
Technical survivability measures for missiles include: improved coatings and camouflage patterns separating re-entry vehicles, non-ballistic trajectories (to foil trajectory prediction), cluster munitions, and penetration aides (such as jammers in warheads). Technical survivability measures for launchers include: improved coatings and camouflage patterns and nets, high mobility (to expand useable launch areas), self-survey capability (to minimize emplace time), short displacement time (<5 min), rapid launch sequence, non-ballistic trajectories (to foil back-tracking for counter-battery fires), employment of high-fidelity decoys, and SATCOM encrypted digital burst communications. These measures are intended to degrade the enemy's detection, targeting, impact or effectiveness kill, and lethality effects.

Other Considerations. State-of-the-art TBMs can cost more than a million dollars each. If the systems are not accurate enough, or if the enemy has ABM capabilities, those TBMs may not have a high assurance of success, and may not be a factor in the OPFOR plan. Thus, budgetary, political, and military considerations affect TBM decisions. The OPFOR may limit its missile requirement to systems used to gain regional political leverage by targeting civilian targets. Given the budget limitations and systems costs impacting most military forces in recent years, the OPFOR will likely have a mix of older and newer systems and selected upgrades. They may also balance the mix of TBMs with other, less costly, long-range precision strike assets. These can include ***precision artillery rockets***, ***precision artillery missiles***, non-line-of-sight antitank guided missiles (NLOS ATGMs), ***unmanned combat aerial vehicles (UCAVs)***, and ***cruise missiles***.

Conclusions. Updates to both launch platforms and missiles systems are allowing the threat to become increasingly mobile and accurate. The extended range of both missiles and their mobile platforms create a dangerous combination providing a potential adversary the ability to launch missiles and strike well beyond preconceived ranges. These assets are a critical component of deep strike mission planning for conventional forces. They are also used as an asymmetrical political tool for use in affecting strategic power calculus in peacetime international struggles.

RUSSIAN BALLISTIC AND CRUISE MISSILE LAUNCHERS ISKANDER-E, -M, AND -K





SYSTEM	SPECIFICATIONS	Launcher Performance	
Alternative Designations	SS-26, SS-X-26 Iskander-M for Russian forces Iskander-E for export	Land Navigation	GNSS
Date of Introduction	1999	Missiles per Launcher	2
Proliferation	At least 1 country. 3 other countries are considering acquiring the system. Iskander-M is in Russian service.	Total Emplace-Launch-Displace Time (min)	15
ARMAMENT	**SPECIFICATIONS**	Time Between Launches (min)	1, for second missile
Transporter-Erector-Launcher		Reaction Time	1 min
Name	SPU 9P78E (MZKT-7930 variant)	Position Location	Gyroscopic inertial with GNSS updates
Crew	3	Missile	
Chassis	MAZ-7930 (8x8)	Name	Iskander-M/Iskander-E
Combat Weight (mt)	44.7 est based on chassis	Type	Single-stage, solid-fuel
Chassis Length Overall (m)	12.67	Launch Mode	Vertical launch
Height (m): TER down	3.02	Max Launch Range (km)	400/280*
Width Overall (m)	3.05	Min Launch Range (km)	50
Armor Protection	None	Length (m)	7.3
NBC Protection System	Yes	Diameter (mm)	920
Automotive Performance		Weight (kg)	3,800
Engine Type	Diesel, 500-hp		
Cruising Range (km)	1,100		
Max Road Speed (km/h)	70		
Max. Swim Speed:	N/A		
Fording Depths (m)	1.4		
Radio	INA		
Armor Protection	None		
NBC Protection System	Yes		

NOTES

RANGE VARIES WITH DIFFERENT WARHEADS AND WARHEAD WEIGHTS. POTENTIAL RANGE WITH THE DESIGN IS 500 KM. FUTURE WARHEAD OPTIONS MAY INCLUDE BIOLOGICAL WARFARE AND NON-NUCLEAR EMP WARHEADS.

PRIMARY COMPONENTS

TRANSPORTER-ERECTOR-LAUNCHER (TEL) AND COMMAND VEHICLE: REAR SUPPORT INCLUDES A TRANSPORT AND LOADING VEHICLE (9T250E), MAINTENANCE VEHICLE, MOBILE TEST AND REPAIR STATION, DATA PREPARATION POST, AND LIFE SUPPORT VEHICLE. THE SYSTEM CAN ALSO BE LINKED INTO AN INTEGRATED FIRES COMMAND (IFC).

COUNTERMEASURES

OFF-ROAD MOBILITY TO CONCEALED LAUNCH POINT, AUTONOMOUS AND PASSIVE OPERATION AT LAUNCH POINT. MISSILE NON-BALLISTIC TRAJECTORY IN ASCENT CONCEALS VEHICLE/LAUNCH POINT LOCATION. MISSILE REENTRY VEHICLE HAS DECOYS, AND POSSIBLE FINAL-PHASE MANEUVER. WITH IR HOMING JAMMING IS INEFFECTIVE. FINAL PHASE IS MOST LIKELY NON-BALLISTIC PITCH-OVER INTO A DIVE.

GUIDANCE

INERTIAL, WITH OPTIONAL GNSS AND/OR OPTICAL/IR HOMING. ADDITIONAL COURSE CORRECTION USES THE RADAG RADAR CORRELATOR.

TRAJECTORY

BALLISTIC WITH NON-BALLISTIC BOOST PHASE FLY-OUT, AND POSSIBLE RE-ENTRY MANEUVER

ACCURACY (M)

5-7 WITH IR-HOMING; 10-20 WITHOUT

FIRE CONTROL COMPUTER

THE MODERN AUTOMATED FIRE CONTROL SYSTEM CAN BE USED AS THE BATTLE MANAGEMENT SYSTEM FOR A RECONNAISSANCE-STRIKE COMPLEX, OR “INTEGRATED FIRES COMMAND”, IN CONCERT WITH ARTILLERY AND OTHER RECONNAISSANCE AND FIRES ASSETS.

FOR IR-HOMING MODE, COMPUTER LOADS TARGET IMAGE FROM A SATELLITE OR UAV INTO THE WARHEAD. THUS, EVEN WHEN THE GNSS OR SATELLITE IS JAMMED OR WEATHER CAUSES INTERFERENCE, THE REENTRY VEHICLE WILL FIND THE TARGET.

VARIANTS

EARLY TEL VARIANT (SPU 9P78) HAS ONE MISSILE. THE TELS CAN LAUNCH R-500 CRUISE MISSILES.

ISKANDER-E: EXPORT VARIANT TEL WITH SHORTER RANGE (280 KM). THIS MISSILE WAS DEVELOPED TO COMPLY WITH THE MISSILE TECHNOLOGY CONTROL REGIME, WHICH IS NO LONGER IN EFFECT.

ISKANDER-M: DOMESTIC TEL AND MISSILE WITH 400+-KM RANGE.

ISKANDER-K: CRUISE MISSILE ONLY TEL, WITH LAUNCHER ASSEMBLY ADAPTED TO MOUNT 6 X R-500 (3M14?) CRUISE MISSILES.

WARHEAD TYPE: HE, ARM, FAE, ICM CLUSTER MUNITION (10), ICM (54 SUBMUNITIONS), NUCLEAR, CHEMICAL, TACTICAL EARTH PENETRATOR

WARHEAD WEIGHT (KG): 700/480

OTHER MISSILES

R-500: CRUISE MISSILE RANGE IS INITIALLY 280 KM; BUT NEAR TERM RANGE IS 500 KM (EST). IT HAS GNSS PROGRAMMED FLIGHT PATH, <100 M ALTITUDE, MULTIPLE WAYPOINTS, IN-FLIGHT REPROGRAM ABILITY, A VELOCITY OF 250 M/S, AND <30-METER ACCURACY. TERMINAL GUIDANCE OPTIONS INCLUDE AN IR (CORRELATOR) OR ACTIVE RADAR HOMING. PRODUCTION WAS DUE 2009. MID-TERM UPGRADE COULD INCLUDE A SUBSTANTIAL RANGE EXTENSION.

RUSSIAN THEATER BALLISTIC MISSILE TRANSPORTER-ERECTOR-LAUNCHER TOCHKA-U



SYSTEM	SPECIFICATIONS	Launcher Performance	
Alternate Designations	System with 120 km was called the SS-21 Mod 2/9K79M (see VARIANTS). For Tier 2 use SS-21 Mod 3.	Land Navigation	GNSS for command vehicle
Date of Introduction	1989 for Tochka-U	Missiles per launcher	1
Proliferation	At least 11 countries all variants. At least 3 countries Tochka-U	Emplace-launch time (min)	16 from march
ARMAMENT	SPECIFICATIONS	Displace time (min)	1.5
Transporter-Erector-Launcher		Time between launches (min)	40
Name	9P129M-1	Position location system	Inertial with GNSS updates
Crew	3	Missile	
Chassis	BAZ-5921 (6x6)	Name	9M79-1F/SS-21 Mod 3
Combat Weight (mt)	18.3 loaded	Type	Single-stage, solid-fuel
Chassis Length Overall (m)	9.5	Launch Mode	Vertical launch
Height, TER down (m)	2.4	Max Launch Range (km)	120
Width Overall	2.8	Min Launch Range (km_	20
Automotive Performance		Length (m)	6.4
Engine Type	Diesel, 300-hp	Diameter (mm)	650
Cruising Range (km)	650	Weight (kg)	2,010
Max Road Speed (km)/h)	60	Warhead Weight	482 Frag-HE
Off-road Speed (km)/h)	30	Fuze	Laser proximity for Frag-H
Max Swim Speed (km)/h	8		
Radio	R-123, R-124 on TEL		
Armor Protection	None		
NBC Protection System	Yes		

NOTES

SYSTEM ALSO REPRESENTS OTHER MODERN TBMS WHICH COULD THREATEN US ARMY FORCES. THIS IS THE TIER 2 SYSTEM FOR USE IN OPFOR PORTRAYAL IN ARMY TRAINING SIMULATIONS (SEE PG 1-5). IN LATER OPFOR TIME FRAMES, (NEAR TERM AND MID-TERM); THE TOCHKA-U IMPROVED WILL INCLUDE OTHER OPTION, SUCH AS BIOLOGICAL WARFARE AND NON-NUCLEAR EMP WARHEADS

PRIMARY COMPONENTS

BATTERY HAS 2 X TELS, 2 X 9T128-1 TRANSLOADERS, AND A C2 VEHICLE. REAR SUPPORT INCLUDES TEST VEHICLES, MISSILE TRANSPORTERS, AND MAINTENANCE VEHICLES. THE SYSTEM CAN ALSO BE LINKED INTO AN INTEGRATED FIRES COMMAND (IFC). A MET UNIT WITH END TRAY / RMS-RADAR AND RADIOSONDE BALLOONS PROVIDES UPDATED WEATHER REPORTS.

COUNTERMEASURES

OFF-ROAD MOVE TO CONCEALED LAUNCH POINT. LIKELY AUTONOMOUS AND PASSIVE OPERATION AT LAUNCH POINT. NON-BALLISTIC TRAJECTORY ON ASCENT CONCEALS VEHICLE LAUNCH POINT LOCATION. APU FOR MINIMUM IR/NOISE. ERECT-TO-LAUNCH TIME: 15 SEC.

GUIDANCE

INERTIAL, WITH IR HOMING FOR FRAG-HE. OTHER HOMING GUIDANCE FOR OTHER MUNITIONS.

TRAJECTORY

BALLISTIC WITH NON-BALLISTIC BOOST PHASE FLY-OUT, AND RE-ENTRY MANEUVER FOR HOMING MISSILES

ACCURACY (M)

5-10 IR-HOMING , OR PASSIVE RADAR HOMING 10 WITHOUT HOMING GUIDANCE.

FIRE CONTROL COMPUTER

AUTOMATED FIRE CONTROL SYSTEM CAN BE USED AS THE BATTLE MANAGEMENT SYSTEM FOR A RECONNAISSANCE-STRIKE COMPLEX (RSC), OR "INTEGRATED FIRES COMMAND" (IFC), IN CONCERT WITH ARTILLERY AND OTHER RECONNAISSANCE AND FIRES/STRIKE ASSETS.

FOR IR-HOMING MODE, COMPUTER LOADS TARGET IMAGE FROM A SATELLITE OR UAV INTO THE WARHEAD. THUS, EVEN WHEN THE GPS OR SATELLITE IS JAMMED OR WEATHER CAUSES INTERFERENCE, THE REENTRY VEHICLE WILL FIND THE TARGET.

VARIANTS

SS-21MOD 1/9K79M/TOCHKA: FIRST FIELDED SYSTEM IN 1976, WITH 70-KM RANGE, 150 M CEP.

SS-21 MOD 2: SYSTEM WITH THE 120-KM 9M79M-F FRAG-HE MISSILE. CEP IS 20-50 M.

TOCHKA-U/SS-21 MOD 3: IMPROVED SYSTEM (SEE PRIMARY COMPONENTS) WITH TEL, NAV, AND SURVEY SYSTEM AND NEW MISSILES. THEY INCLUDE

9M79-1F, THE TOCHKA-R, AND OTHERS (BELOW).

WARHEAD OPTIONS TYPE: FRAG-HE, CLUSTER MUNITION (50 APAM-SIZE SUBMUNITIONS). OTHER WARHEADS CLAIMED TO BE AVAILABLE ARE: FAE, ICM DPICM, NUCLEAR (10 KT AND 100 KT), EMP, AND CHEMICAL.

TOCHKA-R: MISSILE FOR SS-21 MOD 3 WITH ARM (ANTI-RADIATION HOMING MISSILE), WHICH LAUNCHES ON A NON-BALLISTIC TRAJECTORY, THEN TARGETS RADARS.

AN EXPORT MISSILE CAN SWITCH WARHEADS BETWEEN UNITARY FRAG-HE AND APAM CLUSTER. THERE ARE REPORTS OF TESTS WITH 2-MISSILE VERSIONS WITH 180-KM RANGE.

IRANIAN THEATER BALLISTIC MISSILE MOBILE ERECTOR-LAUNCHER SHAHAB-3A AND -3B



SYSTEM	SPECIFICATIONS	Launcher Performance	
Alternative Designations	INA	Land navigation	GNSS
Date of Introduction	INA	Missiles per launcher	1
Proliferation	Iran	Emplace-launch time (min)	60 (est)
Primary Components	INA	Displace time (min)	INA
ARMAMENT	SPECIFICATIONS	Time between launches	INA
Mobile Erector-Launcher		Position location system	
Name	INA	Missile	
Crew	3 (EST)	Name	Shahab-3A
Chassis	Based on No-dong 1type	Type	Single-stage liquid with separating re-entry vehicle (RV)
Combat Weight (mt)		Launch Mode	Vertical launc
Chassis Length Overall (m)		Max Launch Range (km)	1,300
Height, TER down (m):		Min Launch Range (km_	INA
Width Overall (m):		Length (m)	16.58
Automotive Performance		Diameter (mm)	1.38
Engine Type	V8, Diesel Engines	Weight (kg)	15,862-16,250
Cruising Range (km)	550 (est)	Guidance	Gyroscopic inertial
Speed (km/h)	Max. Road: 70 (est based off of No Dong) Off-road: UNK	Warhead Weight	760-1,158
Radio		Fuze	INA
Armor Protection	None	Accuracy (m)	190
NBC Protection System	None		

NOTES

THERE ARE REPORTS THAT PAKISTAN HAS A SIMILAR TECHNOLOGY SYSTEM.

DESCRIPTION

LIKELY A HIGHLY MOBILE TRUCK (NFI) BUILT INDIGENOUSLY FOR THE SHAHAB 3 BASED OFF THE NO-DONG BALLISTIC MISSILE TEL.

FIRE CONTROL COMPUTER: INA

COUNTERMEASURES

OFF-ROAD MOVE TO CONCEALED LAUNCH POINT. THE WARHEAD ON A RE-ENTRY VEHICLE CAN MANEUVER SEPARATE FROM THE MISSILE BODY TO CHALLENGE INTERCEPT SYSTEMS.

ERECT-TO-LAUNCH TIME: INA

VARIANTS

VARIANTS HAVE USED DIFFERENT TRUCKS AND TRAILER DESIGNS.

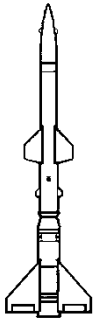
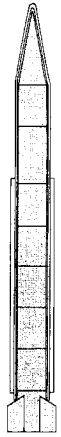
ORIGINAL SHAHAB-3: THE MISSILE AND WARHEAD RESEMBLED THE NODONG-1, WITH A 1,200 KG WARHEAD AND A RANGE OF 1,300 KM. ACCURACY IS SAID TO BE 190 M. WITH ADVENT OF THE NEW MISSILE DESIGN, IT IS NOW CALLED SHAHAB-3A.

SHAHAB-3B: THIS VERSION HAS A NEW DESIGN SEPARATING RV WITH 2,000 RANGE AND SMALLER 500-650 KG WARHEAD. ACCURACY IS SAID TO BE 190 M. IT MOUNTS ON A DIFFERENT MEL TRAILER.

SHAHAB-C AND D: REPORTS THESE ARE IN TESTING.

NO-DONG-A1: A NORTH KOREAN COUNTERPART VERSION OF THE SHAHAB-3B MISSILE.

WARHEAD OPTIONS TYPE: : NUCLEAR, HE, CHEMICAL, OR SUB-MUNITIONS

 Tochka/SS-21 Mod 2	 B610 / CSS-8	 M-11/ CSS-7
 SCUD-B / SS-1c	 Nodong-1	 DF-3 / CSS-2

FOREIGN THEATER BALLISTIC MISSILES

System Type	SRBM	SRBM	SRBM	SRBM	SRBM	SRBM	SRBM	MRBM	IRBM	Technologies & Trends
Name/ NATO Name Designator	Tochka-U SCARAB SS-21 Mod 3	M-7 B610 CSS-8	SCUD-B SS-1c	SCUD-B Mod 2 SS-1c Mod 2	M-11 DF-11 CSS-7	SCUD-C SS-1d	M-9 (export) DF-15 CSS-6	Nodong-1	DF-3 CSS-2	More SCUD variants
Producing Country	Russia	China	Russia North Korea	Russia	China	Russia North Korea	China	North Korea	China	Technology Transfer
Proliferation (countries)	At least 11 all variants	At least 2	At least 20	At least 1	At least 2	At least 5	At least 1	At least 1	At least 2	Increased proliferation
Type Launcher	TEL	TEL	Fixed, TEL	Fixed, TEL	TEL	Fixed, TEL	TEL	TEL	Fixed, Mobile complex	Mobile/decoy launchers
Propulsion	Single-stage Solid	Single-stage (est) Solid	Single-stage Liquid	Single-stage Liquid	Single-stage Solid	Single stage Liquid	Single-stage Solid	Single-stage Liquid	Single-stage Liquid	Non-ballistic trajectory
Range Min-Max (km)	20-120	50-150	50-300	300	50-300	500	200-600	170-1,300	1,500-3,000+	Increased range
Guidance	Inertial	Inertial	Inertial	Inertial IR homing	Inertial	Inertial	Inertial	Inertial	Inertial	Multi-sensor Homing
Accuracy (m) (Max Range)	5-10 IR-Hmg 15 without	150	1,000	50	300	<800	600	4,000	2,000-2,500	Improved Guidance
Payload (kg)	480	190	1,000	600	800	700	500-600	770	1,500-2,150	Separating multiple RVs

Warheads	HE, Chem, ARM, Nuc, IR Homing, APAM, ICM, EMP, DPICM	HE, Chem	HE, Chem, Nuc	Separating HE, Nuc	Separating HE, Nuc poss Chem	HE, Chem	Separating. HE, Nuc poss Chem Poss Fuel-Air Submunitions	HE, Chem poss Nuc	HE, Nuc, or 3 separating reentry vehicles (RVs)	Cluster, Volumetric, Submunitions BW warheads ARM, EMP
Comments	TEL is amphibious 2 msls/TEL	Modified SA-2 SAM Tracked TEL	Technology widely used	Previously called SCUD-E Requires compatible IR imagery	Exported as M-11	SCUD-B variant Russia limited production	Mod 2 range 1000 km DF-15B CEP 150-500 m DF-15C CEP 35-50 m	SCUD-B variant ND-2 IRBM variant Poss export	Variants with varied warheads and ranges Towed launcher Lengthy prep time	Autonomous operation, Penaids*/ Counter-measures, Reduced prep /displace times

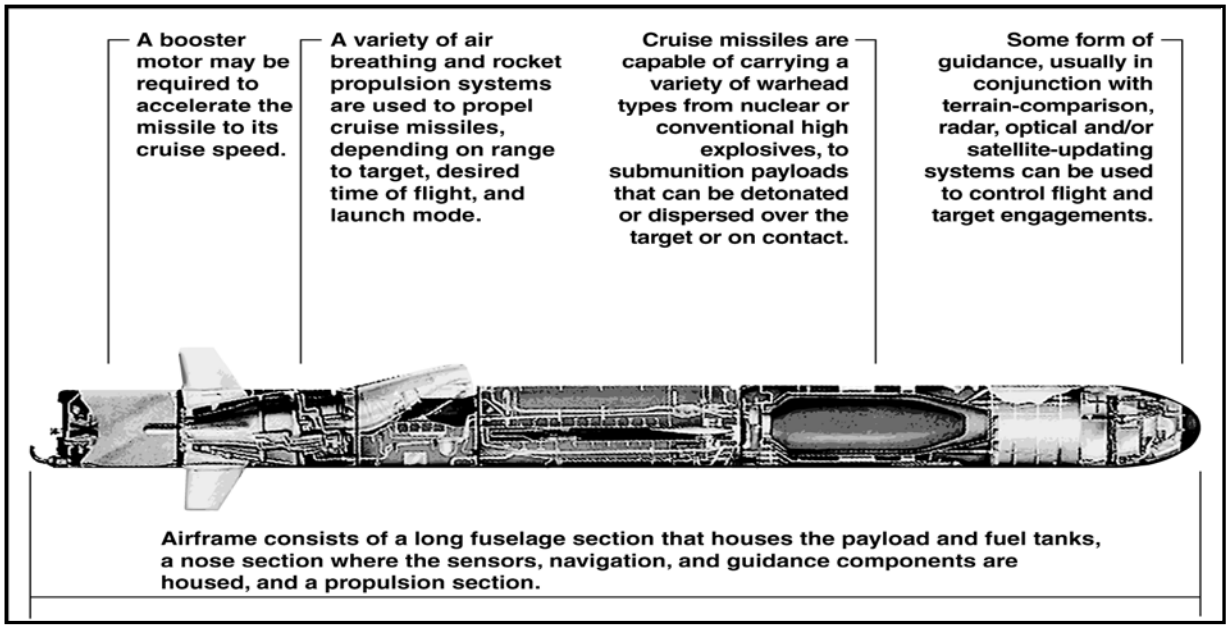
* Penaids - Penetration aids, such as RF jammer

CRUISE MISSILES

In the global arena many countries, including potential Threats to the U.S., are procuring cruise missiles (CM) as an inexpensive alternative to ballistic missiles and aircraft. CMs are economical and accurate delivery systems that can be used to deliver conventional, and nuclear, chemical and biological warheads. CM proliferation poses an increasing threat to U.S. National security interests. As the technology matures further, both State actors and non-state actors are becoming increasingly able to acquire cruise missile and effectively employ CM capabilities. The Hezbollah 2006 cruise missile attack on the INS Hanit illustrates the danger to units that are not technically prepared to meet this challenge.

Many older CMs are still used in less capable military forces. They fly a straight course to target with relatively slow speed (subsonic), are vulnerable to early detection, and can be shot down. Due to imprecision in guidance systems and the difficulty of flying long distance overland to ground targets, they are used as ***anti-ship missiles***. But in most forces they are being replaced by newer systems.

Cruise missiles (CM) are unmanned precision aerodynamic munitions with warheads propelled by rocket motors or jet engines, and designed to consistently fly a non-ballistic trajectory to the target. The diagram below illustrates the four main components of a basic cruise missile: (1) a propulsion system, (2) guidance and control system, (3) airframe, and (4) payload. CMs may have booster rockets which fall off after fuel is depleted. Then turbofan engine engages, the tail fins, and air inlet, and wings unfold. At the target the missile either dispenses its submunitions or impacts the target and is destroyed.



The overall sophistication of CMs has increased greatly with technological advancements. This is especially true with regard to guidance systems in the era of more capable Global Navigation Satellite Systems (GNSS) like GPS, Russian GLONASS, Chinese Beidou and the European Galileo. These advanced guidance systems, in combination with autonomous onboard systems, have allowed CMs to become more accurate in acquiring targets. The basic CM guidance controls consist of one of four different systems (below) that direct the missile to its target. Most newer CMs use a combination of systems to provide redundancy and precision in a combat environment.

1. Inertial Guidance System (IGS) tracks acceleration via accelerometers from missile movement compared against a known first position, usually the launch position to determine current location.

2. Terrain Contour Matching (TERCOM) uses a radar or laser altitude system, and compares terrain features enroute to a pre- loaded 3-D map terrain database.

3. GNSS (e.g., GPS), uses satellites and an onboard receiver to verify the missile's position.

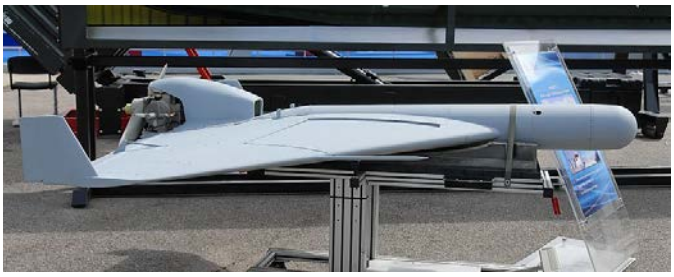
4. Digital Scene Matching Area Correlation (DSMAC) uses a camera and image correlator to identify the target (good versus moving targets).

The most effective mix is IGS on the airframe, with TERCOM and/or GNSS with multiple route waypoints. Upon arrival in the target area, the missile can loiter or home based on warhead identification of target DSMAC, GNSS, or radiation confirmation. Some CMs can change route and target assignment while enroute, to maximize their effectiveness.

Technology of CMs is changing; and their role is expanding. CMs are relatively mobile and easy to conceal. Even after launch the missiles can avoid detection by traveling at low altitude, under many radar horizon and use terrain masking until the CM reaches the target. The newer CMs present even greater challenges to aircraft and air defense assets by integrating stealth features that make them even less visible to radars and infrared sensors. CMs can take roundabout routes to engage their targets, and are usually programmed to circumvent known defenses and engage targets from gaps in radar and SAM coverage. Modern cruise missiles offer flexibility for different configurations, and for air, sea, and ground-launch. In the COE, ground-launched CMs (GLCMs) can fly to targets within artillery range to support artillery fires, or deep to attack high-value ground targets. A CM's size, alterable course, and unique low flight profile makes it a convenient system for dispensing chemical or biological agents, for jamming, and for designating targets with an LTD. Examples of applications include *Exocet* and *Apache*. Swedish Bofors, South African Denel, and German LFK offer similar systems.

CMs used against ground targets are referred to as ***land-attack cruise missiles*** (***LACMs***). They can be ground, ship, or air-launched. Precision guidance has permitted rapid growth of multi-role ***air-launched cruise missiles*** **(ALCMs)**, for use against various naval and ground targets. ALCMs for land-attack are included in WEG chapters on aircraft or in later issues. Cruise missiles vary in size, range (25-2,500+ km), and warhead payload. Larger ones can actually be manned bomber aircraft loaded with ordnance and controlled by a remote pilot system. An innovative modern small CM is the Harpy, which can launch 18 missiles from a truck "cassette launcher". The BrahMos is an example of an operational level supersonic GLCM system, with future applications on other platforms. Initial uses are against ships, as well as high value nodes, such as airfields, C4, and missile launch sites. BrahMos ALCM and ship-launched versions are due out soon.

ISRAELI UNMANNED AERIAL VEHICLE HARPY, HARPY NG



SYSTEM	SPECIFICATIONS	PAYLOAD TYPES	SPECIFICATIONS
Alternative designations:	Harpy 1	Passive Radar Seeker Sensor	Wide Range of Frequencies, 2-18 GHz, pulse and constant wave frequencies
Date of introduction:	1988	Optical Camera:	Electromagnetic/Optical
Proliferation:	At least 5 countries	User Image Capabilities:	Receive images on possible targets via datalink
Ground Crew:	1-3 per truck launcher	Missile:	HE Fragmentation warhead
Engine (hp):	27.5, 2 cylinder, 2 stroke	Max Payload w/Warhead (kg):	32
Propulsion:	Two blade pusher propeller	VARIANTS	SPECIFICATIONS
Weight (kg):		Harpy NG:	
Max Launch Weight (kg):	135	Weight (kg):	135
Speed (km/h):		Wing Span (m):	INA
Maximum (level):	260	Max Launch Weight (kg):	160
Cruising Speed:	185	Service Ceiling (m):	4,572
Endurance (hrs):	6	Radius of Operation (km):	INA
Max Ceiling, normal (m):	INA	Cruising Speed km/h):	120
Ceiling, Service (m):	2,438	Endurance (hrs):	9
Radius of Operation (km):	500	Max Level Range (km):	1,080 (Estimated)
Dimensions:		PAYLOAD TYPES	SPECIFICATIONS
Wing Span (m):	2	Missile:	HE Fragmentation warhead
Overall Length (m):	2.4	Warhead Weight (kg):	15, Same as Harpy 1
Overall Height (m):	.36	Missiles per Launcher	12, Simultaneous fire ability
Flight Control:	GPS and inertial backup geo positioning, autonomous preprogrammed flight	Launcher Trucks per Battery	1 Ground Control Truck with 3 Launcher Medium Trucks
Launch Method:	Booster rocket launched from truck launcher	Radio Frequency (RF) and Electro-Optical Sensor	Combined sensors can be used. Expanded lower RF.
Recovery/Landing Method:	Not applicable, terminal strike	Data Link (direct LOS) (km):	INA
Launcher Trucks per Battery	3 4X4 or 4x6 Medium trucks		
Missiles per Launcher:	18		
Total Missiles per Battery:	54		

NOTES

THE PURPOSE OF THE HARPY DEVELOPED BY ISRAELI AEROSPACE INDUSTRIES (IAI) IS TO ACQUIRE TARGETS WITH A PASSIVE RADAR SENSOR IN ORDER TO DESTROY THE RADARS ASSOCIATED WITH SURFACE TO AIR MISSILES OR OTHER GROUND TARGET ACQUISITION RADARS. HARPY CAN BE USED AS A LOITERING CRUISE MISSILE IN PREPROGRAMED MODE. IT CAN ALSO BE CONSIDERED A UCAV, USING PREPROGRAMMED OR HOMING ATTACK MODES AND OPERATE

DAY OR NIGHT. IF THE TARGETED RADAR IS TURNED OFF BEFORE THE HARPY MAKES ITS TERMINAL DIVE IT HAS THE ABILITY TO AUTOMATICALLY CANCEL THE STRIKE AND CONTINUE SEARCHING FOR OTHER TARGETS.

THE COMBAT UNINHABITED TARGET LOCATE AND STRIKE SYSTEM (CUTLASS) WAS A DIFFERENT DESIGN THAT IAI ATTEMPTED IN 2000. IAI WORKED WITH RAYTHEON TO ACQUIRE A DOD CONTRACT. SIMILAR IN MISSION BUT MUCH SMALLER THAN THE HARPY AND TUBE LAUNCHED FOR USE ON U.S. NAVAL SHIPS. HOWEVER, IAI AND RAYTHEON WERE NOT ABLE TO ACHIEVE A PRODUCTION CONTRACT FROM DOD AND THE JOINT VENTURE WAS TERMINATED. IT IS THEREFORE NOT LISTED ON THE WEG SHEET.

THE NEW HARPY NG VARIANT WAS RECENTLY REVEALED AT THE 2016 SINGAPORE AIR SHOW. AMONG MANY IMPROVEMENTS THE HARPY NG GROUND CONTROL CREW CAN PREPROGRAM MULTIPLE, SEPARATE TARGET PROFILES FOR AUTONOMOUS STRIKES. THIS ENHANCEMENT ALSO ALLOWS THE NG VARIANT TO AUTOMATICALLY SWITCH FROM PRIMARY TO SECONDARY TARGET PROFILES IF THE PRIMARY TARGET IS NO LONGER AT THE DESIGNATED AREA. ITS HIGHER ALTITUDE CAPACITY ALLOWS IT COVER A WIDER AREA AND AVOID DIRECT FIRE WEAPONS AS WELL AS ACOUSTIC SENSORS. ANOTHER SIGNIFICANT IMPROVEMENT IS AN EXPANDED FREQUENCY OF ITS RADAR SENSOR FROM THE ORIGINAL HARPY AT 2-18 GHZ TO THE LOWER END OF 0.8-18 GHZ IN ORDER TO DETECT LOW END FREQUENCY RADAR EMITTERS.

BECAUSE OF ITS DUAL PURPOSE AS A UAV AND A MISSILE, THE HAROP CAN ALSO BE FOUND IN WEG VOLUME 2, CHAPTER 3: UNMANNED AERIAL VEHICLES.

ISRAELI MISSILE/ATTACK UNMANNED AERIAL VEHICLE HAROP







SYSTEM	SPECIFICATIONS	Dimensions:	
Alternative designations:	Harpy 2	Wing Span (m):	3
Date of introduction:	2009	Overall Length (m):	2.5
Proliferation:	At least 6 countries	Overall Height (m):	.3
Ground Crew:	3-4 (EST)	Flight Control:	Mission Control Shelter (MCS) controls vehicle with a "man-in-the-loop" able to engage or abort the attack in real time. In event of an abort, reverts to loiter mode until attack is restarted.
Engine (hp):	38	Launch Method:	Solid-propellant booster rocket from ground-based storage container
Propulsion:	Rotary engine driving a 2-blade pusher propeller	Recovery/Landing Method:	Intentionally expendable, non-recoverable
Weight (kg):		Launcher Trucks per Battery	INA
Max Launch Weight (kg):	135	Missiles per Launcher:	12
Speed (km/h):		Total Missiles per Battery:	INA
Maximum (level):	INA	PAYLOAD TYPES	SPECIFICATIONS
Cruising Speed:	185	Passive Radar Seeker Sensor	Wide Range of Frequencies
Endurance (hrs):	6	Electro Optical	Color CCD, FLIR (IAI Tamam POP-200)
Max Ceiling, normal (m):	INA	User Image Capabilities:	Images received via satcom datalink.
Ceiling, Service (m):	3,000	Missile:	HE Fragmentation warhead
Range (km):	1,000	Max Payload w/Warhead (kg):	23

NOTES
HAROP RESEMBLES AN EARLIER ISRAEL AEROSPACE INDUSTRIES (IAI) 'SUICIDE DRONE' KNOWN AS HARPY. THE MAIN DIFFERENCES ARE THE OUTER WING EXTENSIONS, THE LONGER NOSE, AND CANARD FORE PLANE. LIKE HARPY, HAROP IS LAUNCHED FROM A VEHICLE-MOUNTED CONTAINER. IT AUGMENTS THE HARPY'S RF SEEKER WITH AN ELECTRO-OPTICAL SENSOR, ALLOWING IT TO ACQUIRE AND PURSUE NON EMITTING TARGETS AND MOVING TARGETS AS WELL AS 'QUIT' TARGETS SUCH AS SHUT-DOWN RADARS. IT CAN BE LAUNCHED AT ANY ANGLE AND AT HORIZONTAL OR VERTICAL TRAJECTORIES. BECAUSE OF ITS DUAL PURPOSE AS A UAV AND A MISSILE, THE HAROP CAN ALSO BE FOUND IN WEG VOLUME 2, CHAPTER 3: UNMANNED AERIAL VEHICLES.

INDIAN/RUSSIAN SUPERSONIC CRUISE MISSILE BRAHMOS/BRAHMOS II



SYSTEM	SPECIFICATIONS	Missile	
Alternative Designations	PJ-10	Name	BrahMos
Date of Introduction	By 2006. First Army ground launch regiment was fielded in 2007.	Type	Two-stage, solid-propellant launch and kerosene ram-jet cruise
Proliferation	Developed and offered for export. Russian system is fielded in at least 1 country. Indian contract signed for $2 billion in missiles. Talks have been held with five other countries.	Launch Mode	Angular or vertical
ARMAMENT	**SPECIFICATIONS**	Max Launch Range (km)	290
Transporter-Erector-Launcher		Max Launch Range (km)	INA
Name	Tatra variant (NFI)	Max Altitude (m)	14,000
Crew	3 (est)	Min Altitude (m)	5-10
Chassis	12x12	Missile Speed	Mach 2.8-3.0
Description	It is described as a high-mobility truck (NFI) built indigenously for the MAL.	Length (m)	8.9
Radio	INA	Diameter (mm)	670
Armor Protection	None	Weight (kg)	3,000
NBC Protection System	None	Weight with Canister (kg)	4,500
Launcher Performance		Warhead Weight (kg)	Weight (kg): 250
Land Navigation	GNSS	Warhead Type	Shaped Charge anti-ship
Missiles per launcher	3	Other Warheads	BrahMos A weighs 300 kg. For ground targets, HE warhead is available.
Total emplace time (min)	5		

NOTES

BRAHMOS 2 IS A CONCEPT FOR A FUTURE INDIAN HYPERSONIC CRUISE MISSILE WITH MACH 6-7 VELOCITY.

DESCRIPTION



PRIMARILY DEVELOPED AS AN ANTI-SHIP MISSILE. IT CAN BE USED AS A LAND-ATTACK CRUISE MISSILE (LACM). LAUNCHERS INCLUDE LAND-BASED TEL, AIRCRAFT AND SHIPS (E.G., DESTROYERS). IT CAN ALSO BE LAUNCHED FROM SUBMARINE, FIXED GROUND SITE OR PONTOON UNDERWATER SILO.

PRIMARY COMPONENTS

TRANSPORTER-ERECTOR-LAUNCHER (TEL) IS CALLED A MOBILE AUTONOMOUS LAUNCHER (MAL) LINKED INTO AN INTEGRATED FIRES COMMAND (IFC). THERE IS ALSO A MOBILE COMMAND POST (MCP) WITH IT. RELOAD MISSILES WILL BE LOADED AT A TRANSLOAD POINT FROM A TRANSLOADER VEHICLE (SEE ABOVE).

COUNTERMEASURES

MISSILE SHIFTS FROM RADAR TO INERTIAL AT THE END OF ITS HIGH APPROACH PHASE, USES TERRAIN DATA TO SHIFT TO THE LOW APPROACH, THEN AND USES RADAR FOR ITS COURSE CORRECTION. LOSS OF RADAR DUE TO JAMMING OR OTHER CAUSE STILL PERMITS INERTIAL GUIDANCE OFF ITS LATEST COURSE. HIGH SPEED AND LOW FLIGHT MODE WILL CHALLENGE ALMOST ALL DETECTION AND INTERCEPT RADAR AND WEAPON SYSTEMS.

GUIDANCE

INERTIAL, WITH GNSS MID-COURSE CORRECTION SENSOR WITH UP TO 20-KM ADJUSTMENT FROM A DISTANCE UP TO 50 KM OUT. TERMINAL HOMING RADAR CORRELATOR.

TRAJECTORY

NON-BALLISTIC. MOST LIKELY USE IS HI-LO PROFILE (HIGH, EARLY PHASE, LOW ON APPROACH TO TARGET).

ACCURACY

HOMES TO SHIP AND AIMS USING RADAR CORRELATION TO HIT CENTROID. ACCURACY VARIES BY SEEKER, WITH <20 M.

VARIANTS

THIS IS AN INDIAN-PRODUCED SYSTEM FROM A RUSSIAN-INDIAN JOINT VENTURE. IT IS A VARIANT OF RUSSIAN SS-N-26/YAKHONT, AKA 3M55 ONIKS. THE SUPERSONIC YAKHONT HAS BEEN EXPORTED.

THE RUSSIAN MISSILE HAS A RANGE OF 300 KM WITH HI-LO FLIGHT PROFILE. THE RUSSIANS EMPLOY THE YAKHONT IN RECONNAISSANCE-STRIKE COMPLEXES (RSCS - SIMILAR TO INTEGRATED FIRES COMMANDS).

BRAHMOS A: AERIAL LAUNCH VERSION. LAUNCH TESTS FROM SU-30MKI FIGHTERS ARE IMMINENT.

BRAHMOS ARMY VERSION: FEATURES INCLUDE TERRAIN FOLLOWING CAPABILITY. AN IR SEEKER WILL BE AVAILABLE FOR THE ARMY VERSION

BRAHMOS II: AIR-LAUNCHED HYPERSONIC CM IS APPROVED FOR FIELDING. EXPECTED SPEED IS MACH IS 5+.

A BRAHMOS SHIPBOARD LAUNCHER IS IN TESTING, AND IS DUE OUT SOON, AS IS A SUB LAUNCH VERSION.

ISRAELI LYNX ROCKET/MISSILE LAUNCHER WITH DELILAH MISSILES





SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designations	Lynx is both the launcher module which can fit on various mounts and the Israeli launcher vehicle name.	Launcher Performance	
Date of Introduction	By 2007. Delilah cruise missile used in combat in 2006.	Land Navigation	GPS/inertial
Proliferation	At least 3 countries. Two others are testing versions of the system and adaptations of rockets and/or missiles. Others are looking at adopting TCS to their MRLs	Missiles per launcher	See the Loads above. They can use separate loads on the 2 modules (or launch pod containers, LPCs).
ARMAMENT	SPECIFICATIONS	Total emplace time (min)	5
Transporter-Erector-Launcher		Reload Time (min)	20
Name	Mercedes 3341	AMMUNITION	SPECIFICATION
Crew	3	Name	LAR-160 Rocket
Chassis	6x6	Type	Composite solid-propellant
Range	500 km (est)	Max Launch Range (km)	45
Radio		Min Launch Range (km)	10
Protection	Armor Protection: None. The LAROM and perhaps other variants are armored. NBC Protection System: INA	Rocket Speed (m/s)	1,022
Armor Protection	None. The LAROM and perhaps other variants are armored	Length (m)	3.48
NBC Protection System	INA	Diameter (mm)	160
		Weight (kg)	110
		Warhead Options	Frag-HE/PD or DPICM with time-fuze dispense.

NOTES

THE LAR-160 ROCKET OFFERS A LETHAL EFFECTS AREA PER ROCKET OF 31,400 M2. WITH TCS (E.G., ACCULAR), ROCKETS PERFORM A PITCH-OVER FOR TOP ATTACK AND AN OPTIMIZED CIRCULAR PATTERN FOR FRAG-HE WARHEAD EFFECTS OR SUB-MUNITIONS. THUS, ACCULAR ROCKETS SHOULD HAVE EVEN GREATER LETHAL EFFECTS.

DESCRIPTION

BECAUSE THE LAUNCHER CAN LAUNCH A VARIETY OF ROCKETS (122 MM OF VARIOUS, 160 MM ISRAELI LAR, WITH OR WITHOUT TCS), AND EITHER EXTRA OR DELILAH-GL MISSILES, IT IS LIKELY THAT THE PRIMARY MUNITION MIX WILL DEPEND ON ORGANIZATION LEVEL OF THE LAUNCHER. IF IT IS AT TACTICAL LEVEL, IT IS LIKELY TO BE USED PRIMARILY TO LAUNCH ROCKETS, WITH A FEW MAYBE DESIGNATED FOR EXTRA MISSILES. THOSE LAUNCHERS AT THE OPERATIONAL/STRATEGIC LEVEL ARE MORE LIKELY TO LAUNCH MISSILES, AND PERHAPS ACCULAR (LAR-160 WITH TCS) ROCKETS.

PRIMARY COMPONENTS

TRANSPORTER-ERECTOR-LAUNCHER (TEL) AND MOBILE COMMAND POST (MCP) VAN. RELOAD MODULES WILL BE TRANSLOADED AT A TL POINT FROM A TRANSLOADER TRUCK WITH FOUR MODULES, TO SERVICE TWO LAUNCHERS.

OTHER AMMUNITION

GRADLAR: ISRAELI UPGRADE PACKAGE WITH IMPROVED FCS CONVERTS MRLS FOR MODULES OF 122-MM GRAD ROCKETS AND 21-45 KM RANGE. ANY TYPE OF GRAD 122-MM ROCKET CAN BE USED.

LAR-160 OR LAR: 160-MM ROCKET (13 PER MODULE) WITH A 45-KM RANGE. THE WARHEAD IS A CANISTER; TO CARRY FRAG-HE, SUB-MUNITIONS, OR ANY 155-MM ROUND.

GUIDED ROCKETS AND MISSILES ON LYNX AND OTHER MRLS/TELS CAN USE THE TRAJECTORY CORRECTION SYSTEM (TCS). TCS CAN CONTROL >12 ROCKETS/MISSILES EQUIPPED FOR INERTIAL/GPS GUIDANCE, VS 12 SEPARATE TARGETS. ACCURACY IS 10 M. INDIA TESTED TCS ON THE PINAKA MRL, AND USES IT IN THE RECENTLY TESTED PRAHAAR SRBM.

ACCULAR ROCKET: A GPS FUZED VARIANT OF LAR-160, WITH 14-40 KM RANGE AND 10 M CEP). AT LEAST 4 COUNTRIES USE THESE ROCKETS.

EXTRA (EXTENDED RANGE ARTILLERY): THE 300MM BALLISTIC MISSILE (4/LAUNCH MODULE) RANGES 150 KM WITH A 10-M CEP. IT HAS A 120-KG PAYLOAD, AND FLIES A BALLISTIC TRAJECTORY, CORRECTED WITH GPS. VARIOUS WARHEADS ARE OFFERED.

DELILAH: THIS CRUISE MISSILE HAS A LENGTH OF 3.2 M, WEIGHING 230 KG. IT CRUISES AT MACH 0.3-0.7, AND 8,600 M ALTITUDE. IT CAN BE LAUNCHED FROM SHIPS, AIRCRAFT, AND THE LYNX GROUND LAUNCHER (GL) TO 250 KM, WITH PROGRAMMABLE GUIDANCE, AND MULTIPLE WAYPOINTS. DELILAH-GL HAS LAUNCH ASSIST. AIR, SHIP, AND HELICOPTER VERSIONS ARE OFFERED. THE MISSILE USES GPS HOMING, OR CAN LOITER AND USE A CCD/FLIR SEEKER TO HOME TO TARGET.





VARIANTS

LYNX: IS BOTH A VEHICLE, AND A LAUNCHER TO FIT ON VEHICLES. GROUND LAUNCHERS INCLUDE TRACKED ARMORED VEHICLES AND 8X8 TRUCKS. ISRAEL MARKETS THE LYNX 6X6 TRUCK (ABOVE). BUT THE LAUNCHER FITS ON OTHER USER-PREFERRED CHASSIS. OTHER USER COUNTRIES HAVE LICENSES FOR THE CONVERSION. MANY OF THE CUSTOMERS HAVE SUBSTANTIAL SUPPLIES OF 122-MM ROCKETS.

AZERBAIJAN LYNX: INDIGENOUS MRL/MISSILE TEL WITH LYNX LAUNCHER ON 8X8 KAMAZ-6350 TRUCK. WITH AUTONOMOUS FCS, IT LAUNCHES 122/ 160 MM ROCKETS, OR EXTRA BALLISTIC MISSILES

NAIZA: KAZAKH IMPORT/PRODUCTION MRL WITH LYNX FOR LAR-160 ON KAMAZ TRUCK.

LAROM: ROMANIAN 2-MODULE MRL CAN LAUNCH 122-MM GRAD OR LAR-160 ROCKETS

Other Options for Land-Attack

The overall decline in military budgets is likely to restrict the number of high-technology cruise missiles for land-attack to strategic and operational-strategic systems. For operational level, newer and lower-cost technologies such as semi-active laser-homing (SAL-H) and fiber-optic guidance (FOG), coupled with preprogrammed inertial/GNSS navigation, offer more precision long-range strike systems for forces with somewhat constricted budgets. Examples are *Nimrod* and *Hermes*. These systems are extensions of ATGM technologies, but with fire control mechanisms which resemble those of precision-guided artillery. An example of a bridge system is the Israeli Nimrod 3 (SAL-H), which is listed with the NLOS ATGMs; but its range (55+km) places it in the same range band as precision guided artillery. Better-equipped forces (Tiers 1 and 2) have some AT units for long-range AT strikes, and perhaps in artillery units in the Integrated Fires Command (IFC), against high value targets. A Russian counterpart is Hermes SAL-H missile (initially 18 km) also listed with NLOS ATGMs. By Near Term it will range 100 km, for strikes against deeper high-value targets and guided by UAVs with laser target designators.

Another type of affordable technology cruise missile has emerged—the attack UAV. UAVs differ from cruise missiles in that an operator can guide the aerial vehicle, using its downloaded camera view and ground station controls. Most early ones used less precise pre-programmed inertial guidance, but with camera guidance for a precise hit-to-kill terminal phase. High UAV costs delayed fielding for these attack UAVs. However, the difference has become more discrete with GNSS-based route programming on the approach and return phases to reduce operator fatigue. Thus the UAV operator can focus his attention to the attack phase. Most attack UAVs (see pg 3-15) use less precise programmed guidance than CM (e.g., the Italian/former Iraqi Mirach 150), since they have camera guidance for a precise hit-to-kill terminal phase. As systems have become more robust, recent attack UAVs now offer precise GNSS, with capability for dozens of waypoints and capability for immediate changes, better-stabilized camera guidance, and IIR or MMW radar-homing for the terminal phase, similar to CMs. High UAV costs similar to CM may limit their fielding. Still, modern CM like Israeli Delilah offer programmable navigation and camera view guidance for the terminal loiter/attack phase, similar to most attack UAVs. More successful were ***anti-radiation missiles (ARMs),*** such as Harpy, special-designed to destroy high-value radar targets.

New technologies and a continued requirement for unpiloted deep strike systems have accelerated R&D activity offered new attack systems. Smaller, more effective, and less costly systems are available. They can be separate weapons, canister/MRL launched, or dispensed from bus UAVs as munitions/submunitions. Some use GNSS phase, camera guidance, and IIR or MMW radar-homing terminal guidance, which will blur the lines between attack UAVs and CMs. Recently, UCAVs as ordnance delivery platforms have been fielded (such as Hermes 450 with Mikholit missiles). New longer-range NLOS ATGM systems can also serve in the role of cruise missiles. These, attack UAVs and UCAVs will compete with CM for most battlefield targets to a range of 200 km.

The potential for adaptation of new technologies into attack UAVs or ***LACMs*** strains current paradigms for weapon system boundaries. Artillery rocket launchers can launch course-corrected (or maneuvering) rockets or missiles. The Russian *R-90* reconnaissance UAV demonstrates the viability of such a vehicle for future attack variants. Russian developers also have demonstrated a niche capability, claiming that SA-11 variant (Buk-M1 and Buk-M1-2) SAMs can be used to attack high-value ground and sea targets. Modern LACMs, as well as adaptive applications such as the ones noted, can bridge requirements of ATGMs, artillery, SAMs, and TBMs for OPFOR deep attack.

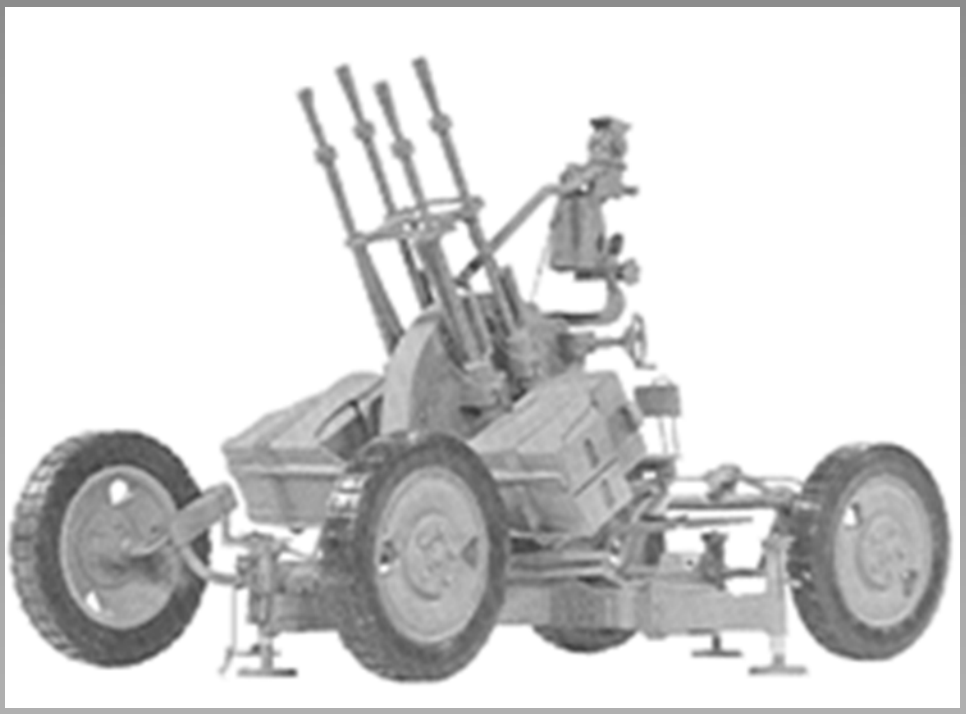
Selected Non-Ballistic Land-Attack Systems

System Name	Producing Country	Proliferation (countries)	Type Launcher	Propulsion	Range Min/Max (km)	Guidance	Accuracy (m)	Warhead Types	Payload (kg)	Comments
Nimrod Nimrod 3	Israel	At least 3	Tracked veh or TUV	Missile motor	0.8-26 0.8-55	Semi-active laser Inertial mid-course	Home to beam (1)	HEAT (800 mm)	15 kg warhead	Dive attack Requires laser designator
Mirach-150 UAV (poss)	Italy, Iraq	At least 5	Ground veh ramp	Turbojet	up to 470	Radio and pre-program	INA	HE est	INA	Attack version of recon UAV
Polyphem/ TRIFOM Polyphem-S (Naval) Triton, torpedo based	Consortium France Germany Italy	In final testing in 2002	Ship, MRL-type, Truck, TUV/ATV	Missile motor	60 TRIFOM 100 future Triton 15	Fiber-optic Infrared. Pre-program mid-course phase	Guide to target (1)	HEAT + Frag/HE	20-25 kg warhead	. ATGM version expected. Concept for remote launch canister and TV control link
Brahmos and Yakhont	India Russia	At least 2	Truck, ship, FW (due)	Ramjet	290	GPS/Inertial	<20	Frag-HE	250	Supersonic
R-90	Russia	1	MRL	Rocket	90	Camera	.5	HE		Adjust fire, BDA
Harpy	Israel	At least 5	Truck	Rocket	500	GPS, Radar	1	Frag-HE	18-22	
Delilah	Israel	At least 1	Truck, ship, FW	Turbojet	250	GPS/Inertial	1	HE	30	Waypoints, loiter

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Worldwide Equipment Guide

Chapter 7: Air Defense Systems



TRADOC G-2 ACE–Threats Integration
Ft. Leavenworth, KS

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Chapter 7: Air Defense

The increased effectiveness of aerial systems in modern warfare continues to drive a corresponding commitment for most forces to improve their air defense forces, tactics, and technologies to counter them. Air defense (AD) is organized to address all capabilities of adversary aerial systems which can be used against a force. In addition, AD is integrated with other units (information warfare (INFOWAR), tactical units, ground reconnaissance, and aircraft units) to counter aerial threats. The "AD plan" refers to a force-wide strategy, encompassing all arms, intended to counter aerial threats; first to negate the effects of aerial systems, and secondly to destroy aerial systems when possible.

Air defense utilizes a variety of systems including: fixed-wing (FW) and rotary-wing (RW) aircraft, ballistic and cruise missiles, unmanned aerial vehicles (UAVs), unmanned combat aerial vehicles (UCAVs), air-delivered munitions (such as missiles, rockets, bombs, etc.), ground-launched rockets, and airships. For nearly a century, as developers of aerial systems developed new capabilities, AD developers responded with new tactics and technologies to counter them. In turn, aerial forces responded to the AD countermeasures. All participants in this inherently ever-escalating contest continue to field new technologies and develop tactics, counter-tactics and countermeasures, and even counter-countermeasures.

The AD forces are finding new ways to integrate changes in capabilities with more aggressive planning and organization. AD requires integration of separate functions: reconnaissance, target acquisition, Command, Control, Communications, and Computers (C4), battle management, and target engagement – often with assets separated by distances of several kilometers. Assets aligning with each function may be vulnerable to physical attack as well as to INFOWAR deception. Thus, AD forces continue updating existing systems and fielding new ones. As with aerial threats, AD seeks out new missions and approaches for success.

Because of their ability to move and strike in any terrain and weather, aerial forces are generally associated with offensive operations. Accordingly, key capabilities of modern aerial threats must be addressed by air defenders. The most challenging threats are traditional ones, enhanced with newer and more lethal technologies.

These include:

- Suppression of enemy air defense (SEAD), AD destruction, and INFOWAR attack (including jamming and cyber-attack)
- Electromagnetic surges, sometimes involving multiple aircraft, multiple types of systems, and multi-aspect approaches
- Strikes, with improved precision surveillance (satellites) and weapons (ballistic missiles)
- Stealth, in aircraft design, UAVs and UCAVs, and use of terrain flight profiles

AD depends on efficient command and control (C2) for responsive, integrated, and survivable countermeasures to enemy aerodynamic weapons. Because of increased threats from stealth, surges during air operations, and aerial long-range weapons, more forces are using improved C2 to form integrated air defense systems (IADS). However, the increased challenges to air defense C2 also require an ability to operate autonomously or in small units.

Key aspects of AD effectiveness against surges are: use of redundant overlapping systems with varied C2 and reconnaissance, intelligence, surveillance, and target acquisition (RISTA) nets, digitally linked and autonomous batteries, increased responsiveness, increased missile loads, and improved missiles for single missile-kill per target. Modern battle management centers in IADS can de-conflict targets and maximize AD effects.

Sensors are a critical component of AD systems, since they perform surveillance and tracking functions against fleeting targets. Radars have dramatically improved, and receive the most attention among AD sensors. But increasingly, acquisition packages use multiple sensors, including acoustics, electro-optics (EO), etc. In advanced AD weapons, radars are integrated with passive sensors, such as optics, electro-optics, TV cameras, night vision sights, auto-trackers, and laser rangefinders. Throughout the force, air approach/attack warners are used, and may be linked with man-portable AD systems (MANPADS). Night sights are now common on weapons such as machineguns and MANPADS.

Weapons trends focus on guns and missiles, e.g., fitting both onto one chassis/platform. Guns and missile launchers are increasingly more mobile and reliable under all conditions. They are becoming better integrated for responsive operation at AD brigade, in small units, and down to the single weapon. Most systems have onboard C2 and passive EO acquisition systems that permit them to operate precisely and autonomously, and slew quickly.

Improved long-range AD (LRAD) and medium-range AD (MRAD) surface to air missile (SAM) systems feature increased velocity and acceleration, high G-turn capability, and precision for use in ballistic missile defense (BMD). Short-range air defense (SHORAD) systems include the use of high velocity missiles (HVM) that can intercept high altitude anti-radiation missiles (HARMs). AD use of low probability of intercept (LPI) radars and signature reduction technologies challenge the ability of aggressors to locate and engage the systems.

Many SHORAD upgrades can counter low-flying helicopters using covert tactics and cruise missiles (CM). New technologies include laser and radio frequency weapons, and hypervelocity kinetic energy (KE) missiles. Modern man-portable air defense systems (MANPADS) can be found in lower-tier forces. Improved missiles with proximity fuzes can fly lower to kill helicopters flying at nap-of-the-earth. New munitions such as frangible or electronically fuzed rounds increase gun lethality. Modular missile launchers and remotely operated guns can transform vehicles or towed chassis platforms into AD systems. MANPADS launchers can mount on vehicles equipped with improved sensors and C2 links, to achieve robust AD support. Upgraded sensors and weapons can rejuvenate older AD systems.

The greatest threat to AD is the use of stealth systems. New missile systems with multi-spectral nets and phased-array radars are being used to better detect stealth aircraft. Updated early warning radars and newer INFOWAR passive radio frequency (RF) systems are being linked into IADS. AD aircraft, nets with substantial numbers of aerial observers, unattended sensors, and nets of modern infrared sensors are also used.

The priority for countering air threats applies force-wide. Most opposing force (OPFOR) weapons and sensors, including infantry and vehicle guns, can engage helicopters and other AD targets. More weapons are multi-role or air defense/antitank (AD/AT). All machineguns can be used for AD. The OPFOR mixes legacy systems, improvised weapons, and recent equipment to improve AD across the area of operations (AO). Modernization trends cover all aspects of the AD network, including SHORAD and LRAD.

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AIR DEFENSE COMMAND AND CONTROL AND RISTA IN TRAINING SIMULATIONS

Portrayal of combat systems capabilities in training simulations is never exact, and often may entail serious limitations that hamper realism. Portrayal of air defense is particularly challenging because effective AD requires timely and effective integration of weapons, support assets, C2, and skillful planning. Budget constraints, hardware, and other limitations can impact portrayals. Meanwhile the OPFOR is required to be ***reasonable, feasible, and plausible***. These priorities also apply to OPFOR air defense systems portrayal. The following describes OPFOR air defense technologies and capabilities that should be incorporated into training simulations.

Responsive, efficient, effective, and survivable air defense requires effective C2 in weapons units and the IADS. Flexible and integrated C2 is particularly difficult to portray in simulations. These divergent priorities are in conflict. The AD system must link weapons with sensors. It begins with the individual air defense system, with the fire control system providing autonomous C2. Increasingly, forces are providing autonomous capability for AD systems.

Many forces are producing mobile AD battle management centers. At the tactical level, for AD batteries and battalions, they are housed in armored command vehicles (ACVs). Tier 1 and 2 AD units have ACV/radar vehicles (e.g., the Sborka). They can also be used in separate batteries plus link to the IADS. A modern ACV can receive, process, and pass a message in seconds (roughly 15, 4 for digital links), with parallel multi-function processing and multiple addressees. Older ACVs, e.g., PPRU (Russian-made Air Defense Vehicles), use analog voice and/or digital data links with longer processing/ transmission times. An IADS with analog C2 is still an IADS, but may be a less responsive one. An IADS is physically dispersed for autonomous action, yet operationally integrated as required.

Air defense organizations balance capability with survivability by managing an array of sensors to provide full 360° coverage and surveillance in depth, with long-range assets supported by mobile reconnaissance assets and overlapping search sectors. The system requires: centralized linkage of various gun, missile, and gun/missile units, and coordination with AD aircraft units. Units will be relocated and re-assigned to prevent gaps in coverage. Airborne warning and command systems (AWACS), and other airborne air defense assets (aerial patrols, etc.) will be used. The IADS integrates AD communications nets and links them with other RISTA nets (air, ground recon, artillery, etc.) to fuse the battle picture, cue AD assets, and warn of approaching aircraft throughout the force. An IADS provides early warning (EW), assures that weapons resources are efficiently assigned to service all targets at the maximum possible stand-off ranges, and reduces delay for vehicle halt and weapon response times. It also provides target acquisition (TA) data during jamming, avoids fratricide for friendly aircraft operating in the area, and reduces redundant fires.

Fire mission communications are linked throughout the IADS with battery/battalion radars, command posts, longer-range radars for battle management at brigade and above, and various other sensors (incorporating acoustic, infrared, TV, visual, and other technologies). Modern EW units use long-range radars located behind the forward area to see for hundreds of miles, and use radar signal parameters to reduce jamming and terrain restrictions. These radars feed approach warnings throughout the net so that most of the interlinked AD systems can operate passively and not reveal their locations until the moment of engagement. They help facilitate AD ambushes by transmitting aircraft locations and allowing weapons' radars to activate only at the last minute when air targets are within range. For passive operations, many SAM systems can use the IADS digital feed instead of their own radars.

The primary detection and acquisition system for an air defense unit is radar. Radars can more easily detect and track aircraft with less operator input than other sensors (e.g., electro-optic sights). Radars are usually categorized by function, and functions usually correlate to a range of frequencies. Older early warning radars generally operate in low frequency bands (A-E), to achieve longer detection ranges. They can track targets and cue precision sensors to support an IADS.

Air Defense Radar Bands in the Electromagnetic Spectrum			
NATO Band	US Band	Low-End Freq (GHz)	Wavelength
A		0.0	
B		0.25	Decimetric
C		0.5	
D	L	1	
E	S	2	Centimetric
F	S	3	
G	C	4	
H		6	
I	X	8	
J	Ku	10	
K	K, Ka	20	Millimetric
L	L	40	
M		60	
X		8-12	

AD units employ a mix of radar systems operating at different frequencies in varied intervals, with some radiating while others surveil passively. More mobile radar systems are being fielded that are capable of quickly employing radars or operating radars while moving. Target acquisition (TA) radars are used to acquire aerial targets (and assign them to the fire control system for launch); they often operate in the I and J bandwidths. Other bandwidths offer precision range-finding while remaining undetectable at scanned frequencies. Fire control (FC) radars (that track missiles and targets and guide weapons to targets) often operate in H-J bands, but can operate in less detectible bands. Many more modern systems use dual-mode/multi-mode radars that can simultaneously perform EW, TA, FC in some combination, culminating with (automatic) target tracking during the engagement. For the OPFOR, unless air missions are scheduled, free-fire zones do not require identification friend-foe (IFF) checks. Thus, most OPFOR sectors are free-fire zones and the OPFOR AD usually launches on first detection.

Radar performance is affected by technical factors that include functional requirements (for EW, TA or fire control), type (phased array vs continuous wave or pulse), operating parameters (fan angle, power levels, operating time, frequency, etc.), mounts (stationary, mobile, missile mounts on active homing missiles), target (radar cross section, countermeasures, speed, altitude, etc.), and environment (curvature of the earth, terrain, weather, etc.). Performance is also affected by the tactical dispositions of targets (aircraft dispersion, their use of stand-off weapons, etc.), requirements for support systems, and survivability tactics of the defending radar (narrowing beam width, limited operation times, passive modes, frequent moves, etc.).

Increasingly, IADS also use passive sensor systems such as acoustic-triggered unattended ground sensors, remote-operated electro-optic (EO) systems with auto-trackers, radio-frequency direction-finders, and sensors operating in other regions of the electro-magnetic spectrum. Acoustic sensors include acoustic arrays such as the HALO (stationary microphone) complex. They also include vehicle systems such as the Israeli Helispot, with microphones (mounted onboard or dismountable). Russian sound-ranging systems (AZK-5, -7, etc.) can detect helicopters. Communications links to nearby units (recon, maneuver, artillery, etc.) can also supplement organic AD sensors.

AD observation posts (OPs) offer an affordable low-technology response to air threats. Forward-positioned OPs can support EW radars as well as AD OPs in tactical units. They can also be manned by special purpose forces or civilian supporters near airfields or helicopter forward arming and refueling points (FARPs), which can engage aircraft or notify AD units. Equipment assets may include day/night observation systems, remote infrared (IR) cameras, acoustic sensors (such as sound-ranging systems), anti-helicopter mines, and MANPADS. In Tier levels 1 and 2 these forces will use laptop computer terminals and digital links to relay data. Sensors can include man-portable radars such as the Russian FARA-1. These OPs use goniometer-based laser range-finders, Global Positioning Systems (GPS), and radios to ensure precise location, increase warning distances, and rapid reporting of approaching targets. In Tiers 1 and 2, MANPADS operators possess azimuth warning systems which alert them (day and night) to approaching aircraft. In lower tier forces, radars can be supplemented with forward OPs (perhaps with binoculars, compasses, and radios) to cover defiladed areas and masked avenues of approach. In the near future OPs will possess micro-UAVs capable of detecting, attacking, and repelling helicopters.

An IADS does not limit autonomous fires; rather it provides early warning and reduces delays for vehicle halts and weapon response times. Because the enemy will attack C2 nodes and detected AD radars, most AD systems and subunits must be able to operate passively and autonomously, while maximizing their mobility and dispersion. An IADS also provides target acquisition data for jamming purposes, avoids fratricide of friendly aircraft operating in the area, and reduces redundant fires.

Most air defense systems have passive EO sights that can be used when conditions preclude the use of radars. They include TV day sights, infrared or thermal night sights, and target and missile trackers. Sights can have a zoom capability with 24-50 + power, an acquisition range equal to or greater than a radar, and minimum altitude tracking capability down to ground level (0 meters). Ranges may be limited, however, by line-of-sight to the target. Thus, EO range is comparable to a targeted aircraft's EO sensor acquisition range.

An IADS can operate as low as brigade level, with AD working in concert with other units and other echelons. Even when a formal IADS is not established, responsive and coordinated AD is possible. For instance forward observers can notify AD weapons of enemy approach and direction. The FARA-1 radar can easily be mounted onto AD guns for day/night operation. Anti-helicopter mines can be used to cue AD ambushes. Innovations such as remote weapons and sensors and portable digital fire control systems

(FCS) are updating older AD weapons, permitting them to link to IADS. Battery ACVs such as Sborka feature EW/TA radars for RISTA and link to IADS.

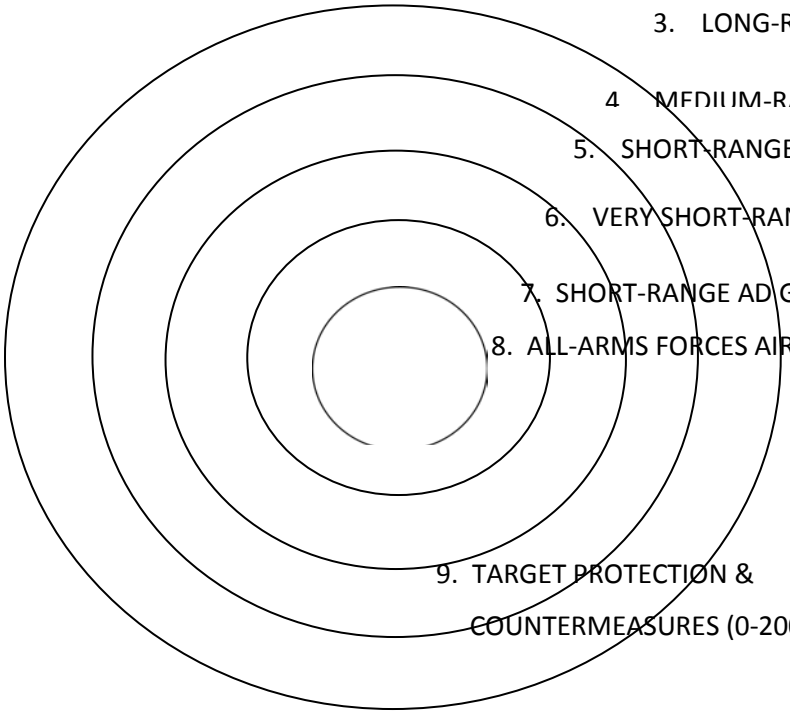
AIR DEFENSE SYSTEMS AND DOMAINS

In modern warfare, the initial air operation is considered to be the critical component to success against modern enemy forces. That operation is expected to disrupt or destroy critical C3 nodes, exploit vulnerabilities in the air defense nets, and facilitate widespread aircraft and missile strikes against military targets. That operation would also include stealth precision aircraft, missile strikes, and rotary wing aircraft flying low-level deep-strike missions. These would be generally conducted prior to entry of ground and naval forces in order to facilitate early entry safely. In modern forces using aggressive planning, the air defense plan will be designed in detail to counter each aspect of the air operation. Thus, the air defense operation must begin prior to the air operation, to deny it success and insure integrity of the defending forces and area. Air operation forces and air defense forces continue to see changes in plans, tactics, and equipment to counter each other's advantages, while operating within modern military budget constraints. A number of militaries are choosing to reduce the size of their costly fixed-wing (FW) aircraft component, while increasing the sizes of theater missile and air defense forces, to deny adversaries air superiority. Trends noted in the following pages concern systems, fielding choices, and capabilities in all AD domains.

There are at least nine air defense plan domains, each with distinct missions, tasks, weapons, sensors, and phases in the air defense operation. Planning may anticipate simultaneous effort in all nine domains. It is an all-arms effort involving more than just air defense forces. Range figures for these systems are general, variable, and changing with overlaps.

1. AIRCRAFT/MISSILES /SPF VERSUS AIRFIELDS/FAARPS

2. AIRCRAFT/LONG-RANGE SAMS VERSUS HIGH VALUE



Domain #1. The plan calls for a combination of pre-emptive, reactive, and passive air defense measures being conducted simultaneously. Surveillance assets, especially forward observers, will be deployed around all potential adversary landing areas, including helicopter lighting points, to monitor activities in these areas. In the initial phase, and later as the adversary's aircraft reach forward locations, pre-emptive measures will be conducted by irregular warfare (IW) and deep-attack assets to degrade the adversary's air operations before they even reach defended airspace. Forces will attack airfields and helicopter lighting points and forward arming and refueling points (FARPs) with air-launched stand-off weapons, ballistic and cruise missiles, and special purpose forces. At critical phases of the operation, they will disrupt satellite systems and attack adversary long-range surveillance assets.

Domain # 2. Generally, AD air and ground forces will attempt to engage and disrupt enemy air activities as early and distant as possible, to decrease the chance for enemy air success. Air intercept aircraft and long-range AD (LRAD) systems will attack reconnaissance aircraft, airborne warning and command systems (AWACS) aircraft, suppression of enemy air defense (SEAD) aircraft, and bombers. Because of curvature of the earth limitations on SAMs, aircraft will operate at altitudes below the minimum altitudes of the SAMs, at ranges of 250 km, or more. Special nets of radars and passive Electronic Support (ES) systems will be created specifically for detection of stealth aircraft and cruise missiles, flying at lower altitudes.

The AD plan includes flexible prioritization of AD systems to deal with key events, such as enemy surges, ballistic missile and cruise missile strikes, and measures to facilitate AD forces survival of air and SEAD operations, and ground forces attacks. The two main deployment priorities are site defense and area defense, and they activate as targets come into range. Forces should designate a portion of LRAD/MRAD launchers for site defense against ballistic missiles. Even when aircraft reach the range of MRAD systems, LRAD may engage targets while MRAD SAMs conduct AD ambushes, monitor the IADS, and use passive electro-optical fire control systems (FCS).

Domain #3. Long-range SAMs include Russian and Chinese missile systems, e.g., SA-5, SA-10, SA-12, SA-20b, SA-21, SA-23, and HQ-11. These upgraded and new systems are networked with long-range early warning radars and electronic support measures (ESMs) to form the base for operational IADS. In the past, the size of the missiles limited them to selected roles, such as countering high priority aircraft (Domain #2), long range defense versus small formations (Domain #3), and anti-ballistic missile defense of high priority sites (Domain #9). However, several LRAD systems are being modified to fit canisters of "small missiles", to counter surges and all air targets in the other domains (#4-8) as well.

A wide variety of RISTA assets including forward observers, HUMINT assets and RISTA systems support AD operations. Early warning systems have lost appeal in certain AD circles, but are still useful. They operate in low bands outside of bandwidth of most radar detection systems, and have long detection ranges. Many are being modernized with multi-target precision tracking, and digital transmission and display systems. As aircraft approach the range of AD weapons, they are acquired by EW radars, which conduct IFF queries and feed intelligence to the Integrated Air Defense Systems (IADS). There is one overall IADS for the force. But other overlapping area and AD brigade IADS are used in case the central IADS is defeated by enemy SEAD. The IADS battle management center will select target acquisition radars to conduct surveillance and track targets, update the plan, and assign new targets. New phased-array TA radar and battle management systems have interface and networking features to form autonomous IADS, and autonomous firing units down to the battery level, and challenge SEAD and evasive aircraft tactics. As aircraft approach the targets, they have entered engagement zones of not one, but many types of AD systems and RISTA nets, each linked to the IADS and its overarching RISTA net. Thus, they are detected by multiple radar frequencies, ground observers, vehicle EO/IR acquisition systems, sound-ranging assets, and AD Infowar (IW) assets. Although the diagram depicts concentric circles with a single epicenter,

defended forces are arrayed throughout the area; and multiple MRAD/SHORAD epicenters and assets overlap.

Domain #4. Most MRAD systems in Domain #4 are Russian, e.g., SA-3, SA-4, SA-6, SA-11, and Buk-M1-2. Some are highly mobile and can move with ground forces and challenge air surge capabilities of expected adversaries. Because of their high cost, which approaches that of LRAD, most MRAD systems in use are older. But a number of users are updating them to approach modern capabilities, to counter short-range ballistic missiles, cruise missiles, stealth aircraft, and low-flying helicopters. Other countries are looking at the possibility of adapting LRAD systems to handle surge requirements and reduce the need to upgrade or produce MRAD systems. Other forces, to include, Israelis (Spyder), Italians (Aspide 2000), and Indians (Akash) designed systems that in some cases are more affordable and mobile.

Domain #5. The short-range SAMs in Domain #5 include a wide array of systems produced and exported throughout the world. Leading producers include China, Russia, the US, and many European countries. Although the systems in this domain include semi-mobile towed systems, most are vehicle-mounted and can be brought into action from the move in 0.5-5 minutes. Many can move with supported maneuver forces. Others cover critical assets that are likely air targets. Some are assigned to cover areas that have defiladed terrain and man-made features that could be approaches used by aircraft flying contour or nap-of-the-earth (NOE) profiles. These systems have substantial missile inventories, increasing capabilities to counter enemy surges. Many modern SAMs are configured as gun-missile systems, allowing engagement of almost all aerial targets (including cruise missiles, UAVs, air-to-ground missiles, and helicopters flying NOE).

Domain #6. The very-short-range systems in Domain #6 include Man-portable SAMs, or (MANPADS). They can be dismounted; however, some vehicle-mounted systems have been developed which use the same missiles. A wide variety of upgrades are expanding the lethality (and range) of these systems. Additionally, multi-role missile systems (such as Starstreak) are being fielded.

Domain #7. AD gun systems are not as widely used as in the past. The primary reason for this is the limited effective range of most guns. Although gun ranges reach as far as 13 km (KS-19M2 with radar), most AD guns are effective at ranges of 4 km or less. Several forces upgraded those guns by merging them with missile systems to form gun-missile systems. Some forces continue to field new self-propelled AD guns. Substantial upgrades have increased effectiveness and utility of most weapons.

Domain #8. Modern forces proliferate weapons (especially machine guns) tailored for defense against air threats. Ground and air responses to air threats include more medium guns, improved AD munitions, and more responsive missiles and FCS.

Domain #9. Developments in target protection and countermeasures include use of charge coupled devices (CCD) technologies and tactics, as described on the following pages.

AIRCRAFT SURVIVABILITY AND AIR DEFENSE COUNTERMEASURES

Modern forces focus much attention on protecting aircraft during air operations through a blend of tactical measures and technical capabilities that are collectively known as ***suppression of enemy air defense (SEAD)***. Separate SEAD aircraft and IW assets are engaged in locating AD assets, jamming AD C2 and RISTA assets, and attacking systems in the AD network. Often SEAD aircraft will accompany fixed wing (FW) aircraft and helicopters in carefully coordinated air missions. In addition, modern tactical aircraft and supporting aircraft can be equipped with aircraft survivability equipment (ASE) to countermeasure incoming AD missiles.

The OPFOR, like most forces in the world today, have developed technologies and tactics to counter ASE and SEAD. The first priority for the AD effort is always force survivability. The OPFOR knows that SEAD usually facilitates other aircraft conducting missions; thus air protection measures are addressed in all units and at all levels. These include a network of air warning receivers to sound air alerts down to battalion level and below.

The most common and challenging air threat is from helicopters, because of their proliferation, their ability to use concealed approaches, and their ability to directly engage AD assets early in the air operation. Helicopters will use terrain and cover to mask their approach with terrain flight modes (low level, contour, or NOE). The OPFOR conducts an intelligence preparation of the battlefield (IPB) early on to determine routes and assign OPs, sensors and on-call AD weapons to cover areas which offer concealment. Air defense priorities are to engage all aerial targets primarily, and counter SEAD secondarily.

Selected Air Defense Tactics Used to Counter Air Attacks and SEAD Operations

Considerations	Examples
Protection and Countermeasures	Use concealment, mixing with civilian sites and traffic Use cover (dug-in positions, hardened facilities, urban structures) Disperse assets and use autonomous capabilities Relocate frequently Operate within a protective envelope of friendly forces Conducting deception operations for convoys, crossings, etc.
Tactics	AD conduct bounding overwatch during movement. Air defense ambush with passive mode (EO, radars turn just at launch) Direct attacks against AWACS, SEAD aircraft, airfields, and FARPs Engage SEAD/ASE aircraft from an aspect outside of the jamming arc Conduct beyond borders operations against hostile air capabilities.
RISTA	Use intelligence preparation of the battlefield - approach routes, etc. Passive radar and EO modes. Use IADS links for TA data. Emissions control measures Utilize civilians and insurgent links.

	Use many OPs linked to AD units, including forward-based SOF, etc. Employ non-AD sensors and units available to feed reports to IADS.
Command and Control	Use mobile, redundant, and concealed systems Practice comms OPSEC measures
Weapons	Engage aircraft, air-to-surface missiles, and ARMs beyond their range Configure all weapons to respond to aircraft. All units conduct air watches with weapons at ready at all times

Airborne SEAD and signal intelligence (SIGINT) operations and technologies include radar acquisition systems, radar jamming assets, and anti-radiation missiles that can find and destroy radars; compel AD units to acquire more robust/ longer range radar systems; and to more carefully manage radar assets. The OPFOR will use equipment and tactics to degrade SEAD effectiveness, deceive it, and attack SEAD directly. Some of those responses are listed below.

Selected Air Defense Technologies Used to Counter SEAD Operations

Technologies	Examples
Command and Control	IADS, directional comms, satellite communications (SATCOM), retransmission systems, etc. IADS links to artillery, recon, maneuver units, special operations forces (SOF), etc. Employ digital comms with reduced response time. Use mobile, redundant, easily concealed systems
Radars	Low-frequency long-wave early warning radars (50-100 km setback) Low Probability of Intercept (LPI) radars (frequency, power control) Multiple-mode, multiple frequency, frequency-agile radars Phased array radars and guidance modes that negate jamming Counter stealth radars and passive sensors integrated for fast response Aerial radars on helicopters, UAVs, mobile airships, with retrans links Mobile radar systems for frequent moves, or operation on the move
Other Sensors	Sensors using passive modes (EO, IR, acoustic, other bands) Mobile goniometer- based fire control sets with GPS and digital comms Remote sensors, unattended ground sensors, linked to AD nets. Remote IR and EO cameras (Sirene, ADAD), and on UAVs/airships
Weapons	SEAD-resistant missile guidance modes (semi-active radar homing, active radar homing, track-via-missile, laser beam rider, etc.)

	Home-on-jam missiles attack AWACS, SEAD, ASE (Aspide, SA-5) AD missiles can destroy ARMs and HARMs (Russian Pantsir, SA-15b) Responsive autonomous or battery AD weapon systems (SA-11, 2S6) Passive guidance, e.g., IR-homing or EO FCS (Mistral, GDF-003)
Countermeasures	Encryption and secure comms modes Decoys: corner reflectors, multi-spectral, bridge mock-ups, etc. Electronic Warfare: SIGINT/ELINT, GPS/fuze jammers, deception

Most units operating in flight paths are subject to air attack and use active measures to respond to air threats. Dismounted infantry units will have AD outposts (OPs) and will engage aircraft as required. Any AD weapon can alert its armored command vehicles (ACVs) and the IADS net of spotted aircraft. Of course the delays from transmitting reports through these links should be considered when determining response times (15 seconds for Tiers 1 and 2, 30 or longer for each message link from observer to AD weapon).

To counter the helicopter threat, a wide variety of tactical and combat support vehicles are equipped with MANPADs/MGs with AA sights to engage aircraft. Two of the greatest advantages for helicopters are weapons stand-off distances and the ability to use terrain cover on approach. Many ground force and AD weapons can match the stand-off ranges, and inflict sufficient damage to force aircraft to disengage. When flying NOE (20-25 feet from the ground), a helicopter rotor is still 40 feet high. A helicopter using terrain masking cannot easily engage targets or evade missiles, but can be targeted by ground weapons. Nearly all SAMs, small arms, and direct-fire crew weapons—antitank guided missiles (ATGMs), antitank grenade launchers (ATGLs), automatic grenade launchers (AGLs), etc.--can engage it. ASE includes infrared (IR) decoys that can be foiled by improved IR missile seekers, and radio frequency (RF) jammers with dead zones (and limited effects against modern radars).

Engagement Factors and Data for Air Defense Simulations

No simulation can predict or reflect reality; but a well-designed air defense simulation can be robust enough and detailed enough to represent reality. Air defense engagements offer a difficult challenge for realistic portrayal in training simulations. A simulation might be expected to depict robust and responsive reconnaissance, intelligence, surveillance, and target acquisition (RISTA) assets executing the target acquisition stages (detection, classification, recognition, and identification) with early warning and target acquisition/battlefield surveillance radars, C^2 processing (report postings on battle management nets, analysis, tracking, target assignment, and shooter assignment), target engagement (TA radar, location and tracking), missile launches, probability of hit (Ph) data, and probability of kill (Pk) by type of kill calculation. Degrading factors can be factored into calculations: e.g., target type, evasive tactics, battlefield environment constraints, AD systems limitations, and AD counter-tactics. In the real world, RISTA capabilities are affected by a variety of factors, which can affect capabilities calculations by system, by class of system, and in various ways. Here are key ones.

Selected Factors Which Affect Air Defense Functionalities

Technologies	Factors	Data Entry
Sensors for Acquisition, EW, And Fire Control	System range	km
	Target tracking range	km
	Night range (EO sensors)	km
	Range to target	km
	Radar down time	min
	Radar search sector (horizontal/vertical from mid-line)	degrees
	Radar altitude	km/m/ft.
	Curvature of earth range limiter (based on sensor and target altitudes)	max km
	Terrain feature effects on line of sight (LOS) (limiter which interrupts LOS)	km
	Aircraft altitude	km/m/ft.
	SEAD/aircraft ASE effects (sector of scan)	km x km
	Counter-SEAD capabilities (0 % degradation)	0 %
Command and Control (C^2)	Report time (x number of links)	min
	Report-processing time (x links)	min
	Authorization to fire	Yes/No
	IFF time	sec
	Target assignment time	sec
Weapons	Missile/gun effective range	Km
	Number of missiles/rounds per target	# x Ph
	Missile/gun minimum altitude	m, or band
	Weapon reaction time	sec
	Area of munition warhead effects (range and altitude)	m or Ph
	Aircraft ASE against missile seeker (degrader x Ph)	%
	Munition ASE CCM capability (0 % degradation)	%
	Ph against target types (RW, FW, ASM, UAV, TBM)	type/name
	Pk-Mobility, Firepower, Comms, Catastrophic, etc.	type/name
	Munition approach/impact aspect vs target (if needed)	Ph
Target Effects	Target flight altitude, speed, range, etc.	m, km, etc.
	Target countermeasures and counter-tactics	Ph factors

Many AD data adjustment factors are expressed in range or altitude, which can be used by the simulation to match AD system to target. Some of the factors or degraders, such as line of sight (LOS) or ASE, can then adjust the capabilities. For time-based capabilities, degraders (such as report time) are critical considerations that can affect the likelihood of AD engagement within the time span of aircraft approach, while the aircraft is still outside of range for ordnance delivery.

Capabilities of AD weapons to engage, hit, and degrade aircraft physical viability and effectiveness are expressed in various data. These include range, altitude, time (noted above), and probabilities of hit (Ph) and kill (Pk). Once target and shooter are within geospatial and time windows, with authorization to fire, the key data are probabilities of hit and kill.

Probability of hit can be affected by many factors (as noted in the table above). Sources vary widely in Ph data for the same systems. Often a range is listed, such as 40%-96%, without clear explanation of calculation criteria, and with many detection variables rolled into the figures. Russian sources often state their figures as "single shot kill probability," combining hit and kill in one figure (Ph x Pk). The Ph figures noted in the WEG for missile systems are averages based on probabilities at all aspects, within operational ranges and altitudes, and against aircraft in noted classes. Different fixed-wing (FW) and rotary-wing (RW) aircraft will have different radar cross-sections, IR heat detection levels, and different Ph levels. Other aeronautical targets such as unmanned aerial vehicles (UAVs), cruise missiles, air-to-surface missiles, and theater ballistic missiles will have different Ph figures by type, system, and aspect. The simulations should use the Ph in the WEG as a single figure for the technical capability. Degraders such as factors noted in the above table could then be applied for use in the simulation. Often AD units will launch multiple missiles at a target. Two missiles will have greater Ph, possibly 2 x one Ph.

Developments in missile seekers, guidance, and gun ammunition technologies are greatly improving probabilities of hit for AD weapons. One of the most deadly AD missiles to threaten modern aircraft are anti-radiation missiles that home-in on an aircraft's ASE or SEAD radar jammer. Another modern AD missile capability is active radar homing missiles, which cannot be easily counter-measured. Both missile types have a higher Ph. The Starstreak MANPADS system offers another new step in missile precision and countermeasure resistance with laser beam-rider guidance. Starstreak has a very high Ph against less maneuverable aircraft, especially helicopters conducting terrain flying such as NOE. Some modern AD guns now have rounds with proximity fuses, for higher Ph. Others rounds have an AHEAD-type fire control system (a laser range-finder-based computer sets electronic time fuzed rounds, for precision air bursts).

Probability of kill (given a hit) can require an even greater variety of figures based on type, system, and aspect, and by munition type or specific munition. Because those Pk figures require laboratory-produced data based on precisely determined conditions, they will not be noted in this publication. However, a few concepts can be noted. A missile with a proximity fuze and large warhead will have a large lethal radius and a high probability of kill, given a hit or detonation. For small missiles, partial kills have a greater probability than total (catastrophic) kills.

Dramatic improvements in AD weapon lethality are raising Pk figures. Increased use of HMX (British high technology) explosives has raised Pks. Frangible gun rounds fly like Kinetic Energy (KE) rounds, permitting better range and precision than high explosive (HE) rounds. But they shatter inside of the target, offering high explosive Pk figures similar to HE rounds. Some missiles (e.g., Pantsir and SA-18S) have frangible rods in their warheads. Others have multiple sabot penetrators and HE effects (3 x "darts" in Starstreak).

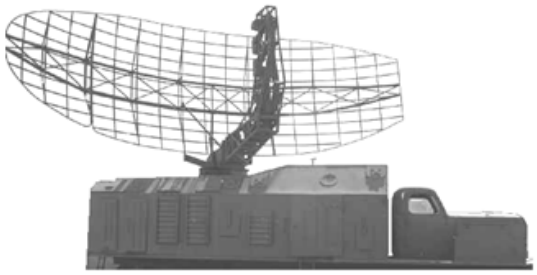
AIR DEFENSE SYSTEMS: KEY TECHNOLOGY TRENDS

Aircraft upgrades and proliferation of other aerodynamic threats (cruise and ballistic missiles, air-delivered munitions, UAVs, etc.) have increased the aerial threat to military forces worldwide. Thus forces expanded their emphasis on all systems engagement of aerial threats or counters to those threats. Forces worldwide are fielding new air defense (AD) systems and upgrading legacy systems.

System Category	Technology Trend	System Example
Short-Range Air Defense (SHORAD) Systems	Missiles engage <1-20 km range, and 0-10,000 meters altitude Radars integrated with passive electro-optical/thermal fire control High-velocity missiles engage aircraft, munitions, UAVs, and missiles Drop-in overhead turrets and remote weapons for AD vehicle systems Guns and missiles integrated into gun-missile systems Many missiles, most guns defeat all countermeasures New or upgraded robust shoulder-fired SAMs throughout the battlefield	Pantsir-S1 Crotale-NG 2S6M1 Strelets/Igla launcher Zu-23-2M1 Mistral 2 SA-24/Igla-Super
Medium-Range Air Defense (MRAD) Systems	Missiles engage 1-45 km range, and 0-25,000 m altitude Tracked or wheeled with increased mobility and responsiveness Some systems mix MRAD and SHORAD missiles for high surge rate New autonomous launchers melded in old units to add more FC radars	Buk-M1-2 Pechora-2M Spyder-MR SA-6b with Buk-M1
Long-Range Air Defense (LRAD) Systems	Missiles engage 5-400 km range, and 0-50,000+ m altitude Vertical launch and increased velocity against ballistic missiles Anti-radiation/radar-homing missiles defeat SEAD/AWACS/JSTARS Launcher can add canisters of 1-120 km “small missiles” for surges	SA-21/Triumf SA-21b/Samoderzhets FT-2000 SA-20b/Favorit
C4ISR	Phased array/low probability of intercept (LPI) radars and more range Radars mounted on RISTA/weapons to operate and rotate on the move Other RISTA sensors, e.g., forward observers, UGS, passive IR, IW Integrated air defense Systems (IADS) across echelons and branches IADS, FOs, and radars for responsive AD even in high-jam areas. Autonomous unit and systems capability in a jamming environment AD complexes to counter SEAD and stealth systems	96L6E Sborka-M1-2 Orion Giraffe AMB SA-10/20 2S6M1 Nebo-SVU
Multi-role Systems	Multi-role (AD/AT) missiles, gun, vehicles, for AD and AT, etc. IW and other Infowar add to RISTA and deceive/deny aircraft C4ISR	Starstreak Orion
Other Systems for AD Use	All-arms AD weapons/munitions damage or defeat low-flying aircraft	12.7-mm/.50-cal MG

	Anti-helicopter mines or mines which can be used in the role Airships in acquisition, jamming, or obstacle fields against helicopters Concealment or deception measures limit aircraft effectiveness	Helkir Helikite w/Speed-A Barracuda RAPCAM

RUSSIAN MOBILE AIR DEFENSE RADAR VEHICLE LONG TRACK



SYSTEM	SPECIFICATIONS		
Alternative Designation	P -40. The name LONG TRACK is actually the radar.	Associated SAMs	SA-4/GANEF, SA-6/GAINFUL, SA-8/GECKO
Date of Introduction	IOC 1967	ADA Unit Level:	Employed at division and echelons above division The system is used in Tier 3 and 4 units.
Proliferation	More than 35 countries		
Chassis	A modified version of the AT-T heavy tracked transporter vehicle (426 U).	Other Radars	The radar system links to the IADS to provide analog warning and to pass analog data.
Engine	465-hp diesel	VARIANTS	SPECIFICATIONS
Weight (mt)	35		Polish Jawor (circa 1965) and Polish Farm Gate (Truck mounted).
Max Road Speed (km/h)	55		
RADAR	SPECIFICATIONS		
Antenna	Elliptical parabolic		
Auxiliary Power Unit	400 Hz gen and gasoline engine.		
Frequency Band	E-band (UHF)		
Frequency	2.6 GHz		
Sweep Rate (rpm)	12-15		
Display range (nm)	200		
Effective range (km)	167		
Tracking range (km)	150		
Effective altitude (km)	30		
Track targets on Move	No		
Emplacement time (min)	INA		
Displacement time (min)	INA		
Tracking range (km)	150		
Dead time (min)	0		
Max targets displayed	>8		

NOTES

BY COMPARING RESULTS AT VARIOUS FREQUENCIES, THE LONG TRACK CAN BE USED TO DETECT STEALTH AIRCRAFT.

DESCRIPTION

TWENTY-FIVE FOOT HIGH SINGLE CONVENTIONAL PARABOLIC MESH REFLECTOR ANTENNA WITH MULTIPLE STACKED FEEDS THAT IS VEHICLE MOUNTED.

RADAR FUNCTIONS

SURVEILLANCE, TARGET ACQUISITION, AND EARLY WARNING. LONG TRACK WAS THE FIRST HIGHLY MOBILE EARLY WARNING RADAR. THE ANTENNA IS FOLDED FOR TRANSPORT.

RUSSIAN AIR DEFENSE ARMORED COMMAND VEHICLE SBORKA-M1 AND SBORKA-M1-2



Sborka-M1 with DOG EAR radar



Sborka-M1 with DOG EAR radar

SYSTEM	SPECIFICATIONS	Communications Intercoms	2
Alternative Designations	9S80M-1, PPRU-M1. System is also called a "mobile aerial target reconnaissance and command post". Some sources incorrectly refer to DOG EAR radar as the name of the system.	Other Communications Links	7, including Integrated Air Defense System, brigade, and division for passive battle operations.
Date of introduction	Circa 1989, with –M1 upgrade by 2000	Vehicle can communicate on the move	Yes
Proliferation	At least 2 countries	Data formats	Graphic and digital data transmission and display
Crew	2 for vehicle	Onboard Generator	Yes
Troop Capacity	5-8 Command and staff workstations or modules	Whip antennae for mobile comms	2 HF whips, 3 VHF
Chassis	MT-LBu tracked vehicle, expanded variant of MT-LB	Other antennae	VHF discones masted, HF dipoles and 11-m mast
Combat Weight (mt)	16.1 est	Digital link to 1L15-1 MANPADS azimuth plotting board	Yes
Chassis Length Overall (m)	7.86	RADAR	SPECIFICATIONS
Height Overall (m)	2.72, with radar folded down	Name	DOG EAR
Width Overall (m)	2.97	Function	Target Acquisition
Automotive Performance		Frequency	F/G Band
Engine Type	240-hp Diesel	Range (km)	80 detection 35 tracking 500m and higher 22 tracking targets flying 25-499 m
Cruising Range (km)	500	Targets display and simultaneous tracking	63, 6 earlier version
Max Road Speed (km/h)	60	Target processing to assignment and track	1-step auto-track
Max Off-road Speed (km/h)	26	Scan rate (s)	2-5, 30 revolutions per minute
Average Cross Country Speed (km/h)	30	Data Transmission rate(s)	4
Max Swim Speed (km/h)	5-6	Scan coverage (°)	360 azimuth (rotating antenna) x 30 elevation
Fording Depth (m)	Amphibious	Antenna scan rate (rpm)	30

Emplace Time (min)	1-3	Antenna horizontal pattern width (°)	5.5 lower plane, 1.6 upper
Armor, Turret Front (mm)	15	Clutter suppression (dB) Operating time max Acquire on the move	30 or more; 48 hrs, but usually use shorter on/off times
NBC Protection System	Collective		
Smoke Equipment	Not Standard		
Target Missions Generated Simultaneously	1 or 2		
Target alert simultaneous rate	5-6		
Number of weapons with automatic control	6 separate weapons 12 with 2 per mission		
CP can operate autonomously/in network	Yes/Yes		
Number of sources which can generate targets	6 plus Sborka		
Encryption	Yes, E-24D		
Digital Navigation Monitor	Yes, GPS, Inertial and Map Display		
Automated Networks	Baget- 01-05 or -06 computer workstations		

COMMAND

CONFIGURATION FOR REAR COMPARTMENT HAS 1-4 OFFICER WORKSTATIONS, 3-6 COMMUNICATIONS/BATTLE STAFF CONSOLES, AND ONE RADAR OPERATOR CONSOLE (DEPENDING ON VEHICLE ROLE AND ECHELON).

COMMAND LEVEL

AD BATTERY AND BATTALION IN MECH AND TANK BRIGADES ASSOCIATED AD UNITS/SYSTEMS: SHORAD SYSTEMS (ZSU-23-4, 2S6, SA-9, SA-13, SA-15, MANPADS)

RADIOS, FREQUENCY, AND RANGE

3-6 X VHF WITH RANGE 30 KM (60 KM STATIONARY WITH MAST) 2 X HF WITH RANGE 50 KM (350 KM STATIONARY WITH MAST) NOTE: MAST AND DIPOLE ANTENNAE FOR LONGER RANGE OPTIONAL.

OTHER ASSETS

LINKS TO INTEGRATED AIR DEFENSE SYSTEM (IADS) FOR EARLY WARNING AND TARGET ACQUISITION DATA IN THE AIR DEFENSE NET. IT IS ALSO USED AS THE AD BATTERY CP FOR AD UNITS AT DIVISION AND BELOW.

VARIANTS

AN EARLIER VEHICLE VERSION WITH THE DOG EAR WAS PPRU-1/9S80/OVOD. PPRU-M1 HAS IMPROVED C3 AND TARGET PROCESSING FOR HIGHER TARGET VOLUME. IT SHARES THE MT-LBU CHASSIS WITH RANZHIR, MP-22 AND OTHER AD CP VEHICLES, BUT WITH DIFFERENT C3 EQUIPMENT AND THE ADDED RADAR.

SBORKA-M1-2/PPRU-M1-2/9S80M1-2: THE NEW VARIANT HAS SOLID- STATE RADAR, WHICH IS MORE COMPACT, AND FITS ON A HEAVIER MAST FOR OPERATION WHILE MOVING. THUS SET-UP AND DISPLACE TIMES ARE NEAR 0 SEC. THE RADAR IS SIMILAR TO THE TA RADAR ON THE LATEST VERSION OF PANTSIR.

NOTES

UNITS WITH TRACKED WEAPONS USE TRACKED CP VEHICLES (CPVS). WHEELED AD BATTERIES CAN USE THESE OR PU-12M6 OR PU-12M7 BRDM-2-BASED CP VEHICLES. TIER 1 OR 2 UNITS WITHOUT ONBOARD ACQUISITION RADARS ON WEAPON SYSTEMS USE SBORKA FOR THE RADAR. SBORKA'S RADAR CAN EXTEND THE RANGE FOR SYSTEMS WITH RADARS. SBORKA C3 OFFERS DIGITAL LINKS, IFF, IMPROVED BATTLE MANAGEMENT, AND REDUNDANT SUPPORT FOR MOST OF THE SYSTEMS. FOR INDEPENDENT OR AUTONOMOUS FORCE MISSIONS, THE VEHICLE CAN BE EQUIPPED WITH A SATCOM ANTENNA AND RADIOS TO EXTEND TRANSMISSION RANGE.

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SBORKA-M1-2/PPRU-M1-2/9S80M1-2: THE NEW VARIANT HAS SOLID- STATE RADAR, WHICH IS MORE COMPACT, AND FITS ON A HEAVIER MAST FOR OPERATION WHILE MOVING. THUS SET-UP AND DISPLACE TIMES ARE NEAR 0 SEC. THE RADAR IS SIMILAR TO THE TA RADAR ON THE LATEST VERSION OF PANTSIR.

NOTES

UNITS WITH TRACKED WEAPONS USE TRACKED CP VEHICLES (CPVS). WHEELED AD BATTERIES CAN USE THESE OR PU-12M6 OR PU-12M7 BRDM-2-BASED CP VEHICLES. TIER 1 OR 2 UNITS WITHOUT ONBOARD ACQUISITION RADARS ON WEAPON SYSTEMS USE SBORKA FOR THE RADAR. SBORKA'S RADAR CAN EXTEND THE RANGE FOR SYSTEMS WITH RADARS. SBORKA C3 OFFERS DIGITAL LINKS, IFF, IMPROVED BATTLE MANAGEMENT, AND REDUNDANT SUPPORT FOR MOST OF THE SYSTEMS. FOR INDEPENDENT OR AUTONOMOUS FORCE MISSIONS, THE VEHICLE CAN BE EQUIPPED WITH A SATCOM ANTENNA AND RADIOS TO EXTEND TRANSMISSION RANGE.

SWEDISH AIR DEFENSE RADAR/COMMAND VEHICLE GIRAFFE 50AT AND GIRAFFE AMB



Giraffe 50 AT



Giraffe AMB

SYSTEM	SPECIFICATIONS	RADAR	SPECIFICATIONS
Alternative Designations	See Variants	Giraffe 50AT Specifications	
Date of Introduction	1992	Frequency Band	G-band, except for HARD (H/I-band)
Proliferation	Various configurations in at least 18 countries	Sweep Rate (rpm)	Antenna rotates 60 rpm
Crew	INA	Track Targets on Move	No
Weight (mt)	6.34, INA with arm	Effective Range (km)	50
Length (m)	6.9, INA with arm	Resolution 0.1 sq m target (km)	20-25
Width (m)	1.9	Effective Altitude (km)	10
Height (m)	2.4 for chassis, INA with arm	Low flying targets	up to 12 (in light of target resolution and aspect)
Engine Type	125-hp Mercedes Benz OM Diesel	Fire Units Controlled/Targets simultaneously handled	20
Cruising Range (km)	330	Track Targets on Move	No
Max. Road Speed (km/h	50		
Mobility	Off road mobility is very good on tracked chassis, off-road speed is slightly reduced due to arm.		
Fording Depth (m)	Amphibious; however, arm may affect it.		

DESCRIPTION

RADAR HAS A BROADBAND FULLY COHERENT TRAVELING-WAVE-TUBE (TWT) TRANSMITTER, AND A VERTICALLY POLARIZED PARABOLIC REFLECTOR ANTENNA LIFTED ON AN ELEVATING ARM. HYDRAULIC ELEVATING ARM HEIGHT IS 13M, 7M FOR GIRAFFE 50AT AND HARD.

GIRAFFE 50 AT CHASSIS (BV208)

THE MOST MOBILE SYSTEMS ARE GIRAFFE 50AT AND HARD, ON A SWEDISH HAGGLUNDS BV208 ALL TERRAIN TRACKED CARRIER, WITH AN ARTICULATED CHASSIS. IT IS A DIESEL-ENGINE VARIANT OF BV206.

ASSOCIATED AD SYSTEMS

RBS70, RBS90, RBS 23/BAMSE, STINGER, RAPIER, MISTRAL, AA GUNS, AND ANY OTHER AIR DEFENSE SYSTEMS WITH COMPATIBLE C2 NETWORKS. EMPLOYED TO SUPPORT SHORT-AND MEDIUM- RANGE FIRING UNITS, AD, AND COASTAL DEFENSE NETWORKS.

RADAR CAPABILITIES

FUNCTIONS: SURVEILLANCE, TARGET ACQUISITION AND EARLY WARNING. VEHICLE IS ALSO AD BATTLEFIELD MANAGEMENT CENTER FOR IADS.

FEATURES: RADAR IS DESIGNED TO OPERATE IN A GROUND CLUTTER AND ECM ENVIRONMENT. SIGNAL PROCESSOR USES DIGITAL MTI DOPPLER PROCESSING, WITH CURRENT ECCM, SUCH AS AUTOMATIC JUMPS TO AVOID JAMMED FREQUENCIES, AND EXTRACTS JAMMER BEARINGS FROM DISPLAY. RADAR HAS AUTOMATIC TARGET DETECTION AND TRACKING.

OTHER ASSETS

GIRAFFE RADARS LINK TO INTEGRATED AIR DEFENSE SYSTEM (IADS) FOR EARLY WARNING AND TARGET ACQUISITION IN THE AIR DEFENSE NET. THEY FUSE DATA FROM OTHER AD AND NON-AD UNITS, TO PERFORM BATTLE MANAGEMENT AT DIVISION AND BELOW. THEY ALSO PASS DATA TO OTHER UNITS AND IADS.

GIRAFFE AMB

SYSTEM HAS AN ISO MODULAR CONTAINER ON A 10-WHEEL CROSS-COUNTRY TRUCK, WITH A 3-D MONOPULSE PHASED ARRAY MULTI-BEAM RADAR ON A 12-M MAST. FREQUENCY IS 5.4-5.9 GHZ, WITH CAPABILITIES OF 100 KM RANGE, >20-KM ALTITUDE. LOW ANTENNA SIDELOBES AND FREQUENCY AGILITY OFFER OUTSTANDING JAM RESISTANCE. IT CAN TRACK OVER 100 TARGETS SIMULTANEOUSLY IN THE ONBOARD AD BATTLE MANAGEMENT CENTER. EMPLACE/DISPLACE TIMES ARE 10/3 MIN. SPLINTER AND NBC PROTECTION FOR THE CAB.

VARIANTS

GIRAFFE 50: SYSTEM FEATURED ABOVE, WITH REDUCED DETECTION AND REACTION TIME, AND BETTER CLUTTER RESISTANCE.

GIRAFFE (PS-70/R): ORIGINAL SYSTEM FOR USE WITH RBS70, WITH 40 KM SURVEILLANCE, 20 KM TARGET DESIGNATION RANGE.

GIRAFFE 40: TRUCK-MOUNTED SYSTEM FOR AA GUNS AND MANPADS SUPPORT NETS.

GIRAFFE 75 (PS-90): TRUCK-MOUNTED MEDIUM-RANGE SYSTEM, WHICH CAN CONTROL UP TO 20 FIRE UNITS.

COASTAL GIRAFFE: COASTAL DEFENSE VARIANT.

GIRAFFE AD: MEDIUM-RANGE VARIANT FOCUSED ON ECCM AND C^2.

GIRAFFE CS: SHORT-RANGE AND COAST DEFENSE VARIANT.

HARD (PS-91): SHORT-RANGE VARIANT ON BV-208 CHASSIS. THE H/I-BAND OPERATING FREQUENCIES PROVIDE LOW PROBABILITY OF INTERCEPT (LPI).

NOTES

THE AMB CAN BE MOUNTED IN VEHICLE CONFIGURATIONS, SUCH AS TRACKED VEHICLE, WHEELED APC, OR TRUCK, AND BE SHIP- MOUNTED. FIXED SITE VERSIONS ARE ALSO AVAILABLE. THE RADAR NET ALERTS MISSILE FIRERS, AND ASSIGNS SECTOR ON PLOTTING BOARDS WITHIN THE SIGHT UNITS FOR RBS-70 AND RBS-90 MANPADS.

AIR DEFENSE AND OTHER TECHNOLOGY COUNTERS TO UNMANNED AERIAL VEHICLES (UAVS)

UAVs are proliferating worldwide. These aircraft are used in various configurations and sizes and for an increasing variety of missions. Their size ranges from bomber size to palm-size micro-aerial vehicles. Missions include attack UAVs and unmanned combat aerial vehicles (UCAVs), reconnaissance, fire support roles, C^2, INFOWAR, etc. Responses generally fit within the categories of command, control, communications and deception (C3D), information warfare (IW), and direct attack. Military tactical and technical responses can vary with the configurations and missions, and require an all-arms approach (see TC 7-100-2, Chapter 11).

Forces will use C3D to counter a wide range of threats, including UAVs; but the proliferation of these aircraft throughout the area will require increased emphasis on C3D discipline. Measures include more use of IR-absorbent and vehicle conformant camouflage, screens for dismounted positions, and use of deformers, deception, and signature modification. Greater availability of responsive smoke and digging equipment will assist in rapid concealment.

INFOWAR assets can be used against UAVs. Intercept assets may be able to detect signals for UAV control and intercept the image display for their own reconnaissance, intelligence, surveillance, and target acquisition (RISTA). The US and Iran have demonstrated abilities to counter and crash UAVs. Even low-cost jam assets can jam UAV controls and GPS in critical areas at critical times, to neutralize/crash them or prompt auto-return to launch point. But jamming has its own vulnerabilities. Jammers generate a signature subject to detection and destruction, and therefore must limit their use time. Intermittent brief jamming can confuse and neutralize many UAVs, and challenge enemy counter-jamming capabilities.

The most likely and most widely available IW counter is the global navigation satellite system (GNSS) jammer. These can be miniaturized with low-power, significant range, and wide area effects. Stationary jammers can be detected and destroyed by direct attack, but mobile jammers can be fitted to ground vehicles. They also can be mounted on UAVs flying prescribed routes with visual markers, or on airships. They can also be linked with AD as a lure for air ambush. Although GPS jammers also jam their own forces, defenders and most adversary forces are generally less reliant on GPS precision than modern offensive-minded forces.

Most forces will prefer to destroy UAVs upon detection using direct action. Early detection is a critical factor. This task requires use of air watches and RISTA assets to surveil all approaches. Thus we see a trend in the proliferation of new, more flexible sensors for use on ground and vehicle mounts. They include aerial sensors, e.g., airships with radars and thermal/EO sensors. They also include acoustic systems: sound-ranging sets, unattended ground sensors, and vehicle/tripod acoustic microphone counter-measure sets. Remote camera arrays offer 24/7 monitoring of large areas. Scores of lightweight remote weapon stations or EO sensor pods fit on vehicles or stands with 30-50+ magnification and fast slew. These can be linked to integrated AD nets, e.g., IADS, to cue other sensors and weapons, or to send warnings to possible units along the UAV flight path, using the attack alert systems and azimuth plotting board. Lightweight, portable, and more responsive radars now fit ground and vehicle mounts for sector searches that include scanning the horizon for aircraft. Larger UAVs with signatures similar to FW aircraft and flying at higher altitudes will be treated like those targets. New stealthy designs in UAVs and unmanned combat aerial vehicles (UCAVs) will challenge conventional air defense radars. Thus, more forces will adopt recent IADS RISTA nets specifically designed to counter stealth aircraft (and their supporting radars).

The enemy will attack UAVs and support assets (i.e. launcher, ground station, and link assets) upon encounter. Weapons for attack vary with UAV size. Conventional aircraft-sized UAV targets can be acquired and engaged by the same assets as their manned counterparts. Tactical UAVs generally feature

smaller visual, thermal, and radar signatures. Reduced UAV thermal signatures at night can challenge observation by systems other than air defense, and air defense systems without radars. However, most can be detected by modern radars and acoustics, some using high-resolution thermal sights. At target acquisition ranges, missiles and rounds with proximity or AHEAD type fuzes can be used against these aircraft. In the future, more calibers of AD rounds will use these fuzes. Tactical UAVs that fly below 3,500 m altitude may be engaged by modern man-portable SAMs and guns. Vulnerability varies with design and flight profile. If a tactical UAV flies below 300 m altitude, it is vulnerable to nearly all weapons, including shoulder weapons. Rotary-wing UAVs are more likely to fly at a low altitude because of their low-speed control features. Anti-helicopter mines can be command-detonated or sensor-fuzed to destroy low-flying UAVs.

UAVs which may present the greatest challenge to air defense are small UAVs weighing less than 25 kg -- mini-UAVs (MUAVs) and micro-aerial vehicles (MAVs). Battery power eliminates their acoustic and thermal signatures. Unless radars or other specialized AD sensors are used, there will be insufficient detection time to use most of the weapons in the UAV flight path. For MUAVs, small size almost eliminates radar signature beyond a few km. If they use a camouflage pattern and fly above 300 m, they are very difficult to see in daytime. However, due to limited camera range and wind patterns above tree lines, many will fly within 300 m of the ground. Machineguns can be somewhat effective against them; rifle fire will be more difficult ("big sky – little bullet"). It is difficult to gauge range without ground level background as a gauge; therefore, a laser rangefinder (LRF) is essential for aiming AD weapons. A preferred weapon, found in some infantry units, is a shotgun with duck hunter loads. Automatic grenade launchers (AGL) with precision optics and air-bursting munitions offer a potentially effective MUAV deterrent. AGLs fitted with bore-sighted FARA-1 man-portable radars for near instantaneous cuing have been displayed.

In the Near Term, as these MUAVs proliferate, adversary forces will seek additional countermeasures. A possible development will be proximity-fuzed grenades tailored for 20-40 mm grenade launchers. About a dozen or so producers have developed shoulder-mounted grenade launchers for these munitions, with ranges of 500 - 1,000 m. Such a weapon with precision optics and proximity-fuzed or air burst munitions (ABM) grenades would enable squads or weapons teams to respond quickly. Vehicle mounted light remote weapon pods with multiple cameras for 360° monitor displays and rapid slew are likely future innovations.

Micro-aerial vehicles (MAV) are not widely fielded. They vary from palm-size to hand-launched weighing 5 kg, with 0.67 m wing-span. Many have small batteries short range (<5 km), a close camera view (<300 m), and fly at low altitudes (often <300 m). With instability and high potential for crashing, many must be treated as disposable. Most are for daytime use only, but limited night capability is available. Good C3D practices, such as camouflage and smoke, can challenge them. Jammers also can defeat them. Weapons discussed in the above paragraph can defeat them, especially the larger MAVs. It is likely that forces will seek other counter-UAV weapons, specifically against MAVs. But MAV detection and rapid destruction will be a challenge. Most will detect targets before they are destroyed. Because MAVs are used by adversary low-echelon units or site security units, an AD targeting force must have assets and alert nets to quickly warn of their presence, and be ready to respond. Some danger exists that an AD weapon response may go awry and alert approaching MAVs.

AIR DEFENSE TRENDS IN COUNTERING LOW OBSERVABLE (LO) AND STEALTH AERIAL SYSTEMS

One of the greatest threats to AD is LO systems. For decades, aircraft used terrain-hugging (low altitude) flight profiles for stealth missions against AD. Modern forces also use LO and ***stealth*** very low observable (VLO) aircraft in the early phases of air operations to neutralize or degrade target air defense capabilities and engage high value targets. Increasingly, stealthy UAVs and UCAVs are used to engage deep targets in cases where manned aircraft would be too vulnerable. Increasing numbers of modern aircraft and UAVs employ stealth design principles by reducing or nearly eliminating their radar signatures. Accordingly, AD forces are finding new ways to detect, acquire, and engage them.

LO systems are designed (or technologically upgraded) to counter use of electronic signals, visual or thermal signatures, noise, or changes in other factors typically associated with stealthy modes of operation (refueling, etc.), to avoid detection. Designs can reduce their radar cross section (RCS) in head-on approaches against specific radar frequencies, but with some vulnerability to detection in other frequencies, and by other approaches. Most UAVs are inherently LO or stealthy. Aerial systems reduce their signal-to-noise ratio (SNR), hide in the radar clutter while approaching their mission area, execute the mission, and avoid AD response. Stealth system designs are especially costly for those roles. But even the stealthiest aircraft are visible part of the time, or in some frequencies. AD must exploit their vulnerabilities by improving the SNR, improving acquisition means, and engaging more quickly upon acquisition.

Counter-stealth or counter-LO (CLO) systems and tactics have been in use since the 1980s. Some evolved from efforts to counter helicopters flying at terrain-hugging altitudes. Goals of these measures include improved responsiveness to counter limited warning time; better precision against protection countermeasures; use of integrated systems to improve responsiveness; expanded links to neighboring units; better utilization of human intelligence (HUMINT) capabilities; and reduced time out of action, all to reduce vulnerability. Methods include using overlapping AD assets to cover all approaches, using air observers to cover air avenues of approach, and integrating active and passive sensors directly with weapons to increase effectiveness. These and identification-friend-foe (IFF) systems are used to support autonomy and enable AD engagement by subunits and individual systems, even when the AD nets and IADS are degraded by SEAD and other methods. Counter-SEAD measures by AD units reduce the effectiveness of SEAD attempts by protecting warning and data transmission systems. Digitization and Global Navigation Satellite System (GNSS) map displays are used in battle management centers from brigade all the way down to the AD vehicle or gun level when possible. These provide faster planning and report updates to autonomous units. Blimps can be used in area defense. Space and airborne reconnaissance platforms supplement ground-based AD. Aircraft are tasked to intercept adversary stealth systems long before they can engage targets. Since most air stealth missions are conducted at night, improved night sensors (thermal sights, etc.) help facilitate the AD counter-stealth effort.

Stealth aircraft equipped with high-altitude anti-radiation missiles (HARMs) could attack AD units from stand-off ranges if AD lacks HARMs countermeasures. Some LRAD and MRAD units are increasing weapon loads on their transporter erector launchers (TELs) or adding launcher-loader vehicles to engage both aircraft and the precision ordnance they carry. Increased missile loads can be added to LRAD systems like the Russian SA-20b, SA-21, and recently deployed South Korean KM-SAM system.



SA-20b with 4 “small missiles”



30N6E2 Radar Vehicle

Most AD units use ***monostatic*** radars, which transmit and receive their own signal. The Russians have fielded a variety of complexes, which can transmit results in real time to battle management centers in LRAD radar units and IADS. Radars may operate in ***bistatic radar*** complexes, with one sending, and others receiving to operate passively and view targets from different aspects and detect stealth systems. There are also ***multistatic radars***, with multiple radars and frequencies in complexes, overlaying and comparing results. The need for multiple overlapping radar frequencies has led to new Russian radars of various frequencies in MRAD and LRAD units. Modern LRAD radars are often phased array systems (e.g., 30N6E2 for the SA-20b/Favorit) with 360° coverage, employing various search modes. They can be integrated, transmit results in real time to map displays, and are difficult to jam. Many AD radars use common (centimeter) H-J bands; but others use less detectable or less vulnerable bands. With real-time integration and analytic fusion, battle management centers can detect and track adversary stealth systems. These complexes can be costly for most forces, unless costs are mitigated by updating and digitally integrating older radars into existing systems. A number of countries offer similar radars for MRAD and LRAD systems, complexes, and IADS.



Avtobaza

The complexes can also include early warning (EW) radars which operate in lower frequency bands (A-C), are updated with robust multiple target tracking and display, and have secure responsive digital data links to integrate their results with IADS. Assets also include long-range passive electronic intelligence (ELINT) systems, to support the IADS with a low probability of suppression. They scan wide areas over a wide band of frequencies including communications, guidance, and radar bandwidths. Examples of such systems include Russia's Vega 85V6-A/Orion 3-D complex with 400+ km range, a 0.2-18 GHz frequency range, and a 100-target handling capacity). The 4-vehicle complex mounts a telescoping antennae on a 6x6 off-road truck chassis, to detect and track ground, sea, and air targets. Another example is the Avtobaza, which is fielded and exported; user countries reportedly include Iran and Syria. Other countries also produce/export ELINT systems.



Nebo 1L13-1 (left) and 1L13 (right) radars

Russian and other AD forces have developed *"counter-very low observable"* (CVLO) radar complexes, with meter-wave radars specially designed to find stealth aircraft. The Russian Nebo series, dating from 1986, has seen several upgrades. The 1L13-1/Nebo-SV two-dimensional system was replaced by 55Zh6-1 and 1L13-3 automated 3-D versions. The 1L119/Nebo SVU 3-D active phased array system appeared in 2001, and links to modern systems, e.g. the SA-20b. The new Nebo-M system is a mobile radar complex , with frequency bands ranging from B through X band. Russia is now fielding this system. Nebo variants have been exported; and CVLO radars have been developed by other forces.

Aerial forces are expanding stealth capabilities with longer stand-off distances for aircraft (and missiles), and smaller UAVs, UCAVs and UAVs with stealthy designs. Even in an era of reduced budgets, this array of improved aerial systems and AD countermeasuress will continue to drive the requirement for AD upgrades in acquisition, C^2, weapons, and tactics.

ELECTRONIC INTELLIGENCE (ELINT) SUPPORT TO AIR DEFENSE

ELINT (or Electronic Support, e.g., ES) systems have been in AD forces' inventories for decades. They include equipment specifically designed to detect aircraft electronic emissions. General-use ELINT systems that detect air, ground, and naval emitters can also be effective with AD forces.

These sensors offer key benefits that include long ranges and the ability to operate passively and continuously (for days at a time). Thus they are well suited as early warning assets, particularly against aerial systems using radios, radars, or jammers. They can cue the IADS and use triangulation to locate approaching aircraft. Most systems use multiple stations and a control node, but an individual station could be data-linked with radars or other IADS sensors for location purposes. ELINT systems are ineffective against stealth aircraft when such aircraft are not emitting electronic signals.

Specialized systems include the Czech Ramona (aka KRTP-81 or -81M). It was first seen in 1979 and deployed in at least 3 countries. It is complicated, comprised of 3 or more stations that require 12 hours to emplace, and locates targets by triangulation from each separate station. The system is difficult to operate, but can track up to 20 targets, emitting in a bandwidth of 1-8 GHZ. The Tamara (KRTP-84), which followed in 1987, is mounted on a rapid deploying 8x8 truck chassis. With a bandwidth of 820 MHz-18 GHz, the Tamara can track 72 targets up to a maximum range of 450 km.

Modern systems include the Czech-tailored Vera-E and Borap, the Chinese DLW002 and YLC-20, and the Russian Valeria and Avtobaza. The following systems are deployed in AD as well as EW venues.

UKRAINIAN KOLCHUGA-M



SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designation	None	Azimuth Coverage (°)	360
Date of Introduction	2000 for Kolchuga-M	Surveillance range (km)	450-620, depending on target altitudes and frequencies. The latter figure applies to targets at 18.5 km altitude. Manufacturer claims 800 km (may be valid - some frequencies).
Proliferation	At least 4 countries, reportedly including Iran	Effectiveness Against Stealth	Reported but not likely
Components for Complex	2-3 vehicles plus control post	Maximum Number of Targets Tracked	32
Crew	2 at the receiving station, 3or 4 at control node	Range for a Complex (km)	1,000 frontage or 450-600 radius
Platform	6x6 van	Operation Duration Time (hrs)	24
Antenna Type	4 in VHF, UHF, and SHF		
Frequency Range	0.13-18 GHz (to include X and Ku bands)		

NOTES

RUSSIAN 85V6 VEGA ORION ELINT SYSTEM

NO PHOTO AVAILABLE

SYSTEM	SPECIFICATIONS	SYSTEM	SPECIFICATIONS
Alternative Designation	85V6-A or 85V6E	Azimuth Coverage (°)	360
Date of Introduction	By 2000	Elevation Coverage (°)	0-20
Proliferation	At Least 3 countries	Bearing Accuracy (°)	1-2 for .2-2 GHZ, 0.2 for 2 GHz or more
Components for Complex	3 stations and control post	Maximum Distance Between Stations (km)	30
Crew	2 per station, 3-5 at the control post	Maximum Control Post Separation (km)	20, near ELINT user
Platform	URAL 43203 6x6 van, for receiver and for control post	Deployment time (min)	5-10 for station, 40 for system. Receiver stations may make several local moves before the CP moves. Some users will locate the CP near a receiver station
Power source	Vehicle PTO, or diesel APU on a trailer	Report Format	Digital map display plus acoustic alert, RF signal
Antennae Type	Spinning omni-directional and dish receiver antennae. The antennae can be manually pointed or set on auto-track		
Frequency Range	0.2 – 18 GHz C-D (up to 40 option)		

NOTES

RUSSIAN GROUND BASED ELINT SYSTEM AVTOBAZA





SYSTEM	SPECIFICATIONS	Antenna	SPECIFICATIONS
Alternative Designations	1L222	Description	Rotating Parabolic Antenna
Date of Introduction	1980-1999	Azimuth	360º
Proliferation	At least 4 countries*	Elevation	18 º– 8.5 to 10.2 GHz 30º– 13.4 to 17.5 GHz
Crew	4	Rotation	6 -12 orbits per minute
Power Supply	6V or 15 V DC	Environmental Conditions	
Weight	13.3 t.	Operational Range	Ambient temperature, ° C from -45 to +40 Humidity 98% at temp ≥25 ° C
Frequency Range	GHz to 17.5 GHz	VARIANTS	SPECIFICATIONS
Power (kW)	12 consumption	Avtobaza-M	Target detection range of up to 400 km (est.) Frequency range: 0.2 to 18 GHz
RECEIVER	SPECIFICATIONS		
Range (km)	150		
Sensitivity of Receiver	-88dB		
Receiver Modes	Side-looking airborne radars (SLAR) used in combat aircraft, targeting radars of air-to-surface weapons, and radars used to guide aircraft flying at extremely low altitudes, early warning and control radars and jammers.		
Operational Range	X and Ku –Band		
Target Data	Target quantity according to frequency, assignment of jamming systems, type of emitting radars and their angular coordinates		
Frequency identification accuracy	± 30MHz		
Accuracy of DF, degrees	Azimuth: 0.5 Elevation: 3		
Target Throughput	Up to 60 targets		
Reaction Time	50 µs		

DESCRIPTION

PASSIVE ELINT SIGNALS INTERCEPT SYSTEM DESIGNED TO INTERCEPT AND LOCATE PULSED AIRBORNE RADARS, INCLUDING FIRE CONTROL RADARS, TERRAIN FOLLOWING RADARS AND GROUND MAPPING RADARS, AS WELL AS WEAPON (MISSILE) DATA LINKS.

OPERATION

- **FREQUENCY RANGE: 8,000 MHZ-17,455 MHZ**
- **ADJUSTABLE PRIORITIZATION OF TARGET SETS**
- **UP TO 100 METERS DISTANCE FROM AUTOMATED COMMAND POST (ACP)**
- **MONITORS 15 TARGETS PER SECOND UP TO 60 TARGETS**
- **LESS THAN 25 MIN SET UP TIME**
- **REAL TIME SELF REPORTING STATUS UPDATES**
- **PROVIDES LOCATION DATA, AND TARGET PROCESSING FOR GROUND-BASED AIRCRAFT RADAR JAMMING SYSTEM**

NOTES

ACORDING TO AT LEAST ONE SOURCE, THE SYSTEM HAS BEEN MODIFIED TO RECEIVE AND LOCATE EMISSIONS ASSOCIATED WITH SATELLITE TELEPHONES. THE SYSTEM WAS REPORTEDLY DEPLOYED TO IRAN AND SYRIA IN THE 2011 -2012 TIME-FRAME.

AIRSHIP SUPPORT TO AIR DEFENSE

Airships ("lighter-than-air" craft) have been used in warfare since the 1800s, when balloons offered elevated platforms for military observers. Airships are increasingly used in civilian venues, and their capabilities for military use include air defense. Potential roles include support to communications, with airship lift capabilities exploited for using longer range antennae; and airborne-mounted communications retransmission systems. AD electronic warfare and RISTA units can use aerostats to raise recon systems. A simple method would be to attach a jammer round on a cable. A GPS jammer could be mounted on a vehicle-based aerostat or a dirigible moving within protected zones.



Some signal intelligence and communications units have the option of using aerostats to raise antennae to achieve increased operating ranges. British Allsopp developed the Mobile Adhoc Radio Network (MANET), with three steerable Low Visibility Skyhook Helikites bearing International Telephone and Telegraph (ITT) Spearnet radios to 65-m height. They demonstrated that an infantry radio, usually limited to 1 km range, can send video data (using a 15 kg helikite backpack) to a receiver 10 km away. The manufacturer claims that the antenna altitude could reach up to 500 m.



Electronic warfare units can use aerostats to raise antennae on jammers and recon systems. A simple method would be to attach a jammer round on a cable. A GPS jammer could be mounted on a vehicle-based aerostat or on a dirigible moving within protected zones. Artillery units have long used weather balloons in meteorological units to supply data for calculating fire adjustments. Those same units also possess helium generators for supplying the gas.

The most-used role for airships is reconnaissance, including low level aerial surveillance. Airship-mounted camera systems can detect helicopters flying at low altitudes (using forest canopy for cover) earlier than ground-based cameras. Some military and civilian forces use large aerostat balloons with cameras to surveil border areas. Elevated platforms offer long-range unobstructed fields of view, and extended viewing duration. Airship-mounted sensors vary in design from a simple camera or camcorder to a day/thermal video-camera or TV transmitting in real-time to a palm pilot or laptop computer, or over a digital net. The Israeli Speed-A stabilized payload system with automated EO/thermal imager and laser rangefinder attaches to lightweight airships. Gondolas may employ camera bars, stabilized mounts, or even gimbaled sensor balls (shown) with multiple sensors, laser rangefinders (LRF), and auto-trackers with 60+ power digital/optical zoom capability. Navigation aids can include GPS location systems, ground-based location capability that employs an LRF, or an inexpensive in-viewer display.





As airships become better-controlled and more stable, a variety of sensors can be added to their payload. In reconnaissance units, an airship could be used to mount a small light-weight radar antenna, such as the FARA-1E. The Russian Gepard airship automated platform offers an electric link and lifts a 300 kg payload

to a 2 km altitude. Airships could raise a cordon of light-weight radar antennae over obscured approaches to detect approaching helicopters and other airborne threats. Because they may be vulnerable to enemy aerial threats, the airships can be motorized with para-motors to permit remote steering and navigation, thus avoiding a vulnerable fixed location for easy interdiction. Airships can also be raised and lowered from transport vehicles that can rapidly relocate.

Using modern airships as barrage balloons is an air defense capability that can be resurrected from the World War II era. They can deny low-level airspace to enemy aircraft by:

- Forcing aircraft to fly at higher altitudes, thereby decreasing surprise and attack accuracy
- Canalizing the direction of enemy attack, permitting more economical use of AD assets
- Presenting definite mental and material hazards to pilots by support cables and the airships themselves.



During WWII in 1944, the UK had 3,000 aerostats operating. During the Blitz, 102 aircraft struck cables (66 crashed or made forced landings), and 261 V-1 rockets were downed. The blimps were 19 m long. Modern, more compact airships offer more flexible options, with fast vehicle-mount winches, powered dirigibles, and lighter and stronger cables. Although modern aircraft have better sensors (such as thermal sights for night use), most airships have no thermal or radar signature and can be camouflaged and concealed for rapid rise with minimal visual signature. The latest recorded catastrophic collision of an aircraft with an aerostat cable occurred in 2007 in the Florida Keys. The Iranians have demonstrated ***air mines***, barrage balloons with explosive charges.

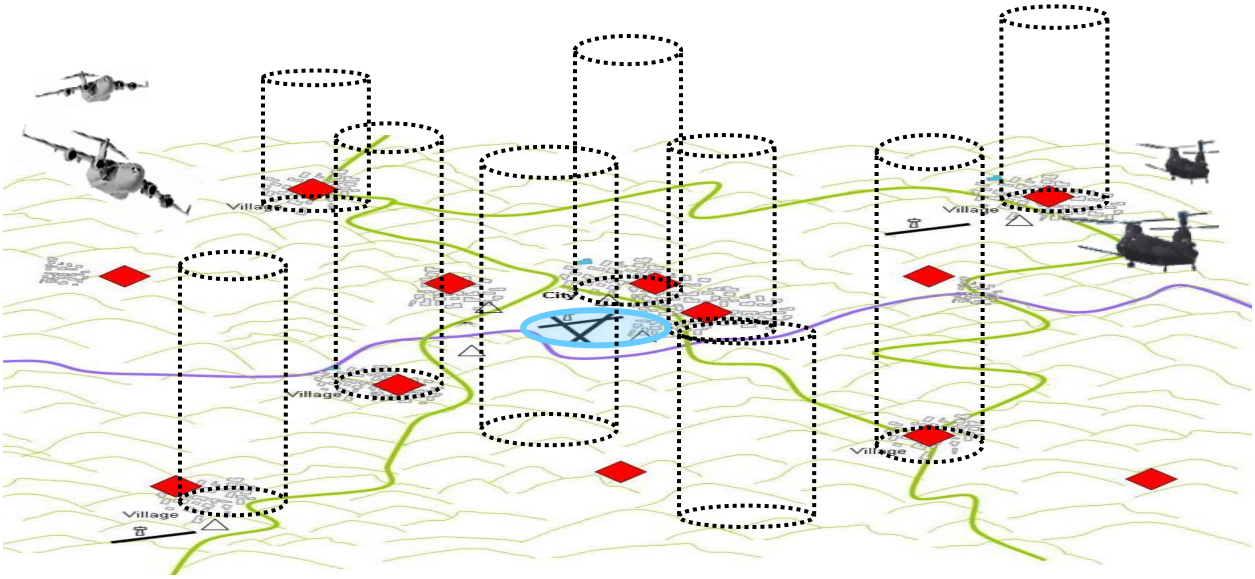


The tether cable and loose lines are the main threat to low-flying aircraft. Tether cables are next to impossible to detect in either day or night conditions, and typically made of steel, Kevlar, lead oxide (PBO), or nylon.



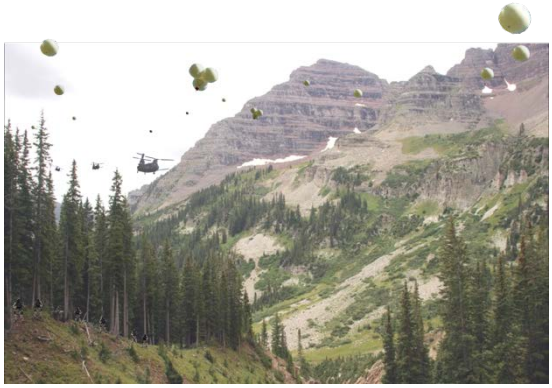
The type and length of tether material is determined by lift capacity of the balloon. Multiple loose lines and/or tethers may be suspended from the balloon. Short-notice balloon fields can be emplaced in 10-20 minutes, and the aerostats raised or lowered with fast winches in 1-5 minutes. Netting, buildings, and trees can be used to conceal inflated balloons between uses. Smaller (e.g., 1-m) inflated shaped balloons can be used for shaping bogus targets, and altering the appearance of buildings, vehicles, weapons, etc. They can also be raised as AD aerostats.

Although some balloons will employ concealment techniques, others will be clearly displayed to divert aircraft, or as bait to trigger a response and draw aircraft into air defense ambushes. Captured marker balloons can divert search and rescue aircraft into ambushes. Balloons can be used in deception as decoys to draw aircraft away from high-value targets.



Two areas where airships are most effective in air defense are urban and complex terrain.





RECENT DEVELOPMENTS IN VERY SHORT RANGE AIR DEFENSE (VSHORAD) SYSTEMS

Very short range air defense (VSHORAD) systems encompass a wide variety of technologies, determined by AD missions and ranges (up to 8 km). These systems are dispersed across the battle area and used for area and site defense, and as multi-role systems for use against a wide variety of targets. They are used by modern regular forces and irregular forces constrained by limited budgets, limited training, and minimal mobile assets.

The most widely proliferated VSHORAD systems are weapons employed throughout the force in the All-Arms Defense. These weapons are primarily used against low-flying aircraft (helicopters, UAVs, etc.) that are within range and venture into their designated defended area. Such weapons include infantry small arms, vehicle guns, grenade launchers, and missiles. The single most prolific and dangerous weapon in this category is the machinegun (MG). Medium (12.7-mm) and heavy (14.5-mm) MGs provide protection for dismounted personnel and any vehicle, boat, or reconnaissance vehicle (RV) against attacking adversaries. MGs can also be used against the growing UAV threat.

All-arms weapons include new multi-role weapons and munitions for use by ground forces, and include some weapons capable of engaging aerial targets. Antitank guided missiles (ATGMs) have always been able to engage low-flying aircraft (most of which must fly at slow speeds). However, some ATGMs fly at higher speeds (such as AT-9) for superior intercept. The AT-9 and some others feature an anti-helicopter missile equipped with a proximity fuze that increases the warhead's lethality. The following section also notes other adaptive weapons that can be tailored to support specific missions. Tactical units can use selected mines, including anti-helicopter mines, to support AD requirements.

The most widely fielded VSHORAD weapons for lower-tier forces are AD guns, including MGs, and medium cannons up to 57 mm in caliber. There are even heavy AD cannons (76-100+ mm). With improved fire control systems (e.g., radars) and improved munitions, some of these remain a viable threat to aircraft flying at 0-6,000 m. Forces are upgrading some ground-mounted guns by mounting them on vehicles with modern fire control systems. They are also fielding multi-role systems (AD/AT) and infantry fire support vehicles with improved AD guns.

Generally, forces that are more modernized have chosen a different route. They mount robust AD capable guns on ground force infantry fighting vehicles (IFV) and armored personnel carriers (APCs), but equip AD forces primarily with missiles. The most widely proliferated missiles in any force are man-portable SAMs (MANPADS). These are missiles launched from disposable canisters attached to hand-held grip-stocks. They are used not only by dismounted soldiers, but also mechanized units, in missile launcher vehicles, on helicopters, ships, and boats. Some mount MANPADS on support vehicles, e.g., motorcycles, all-terrain vehicles (ATVs), light strike vehicles, and even on AD guns. MANPADS have seen upgrades in fire control (EO/thermal and auto-trackers), in warheads (proximity fuzing, larger Frag-HE fills with HMX explosive, KE frangible, etc.), and in missile motor design (high velocity speeds and improved maneuverability). Most MANPADS use infra-red (IR) homing with seekers cooled by an attached battery coolant unit (BCU), with modern upgrades such as two-color IR with improved detectors and needle shockwave dampers for cooler seekers, better clutter rejection for improved lock-on and countermeasure rejection to achieve a hit probability of up to 85% (90% against helicopters). Recent guidance modes include semi-automatic command line of sight (SACLOS) laser beam rider (LBR) on Starstreak and semi-active laser (SAL) homing to defeat countermeasures with a hit probability of 95% or more. The Lightweight Multi-role Missile variant of Starstreak is due out soon and is offered on a Camcopter UAV combat variant).

ADAPTIVE WEAPONS FOR AIR DEFENSE IN CLOSE TERRAIN

Military forces worldwide generally recognize the need to counter aerial threats throughout the battlefield. Fixed-wing threats formerly drove the requirements for air defense systems, but since the Vietnam War era most countries have increased the capabilities of their forces to counter threats from rotary-wing aircraft. These anti rotary wing AD weapons may not destroy the targeted aircraft, but their damage can disrupt the aircraft's mission and deny its capability to accomplish subsequent missions.

The OPFOR will employ conventional AD weapons against helicopters when available. In some environments however, many AD weapons are less effective, such as in dense terrain or urban areas. In dense terrain helicopters may be spotted at <500m, with their concealment or sudden appearance requiring fast reaction, and weapons' adjustment for minimum ranges and altitudes by air defenders. The same factors limit use of most surface-to-air missiles (SAMs). Helicopter countermeasure systems may also degrade SAM performance.

Tactical forces may employ teams and assets to augment organic air defense assets to counter the helicopter threat, in addition to ground threats, in their assigned areas of responsibility.

--*Tactical security elements* are specially-designed units that operate in the OPFOR rear area and use weapons such as machineguns to protect rear area assets from ground and air attack.

--*Air defense observers*. Units will assign AD observers for moving and stationary units. At least one observer team (1-3 people) per platoon is assigned the role of AD observation. Most tactical units are linked into the tactical warning net with an alarm system that can warn of ground and air attacks. The team may be assigned a machinegun or other weapon for this role.

--*Air defense teams*. Infantry forces in dense terrain and in dispersed operations may send out teams (2-3 men) against helicopters. These teams can also move with other units for tactical and security missions. A team has to travel fast and light, and engage quickly; thus the maximum recommended weapon weight is 20 lbs (9.1 kg). The AD team should employ a mix of weapons against air and ground threats. The most common AD weapon is a 7.62 or 12.7-mm MG. An AD team may encounter numerous targets. Systems need ammunition for 2-5 encounters per mission. Equipment needed includes a radio, night vision equipment, and laser rangefinders. These teams can use light vehicles but might be better served with motorcycles or all-terrain vehicles (ATVs).

--Combat support and combat service support vehicles with machineguns, medium guns, or automatic grenade launchers will generally not initiate engagements with aircraft, preferring to reserve these weapons for defensive purposes. They may destroy or damage aircraft, force aircraft to break off engagements, and deny aircraft the option for low-altitude flight over wide areas.

--Combat vehicle weapons. Operation Desert Storm demonstrated the capabilities of helicopters against fighting vehicles. Therefore, AFVs are increasingly addressing the threat from above with improved weapon systems. Training experience has shown that tank main guns with sabot rounds can be effective against rotary-winged aircraft. High-angle-of-fire turrets and air defense sights for light armored fighting vehicle (LAFV) medium guns and machineguns are being fielded and upgraded to address aerial threats. Frangible rounds offer kinetic energy (KE)-type accuracy and high explosive (HE)-like lethal effects against aircraft. Vehicle guns with programmable-fuze ammunition (such as the Russian BMP-3M and T-80UK) can approach the lethality of precision AD systems such as Skyguard. Antitank guided missiles, especially those that are gun-launched, are a threat to slow-moving or hovering aircraft.

--Anti-helicopter mines or directional mines (such as Claymore or Russian MON series) can also be used in an air defense mode. Conventional mines can be adapted with acoustic or multi-sensor units

(such as Ajax) to create anti-helicopter mines. RW aircraft obstacle systems can include wire obstacles at landing zones (LZs) and airship nets (armed or unarmed).

Here are a few weapons that can be effective against aircraft.

System Type	Example
ATGM Launcher	- Short-range systems like Eryx and man-portable ATGMs like Gill, AT-13, AT-7 - Portable systems like European HOT, Russian Kornet, AT-5B
Machineguns	- SQD: Russian 7.62-mm PKM - CO: 12.7-mm w/API, sabot, and frangible
Sniper/Marksman rifle	- 7.62-mm SVD, or .338, with API rounds
Under-barrel grenade launcher	- 40-mm GP-30 HE grenade
Rifle grenades	- BE FN Bullet-thru AV (Anti-vehicle), 3 per rifle
Lightweight grenade launcher	- M79 40-mm grenade launcher
Automatic grenade launcher	- CH 35-mm W-87 w/HEDP, 30-mm AGS-17 (HE) Singapore CIS 40GL, HEDP or airburst munitions
Antitank grenade launcher	- Any ATGLs, esp. with longer-range DP or HE grenades - Carl Gustaf M3, w/HEDP grenade, LRF and night sight - German PZF3-T600 or -IT600 with HE and DP grenades
Recoilless rifle	- Yugoslavian M79, US/Swedish M40/M40A1
Antitank disposable launcher	- German Armbrust, Russian RPO-A
Mini-UAVs/Micro-Aerial Vehicles	- With or without warheads, to attack/harass RW aircraft
Air-to-surface rocket launcher	- "C-5K" Iraqi or Chechen launcher with S-5 57-mm rockets
Semi-active laser homing	- Recent ATGLs and ASRs with SAL-H homing munitions

--Improvised rocket launchers. Man-portable air-to-surface rockets of less than 100 mm can be launched at low-flying helicopters. Rockets include the Russian S-5 series, French 68-mm SNEB, and others. Most improvised launchers lack sights with adequate precision. However, some fabricators use fairly standard designs and have employed sights from the Russian RPG-7V antitank grenade launcher (ATGL). These sights are adequate for use out to a range of 500 m. To avoid the common problem of high

amounts of ash discharge, some fabricators added plexiglass shields. With these improvements, launchers for these high velocity rockets with very flat trajectories are a viable threat to helicopters, and are claimed to have downed at least one in Iraq.

Air defense teams using man-portable air defense systems (MANPADS) are not considered adaptive responses, but MANPADS can be employed in an adaptive manner. Because of its vulnerability to detection and high priority as an adversary target, an AD team should be equipped to engage multiple targets - air and ground. The Starstreak MANPADS system offers unique flexibility. It was optimized against helicopters but it can also be employed against FW aircraft, light armored vehicles, and selected other priority targets, such as snipers in bunkers or buildings. Thus a team equipped with Starstreak and other multi-use weapons such as antitank grenade launchers (ATGL) and automatic grenade launchers (AGL) can be used for a wide array for security, ambush or attack missions. The MANPADS can be linked to MG or cannon fire control, or mounted on reconnaissance vehicles.

ANTI-HELICOPTER MINES FOR USE IN AIR DEFENSE

The modern attack helicopter, with increasing agility and weapons payload, is able to bring enormous firepower to bear on enemy forces. To counter this threat, some forces employ air defense mines to execute air defense ambushes. The intent is less to destroy helicopters, than to: (1) force low-flying helicopters to increase altitude or change course, (2) alert air defenders to trigger the ambush, and (3) distract enemy pilots while engaging them with ground weapons. Some ground-based mines, such as Mon-100 and Mon-200 directional fragmentation mines, can be pointed upward for use against helicopters.

Additionally a type of mine—the anti-helicopter mine—was recently developed. By borrowing technologies from side-attack and wide-area landmines, anti-helicopter mines may make use of acoustic fuzing to locate and target potential low-flying targets at significant distances. Their multiple-fragment warheads are more than capable of destroying light-skinned, non-armored targets and damaging any helicopters at close ranges.

A simple anti-helicopter mine can be assembled from an acoustic sensor, a triggering IR sensor, and a large directional fragmentation mine. More advanced mines use a fairly sophisticated data processing system to track the helicopter, aim the ground launch platform, and fire the kill mechanism toward the target. As the helicopter nears the mines, the acoustic sensor activates or cues an IR or millimeter wave (MMW) sensor. This second sensor initiates the mine when the helicopter enters the lethal zone of the mine. A typical large fragmentation warhead is sufficient to damage soft targets such as light armored vehicles and aircraft. Alternate warhead designs include high-explosive warheads and single or multiple explosively-formed penetrators.

This data was developed for and incorporated in the Engineer Chapter of Volume 1. OPFOR forces would be expected to deploy mines in Air Defense units to support air ambushes. Therefore, pertinent data was duplicated here to assist the Air Defense planner.

AUSTRIAN ANTI-HELICOPTER MINE HELKIR



SYSTEM	SPECIFICATIONS	FUZE/SENSOR	SPECIFICATIONS
Alternate Designations	None	Types	Dual, Acoustic, and IR
Date of Introduction	In Current Production	Number of Fuze Wells	INA
Proliferation	At Least 1	Resistant to Explosive Neutralization	Yes
Shape	Rectangular	PERFORMANCE	SPECIFICATIONS
Color	Green	Armor Penetration (mm)	6 @ 50 m or 2 @ 150 m
Case Material	Metal	Effect	Directed Fragmentation
Length (mm)	INA	Effective Range (m)	150
Height (mm)	INA	Target Speed (km/h)	250
Diameter (mm)	INA	Emplacement Method	Manual
Total Weight (kg)	43	Controllable (remotely detonated)	Yes
DETECTABILITY	SPECIFICATIONS	Antihandling Device	Yes
Ready	Visual	Self-destruct	INA
EXPLOSIVE COMPOSITION	SPECIFICATIONS	VARIANTS	SPECIFICATIONS
Type	INA	None	
Weight	20		

NOTES

THE HELKIR ANTI-HELICOPTER MINE IS DESIGNED TO ENGAGE NAP-OF-THE-EARTH TARGETS. THE SENSOR IS A DUAL ACOUSTIC-IR. THE ACOUSTIC SENSOR LISTENS FOR A VALID NOISE INPUT AND TURNS ON THE IR SENSOR. THE IR SENSOR IS LOCATED COAXIALLY TO THE WARHEAD. WHEN A HOT IR SIGNATURE IS DETECTED, THE WARHEAD IS FUNCTIONED.

ANTI-HELICOPTER MINES

Name	Country of Manufacture	Number of User Countries	Emplacement Method	Armor Penetration (mm)/ Kill Mechanism	Effective Range (meter) Maximum	Detectability / Composition	Target Velocity (m/s)	Fuze Type/	Warhead Type/Total Weight (kg)	Status
AHM-200	Bulgaria	1	manual	10 @ 100 m	max 200	visual		combined acoustic & Doppler SHF	Total weight: 35 kg	in production
HELKIR	Austria	1	manual	6 @ 50 m 2 @ 150 m		visual		dual acoustic & IR	Total weight: 43 kg	in production
TEMP-20	Russia	0	manual		detection 1,000 max 200	visual	100	dual acoustic & IR	Total weight: 12 kg	development
AHM	UK	0	manual remote		200/50	visual		dual acoustic & IR	multiple EFP	development

AIR DEFENSE/ANTITANK (ADAT) VEHICLES

The battlefield has always held a requirement to fight dispersed while engaging a variety of threats. In the era of large conventional forces, requirements could be met efficiently and inexpensively by task organizing units to meet any fighting requirement. Most weapon systems can be employed against multiple targets. Any machinegun, for example, can be employed against aircraft, as well as unarmored and some light armored vehicles. Most forces now include weapons in tactical vehicles to address a variety of threats. But technologies and budget constraints often require tactical forces to use systems that can be effective in both air defense and anti-armor missions.

Infantry units make use of *ADAT vehicles*. By the 1960s, infantry fire support vehicles were distributed within infantry and dispersed throughout the battlefield. The vehicles had some limited ADAT capability, but their primary role was to carry dismount teams with weapons corresponding to a particular subunit's support mission. More capable and responsive vehicles for infantry ADAT, AD, and AT units have recently become available.

Technological changes, force reductions, and increased emphasis on rapid deployment equipment (tailored for elements that may have to fight dispersed) have led to development of more capable *ADAT vehicles*. Improvements in fire control systems and weapons stabilization are crossing from the antitank arena into the air defense arena. Reverse technologies from air defense systems are also available for antitank and anti-armor roles. ADAT vehicles have multi-mission capability.

Among the modern specialized systems advertised with this dual capability is the Canadian Air Defense/Antitank System (CADATS). It features a high-velocity missile launcher on a tracked chassis. It also offers responsiveness, high lethality, and lethal short range air defense (SHORAD) capability for use in specialized roles or at the division/brigade level.

The German Rheinmetall Sky Ranger Advanced Maneuver Support System is advertised as a multi-mission vehicle. Equipped with a 35-mm revolver cannon on a Piranha IV wheeled APC chassis, it can defeat aircraft (and vehicles other than tanks) out to a 4,000-m range. Rounds include electronically-fuzed AHEAD (Advanced Hit Efficiency and Destruction) electronically fuzed rounds against aircraft, some vehicles, and selected ground targets. The highly mobile unit also includes a Bolide SAM launcher vehicle and a radar vehicle on the same chassis.

The Starstreak ADAT application was discussed earlier. Armored Starstreak is representative of missile launcher vehicles that could be used for multiple roles, including AD and anti-armor use. Now there is another Starstreak application: the Thales Thor remote weapon system (RWS). The light-weight (0.5 mt.) remote weapons system (RWS) features a turret with four launchers, a modern responsive day/night fire control system, and remote laptop displays and controls. The launchers will accommodate Starstreak and other MANPADS, such as Mistral and Stinger. It also launches ATGMs such as HELLFIRE, TOW, Ingwe (and probably Mokopa), and Spike-LR.

The Multi-purpose Combat Vehicle (MPCV) is a French and German system with a remote weapon system (RWS) missile launcher mounted atop a VBR (Portuguese variant) combat support vehicle. The launcher in AD configuration holds 4 x IR-homing Advanced Short-Range Air Defense (ASRAD) MANPADS missiles. In the AT configuration it can launch 4 x MILAN-ER ATGMs. The system includes a charge coupled device (CCD) digital camera, laser range-finder, and 3rd general thermal sight. The missiles cannot be mixed.

Some ADAT vehicles were designed from the beginning to fulfill the multi-role requirement. Most were modified from existing systems by fitting them with replacement subsystems or added capabilities. Add-ons, like the Strelets remotely operated MANPADS launcher, or the Israeli RWS with the Spike ATGM launcher, enable vehicles to perform multiple missions at less cost than special-built vehicle designs, while maintaining comparable capability. Thus, the Russian BTR-80 armored personnel carrier (APC) features a

higher angle-of-fire gun to engage aircraft and other higher-angle targets. Ukrainian KMDB developed twin 23-mm cannon to replace turrets or fit atop existing turrets, to allow engagement of fast-moving targets that cannot be engaged by other vehicle guns. The 23-mm round is also affective against light armored vehicles, materiel, and personnel such as snipers firing from high angles.

A Russian developer offers a replacement turret for the PT-76B amphibious tank and other armored fighting vehicles (AFVs). The PT-76E turret uses a 57 mm stabilized auto-cannon from the S-60 (a towed Soviet era AA gun dating to 1950), fitted with a modern fire control system (FCS). The 57-mm kinetic energy (KE) round defeats almost all light armored vehicles at 2,000 m, and accurately fires up to 3,000+ m. The upgrade converts the tank into an effective AD/anti-armor system, with mobility superior to almost all other vehicles and at a fairly low cost.

Most ATGMs can be employed against helicopters. The faster ATGMs, such as gun-launched missiles and those fired from the Russian 9P149/Shturm-S ATGM launcher vehicle are more effective at intercepting fast-flying helicopters. The 9P149 now features an Ataka missile AD variant with a proximity fuze and frangible rod designed for use against helicopters. Spike-ER (extended range), with fiber-optic guidance and IIR (imaging infrared)-homing option, is advertised as an effective missile for use against tanks and helicopters. Vehicle remote weapon stations include launchers for this missile with ranges out to 8+ km. Modern radio frequency (RF) threat warning systems can warn of attacks from aircraft and ground vehicles, and differentiate the threats. Some of those systems designate direction of threat approach, such as the azimuth warning system 1L15-1.

The ADAT requirement has also driven improvements in ammunition and sensors. Modern Russian tanks can remotely fire their antiaircraft machineguns (AAMGs) using special air defense sights. The Russian FARA-1E radar can be attached to the NSV 12.7-mm MG as a fire control radar to facilitate use against aerial as well as ground targets. Long range AD sensors such as 3rd generation forward-looking infrared radar (FLIR) on the MPCV offer night ranges comparable to day sight ranges.

Many air defense systems mount guns and missiles that can easily engage and destroy light armored vehicles. The Russian 2S6M1, Pantsir-S1 and Sosna-R drop-in turret both feature 30-mm twin-tube auto-cannons and high-velocity missiles with kinetic energy munitions. The manufacturers claim that these can be effective against aircraft and light armored vehicles. Similarly, the Russian SA-11/SA-11 FO/SA-7 systems are claimed to be effective against ground targets. The 690 or 715 kg missiles (even with only Frag-HE warheads) can destroy any vehicle. But because of the cost of SAMs, ADAT systems use mostly guns and ATGMs against ground vehicles.

Current trends indicate that recent technological improvements offer a great variety of ADAT vehicles. Technologies include gimbaled and gyro-stabilized RWS and overhead weapons systems (OWS), better recoil compensation systems, auto-trackers and stabilized fire control, computer-based integration, radars, EO, acoustics, laser systems, and GPS-based digital C^2. Breakthroughs in ammunition and vehicle drive stabilization technologies offer users more responsiveness and precision. In the near term, these capabilities will become prevalent, so that forces will increasingly be organized economically to fight dispersed, with the ability to engage air and land force threats equally with deadly effect.

SHORT-RANGE AIR DEFENSE: GUN AND GUN/MISSILE SYSTEM TECHNOLOGY TRENDS

The primary role of air defense continues to be inherently defensive, with a primary intent to deny any adversary the opportunity to use control, or dominate OPFOR air space. Meeting that goal presumes the capability to provide area-wide protection. Protection is accomplished with three methods: maintaining sufficient inventories of weapons and munitions, achieving high system mobility, and involving all units to ensure an effective air defense. Methods include use of passive counter-air protective measures and use of lethal counter-air weapons. The focus for many force and weapons designers in recent years has been on missile systems, because of their range and precision against modern aircraft. Gun ranges limit air defenders to the Very Short-Range Air Defense (VSHORAD) role, but that role is steadily gaining in importance.

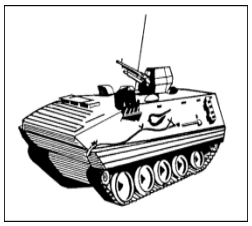
Many countries have significant inventories of air defense guns and are modernizing their inventories of AA weapons and munitions. Reasons for this effort include:

- Large inventories offer wide dispersion over large areas and point protection of assets.
- Guns rarely lose their operability over time. Older guns can be modified to achieve technological parity.
- Guns are very difficult to put out of action. Vehicles can be disabled and personnel can be killed, but weapons can be brought back into action quickly.
- They are generally less costly to produce, train on, and use than missile systems.
- They can respond to air threats more quickly than missile launchers.
- There is no “dead zone”, compared to missile systems. Guns can engage targets down to 0 meters altitude and at a few hundred feet minimum range.
- They are nearly immune to countermeasures.
- They are multi-target systems that can engage a variety of aerial targets (including most likely air threats – helicopters and unmanned aerial vehicles), as well as a variety of ground threats (including infantry and light armored vehicles).
- They can engage small aerial targets (mini-UAVs, rockets, etc.) which missiles cannot engage.
- The active market in add-on subsystems supports improvements in gun mobility, survivability, fire control, weapon function, ammunition handling, and C^2.
- New types of ammunition increase range, precision, and lethal effects.

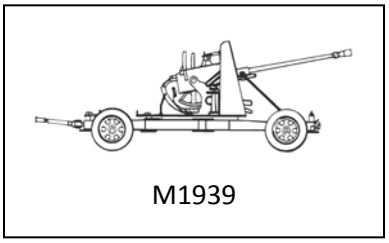
New gun systems are being produced, but the greatest activity is in the area of upgrading existing gun systems. To examine modernization activities in AD guns, we will look at them from the aspect of three primary factors: mobility, survivability, and lethality.

The guns most often used for air defense are not specifically designed for AD purposes. Instead, they are typically small arms and general purpose weapons organic to tactical and supporting units, with a capability to engage aerial targets that happen to fly within range. Weapons used in these units to engage aerial targets include grenade and rocket launchers, ATGM launchers, combat shotguns, tilt-able mines, and improvised explosive devices (IEDs).

The most numerous gun systems that are effective for air defense are machineguns in 7.62 mm to 14.5mm caliber ranges. These weapons are used for targets of opportunity, especially aerial targets. They can be ground-mounted (shoulder-fired, tripod, or bipod), can be fitted onto a pintle for vehicle mount, or integrated into a vehicle fire control system (turret or remote weapon station (RWS) mount, coaxial with a main gun, or fired from a firing port. Most tactical vehicles use machineguns as the vehicle's main gun.



Even AD unit missiles and medium guns commonly use MGs in supporting units and on combat unit support vehicles



M1939

Mobility. The guns, missile systems, and gun/missile systems in AD units are generally towed, ported, or vehicle mounted. Most towed guns have limited mobility. They cannot be towed cross-country and make amphibious crossings as easily as self-propelled anti-aircraft guns (SPAAGs). A few towed guns, like the Russian 37mm M1939, can be quickly halted, mounted, and fired during a road march. A few developers have marketed towable gun complexes that can be manned and operated during the march (such as the Oerlikon 25mm Diana). These ventures have not found market success because they are still less mobile and responsive than SPAAGs, and are almost as expensive as SPAAGs.

A new kind of ground mount is the remote-operated modular gun system. An example is the Skyshield 35 35-mm AA gun unit (2 guns, radar, and generator), for use in the Skyguard air defense system. An entire gun unit can be carried on a flatbed truck, hoisted to the ground, and brought into operation in a few minutes. These guns can locate on uneven ground and orient to level with their servo drive, using computer-adjusted fires. Operators can be up to 500 m away.

Some towed systems can be portaged, then dismounted upon arriving at an AD site. Vehicles can operate in locations beyond towed guns. The BTR-ZD (in Russian airborne AD units) transitioned from towed to portaged carry. Although portaging improves gun mobility, the penalty is that emplacement time may be even greater than the normal transition from a towed mount. Thus, after an initial displacement from an airborne LZ, the Russian BTR-ZDs are more likely to mount their ZU-23 AA gun onboard, using a simple method of fitting the gun on top of the hull.

Hull mounting is one basic way of converting a vehicle into a self-propelled anti-aircraft gun (SPAAG). Another common mounting expedient is to install a weapon in the bed of a "gun truck". An early example was BTR-152 truck-based APC SPAAG variants, e.g., a 14.5-mm ZPU-2 in the bay. Many insurgent forces' and Third-World military forces' "technicals" are pick-up and utility trucks that have been fitted with AD guns. Some developers offer trucks with medium guns on flatbed trailers converted into highly integrated mobile gun systems. These gun trucks can provide general purpose fire support against all air and ground threats.

Self-propelled anti-aircraft guns (SPAAGs) have been in use since before World War II.

Most early SP systems use AA guns in shielded open turrets, so that crews can easily feed ammunition and slew the guns. Later-model SPAAGs with auto-cannons, auto-loaders, and integrated wide-aspect FCS, can be responsive and precise without the need for large gun crews and open turrets. To handle the recoil of medium caliber guns (20-75mm), SPAAG chassis are generally heavier than on commercial vehicles. The chassis best-suited for handling gun weight and providing a stable mount for precision fires are those found on tracked vehicles, especially modified tanks. However, those chassis may be costly, and are less mobile on roads while travelling with wheeled units. A good rule is for the SPAAG to use the same chassis, or more mobile chassis, as the units it supports. Thus, SPAAG often use existing chassis (especially APC/IFV or combat support vehicles) that match those used by tactical units. For instance, the Russian Pantsir gun/missile system initially was fitted on a truck chassis; but early sales favored the turret (Pantsir-S1-0) on a BMP-3 IFV chassis. Considerations for some forces include cross-country capability and swim capability, to assure that units can bring their AD systems with them wherever they go. A few new SPAAGs have been offered on the world arms market, but sales have been slow. Current trends favor using modular AD turrets or RWS which can be fitted to a variety of existing chassis. Other forces are adding gun, FCS, and ammo subsystem upgrades and vehicle conversions to the AA role.



M42 Duster

Survivability. Factors relevant to survivability of AD guns in combat are similar to those affecting other AD systems and the force in general. Forces are upgrading them to improve survivability. Improved mobility and lethality aid survivability. Use of camouflage, concealment, and deception (CCD), including millimeter wave (MMW)/infrared (IR) netting, and the low profile inherent in many towed guns still challenge modern air and ground threats to AD systems.



FO with LRF

Two other factors which help counter modern air threats and SEAD are autonomy and integration. Modern guns are increasingly equipped to function effectively as a battery, platoon, or single gun. Thus they can be farmed-out in support of tactical units. They may have effective links to the integrated AD network, directly linked with their own forward observers (FOs), or used as air watches for supported units. Attack alerts and azimuth warning receivers like the 1L15-1 are dispersed among tactical unit command posts (CPs) and AD guns, to alert them to approaching targets and enemy direction of approach. At the same time that autonomy is improved, AD units also enjoy increased integration. Widespread use of comms and improvements such as digital systems, encryption, frequency agility, satellite communications (SATCOM), and redundancy can assure the integrity of C^2 for IADS), AD units, and links to nearby tactical and supporting units. Vehicles like Sborka and Giraffe AMB link to IADS and adjacent units to assure that gun crews are aware of air activities in their sector.

Lethality. The most dramatic upgrades in AD gun capabilities are in the area of lethality. As with other tactical subjects, lethality can be addressed in terms of system components: gun, mount, sensors and fire control, C^2, and ammunition. Modernization continues in all of these respective components. Conventional wisdom for AD guns holds that success depends on putting more rounds onto the target. Therefore, most gun design improvements focus on longer range, better gun stabilization (to include reduced recoil and barrel-whip) for better accuracy, reduced weight for shorter response times, and increasing rate-of-fire while decreasing overheating – to achieve more rounds per salvo.

Machineguns. The most proliferated guns used for AD are small-caliber (5.45-14.5 mm), because of the inventory of machineguns in all forces. Because MG size and lower cost separate them from medium-caliber guns, they should be treated separately. The inventory for MGs is so large because they can be ground-mounted and easily added to light vehicles with a pintle mount. All MGs can be used against aerial as well as ground targets.



12.7mm AAMG

Machineguns are increasingly available for use on unarmored or lightly armored combat support vehicles, including tactical utility vehicles, motorcycles, and all-terrain vehicles. Vehicle mounts include pintle mounts, remote weapon stations, overhead weapon stations, and turrets. By capitalizing on economical laptop computer FCS, servo-motors and stabilization, MG add-ons are increasingly being used as vehicle main weapons, or as secondary weapons to supplement main weapon fires and to provide general and AD security. For more information on MG applications, see the section at Vol 1, *Auxiliary Weapons for Infantry Vehicles*.

A general rule-of-thumb for guns is that AD range can be calculated at 100 times the mm bullet size, with the answer expressed in meters. Of course range actually varies among the components noted above, especially ammunition. But under that rule of thumb, a 7.62-mm MG has a 1,000-m AA range, and a 12.7-mm MG ranges about 1,300 meters. Those estimates are fairly accurate. Vehicle-mounted machineguns with good FCS, ranges can extend ranges somewhat farther. The 12.7mm MG typically achieves better range and penetration than the 7.62mm weapon. Although the 14.5 mm round is larger than 12.7 mm, with a marginal advantage in penetration and range, the superior round capacity, precision, recoil, ease of fit, and rate of fire of the 12.7 mm MG make it the preferred weapon of dismounted personnel and light vehicle crews.



BTR-80 MG turret

The 14.5 MGs are widely fielded on APCs, such as Russian-made BTR-80. But Russian forces consider them to be obsolete (Tier 4) for use as AD guns. Thus they have generally replaced ZPU guns (on towed mounts of 1, 2, or 4 guns) with 23-mm cannons. Nevertheless, these guns endure and can still be found in more than 45 countries. Improvements available include fire control radars (like the SON-9), turret mounts, improved command and radio links (such as azimuth warning receivers), and hand-held encrypted radios.



FARA-1E on MG

Machineguns in AD units, or those officially designated as AD MGs, tend to be better equipped to deal with air threats. Their features typically include improved recoil damping, stabilization, twin barrels to achieve higher rates-of-fire, and better fire control systems. Another modern trend is to adopt chain-driven guns. With chain drive comes more efficient and compact guns, multiple barrels, less recoil, and better precision at longer ranges. Air defense MGs often use quick-change barrels and superior air cooling that allows successive 10-15 round bursts, and increased practical rates of fire (100 rounds per minute up to 250-300). Like other MGs, many AA MGs are remotely operated with electronic triggers. Due to their shorter range, MGs require a relatively low level of technological support, including air watches, forward observers, and links to nearby units for warning to AD command nets, and to air warning nets.Fire control systems have improved in tandem with gun and mount technologies. Gun mounted or stabilized remote day/night ballistic computer sights with electro-optics (EO) and laser range finders (LRF) are available. The FARA-1E millimeter wave (MMW) radar can be mounted and bore-sighted for immediate fire control. Binocular LRFs such as the Sophie-LR or manual focus (MF) binoculars offer thermal day/night use along with other functions. For responsive C^2, hand-held radios and the 1L15-1 azimuth warner give alerts and azimuth directions. In vehicles fitted with good

telescopic EO sights, effective gun AA range is extended up to 2,000 m. Russian AD sights offer a high-angle view for the AD role. Lead-angle sights and auto-trackers are also available.

An emerging trend among small-caliber AD guns is the Gatling-type multi-barrel gun. The weapon was modernized in the US 20-mm towed M168 Vulcan cannon, and first employed in the 1950s. The M163 AD vehicle was an M113 APC fitted with a Vulcan cannon. Other countries, including Russia, have fielded Gatling-type guns in 12.7, 20, 25, and 30 mm calibers. The US Dillon Aero M134 fires 7.62-mm ammunition. There are inherent advantages in these guns. The multi-barrel design permits larger salvos and helps prevent overheating. The flanged barrels reinforce each other to eliminate barrel-whip. Vulcan cannons can use chain-drive for maximum recoil dampening with precision fires. Recoil is still significant, but it can be reduced to a consistent level to allow accurate aiming. The design also reduces stopages due to jammed rounds. But Gatling guns have their limitations. Recoil and system weight can overwhelm light vehicles (and require stopping). The huge ammo requirement can strain logistic assets. Cost per kill is greater. For those reasons Gatlings have seen limited use as light vehicle main guns or in vehicle auxiliary AD weapon station upgrades. The greatest limitation for small-caliber Gatlings is insufficient range against aircraft weapons. In the future, if ranges for small-caliber ammunition improve alongside gun improvements, the resulting higher carry capacity with smaller rounds may make 12.7-mm Gatling-type guns preferred replacements for MGs (versus medium guns).


GE Miniguns

Ammunition developments are the single greatest factor for improving air defense. Improved ammunition is increasing range, precision, and lethality for all air defense guns. Although small-caliber guns have less variety of rounds than medium/large guns, there are new types. Improved armor-piercing incendiary tracer rounds can extend useable ranges for MGs. Chinese and Russian 12.7-mm duplex rounds (e.g., Russian 1SLT) are embedded with two separate projectiles, following the pattern of projectiles in any salvo fired. These rounds are especially useful against close-in small targets, like UAVs. Several countries make 12.7-mm sabot rounds like the US Olin M903 saboted light armor penetrator (SLAP) round, with greater precision and penetration at maximum range. Frangible rounds are made in calibers 7.62, and 12.7 mm and .50-cal. They fly like KE rounds, and can be ballistically matched to KE rounds (unlike HE), yet are more lethal at the target than KE (like explosive HE rounds). The most lethal mix may be KE and frangible. One problem associated with having more than one type of ammunition on hand is being able to switch among them when engaging rapidly changing target types. With some MGs using box feed, the mounts permit two boxes, left and right, thus allowing ammunition types to be switched very fast.

Medium AD Guns. In order to increase lethality, the best course of action is to go up in gun size to medium guns. As we noted in the range rule, a 12.7-mm MG can reach ranges of about 1,300 meters. But a 30-mm gun can engage targets at 3,000 m, and a 57-mm gun to 5,700 m. Emphasis in modern AD guns is on medium calibers (20-75 mm). There are some still larger guns in 76, 85, 100, and 122 mm calibers; but upgrades for these weapons are limited to adding radars, radios, and azimuth warners (KS-19M2). Within medium AA guns, calibers are creeping up to improve ranges against aerial threats.

Medium-caliber guns (cannons) have seen the greatest variety of upgrades. Medium guns suffer from many of the same problems of MGs, including barrel whip, overheating, and recoil. In the 1950s and 60s, most AD cannons were of 20, 23, 37, 40, and 57 mm. calibers. Most are still in use today, and are recoil/gas-operated. Many are twin guns like the Russian 23-mm ZU-23 and Chinese 37-mm Type 65. In recent years, the use of 25, 30, and 35 mm auto-cannons has increased. Many use chain-drives. Modern guns like the Russian 30-mm 2A38 and Swiss 35-mm GDF-003 can fire at rates up to 2,400 rds/min, with 25-round bursts. But limited salvo size and practical rate-of-fire still limit fires, to avoid over-heating.



GDF-003

The modern gun size that has received the latest technology is 35-mm in caliber. With their lightweight designs (some less than 100 kg), these guns can be fitted on ground chassis like the GDF-003, (pg 6-43) and vehicle-mounted in modern turrets like the South African LCT35 for IFV or SPAAG. The best AA gun templates are embodied in the 35-mm and 40-mm guns (made by manufactures like Bofors, Oerlikon, and LIW). These modern weapons can accurately reach ranges up to 4 km, and exploit new munitions technologies. For instance, the Swedish Skyshield-35 gun uses a compact 35/1000 revolver cannon (with a single barrel, rotating cylinders, and linkless rounds fed by a conveyor system). The gun weighs half that of the GDF-series 35-mm guns.

A new AD gun technology is the RMK-30 30x173 mm recoilless Rheinmetall auto-cannon, mounted on Spanish Pizarro and Austrian Ulan IFVs. The combustible case rounds produce gas blowback, expended out of the cannons' rear to <2 feet. The rate of fire for the 100 kg gun varies from 300 to 800 rds/min. Fitted with a RWS, the gun can be mounted on nearly all light tactical vehicles. It fires sabot and frangible rounds, and AHEAD-type programmable air-burst rounds to 3,000 m effective range. The gun could replace MGs in light AD and combat vehicles.

Some countries use Gatling-type cannons for AD. The US M163 SPAAG with 20-mm Vulcan gun was followed by the Blazer with a 25-mm Gatling gun on a Bradley chassis, and the LAV AD with Blazer gun on the USMC LAV chassis. A French program fitted the gun on a French chassis with radar FCS. The Chinese M1990 30-mm towed gun features a 4-barrel Gatling system. Nevertheless, because of reasons noted on the page above, Gatling AD guns are not widely fielded. Also, as they increase in caliber, recoil and the ammunition storage burden increase dramatically. Better gun precision and ranges of alternative weapons systems more than offset the advantages of high-volume fire associated with Gatlings.



M163

The gun mount is a critical consideration in an AD gun system. For ground systems, we do not see an auxiliary power unit (APU), like that found on the GHN-45 artillery cannon, and the Russian 2A45M AT gun. But some modern guns have lift hooks that permit rapid mounting/dismounting. Motor gun drives, such those contained in Chinese Type 79 vehicles, permit faster slew to target, allowing better fire precision and more salvoes fired against fleeting targets.

Some SPAAGs have stabilized guns for delivering AA fire on the move. Stabilization kits are available and fairly inexpensive. Turrets for IFVs and several RWS are easily stable enough for AA use, and can be fitted on a variety of vehicles. For vehicle mounts, cannon recoil has led some forces to use tank chassis to absorb the recoil and assure accuracy. The Polish Loara SPAAG features twin 35-mm guns on the PT-91 (Russian T-72 upgrade) chassis. Light turrets such as the Russian Sosna turret (either 30-mm guns or gun/missile system) can fit onto IFV/APC chassis of supported units, which means that they offer amphibious or airborne capability. The German RMK-30/Wiesel can be used with airmobile units. The Bofors TriAD turret fits on IFVs such as the Swedish CV90 and the Piranha APC. Equipped with radar, superior EO, and a quick response 40-mm L70 gun, the SPAAG fires programmable 3P HE rounds to achieve lethal effect.



CV90C with TriAD



Slovak BRAM

A few new SPAAGs have been developed. The Rheinmetall Sky Ranger is actually a multi-role system, and is discussed in another section of this document. Recent truck-mounted SPAAGs include the South African Zumlac, with a mine-protected South African Military (SAMIL) (4x4) truck, and a ZU-23 gun on the rear bed. China offers its fast attack vehicle (FAV) light strike vehicle with the ZU-23 on the rear and extendable spades. Oerlikon and Skoda proposed a SPAAG with a Tatra T815 8x8 truck, and a Skyshield 35 gun mounted on the rear. A disadvantage with large truck-mounted SPAAGs is that they can be distinguished from other vehicles, making them high-priority targets for destruction. Note that most of the systems mate existing guns and vehicles rather than adding costly special-design systems.

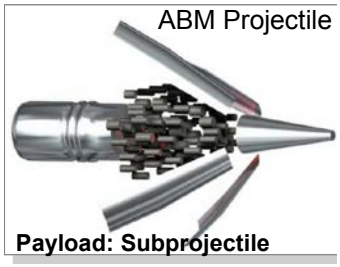
Improvements in fire control include day/night all-weather EO computer-based sights and monitors with digital transmission capability. Many older AD guns have added target acquisition radars. With added onboard computers, radars and electro-optic (EO) tactical vehicle (TV) thermal sights with auto-tracker for day/night passive operation, older guns like the ZU-23 can be converted into a responsive autonomous weapon like the ZU-23M or ZU-23M1. Vehicles can integrate a FCS from disparate fire control elements (CCD TV day sight, thermal night sight, ballistic computer, voice radio nets, and forward observers, digital C^2 nets) into the IADS. Other AA assets include tactical nets, auto-trackers, dual-mode radars, AD net azimuth warning systems, laser rangefinders, laser radars, RF detectors, digital displays from remote cameras, robots, unattended ground sensors (UGS), acoustic sensors, UAVs, etc. Many of these can also be linked to laptop monitors or FCS displays for ground AA gun systems or transmitted to the unit net or IADS.

The greatest changes for AD guns are in new ammo to reach longer ranges and achieve better precision. These rounds for medium guns generally render the previous requirement for higher rates of fire irrelevant in the context of air defense lethality. Air defense guns generally have rounds such as high explosive incendiary (HEI), armor piercing incendiary-tracer (API-T), and semi-armor piercing high explosive incendiary-tracer (SAPHEI-T). More recent guns use sabot armor piercing fin stabilized discarding sabot with tracer (APFSDS-T) rounds, frangible rounds, and proximity-fuzed HE rounds. These rounds enable many systems, which formerly could not reach beyond 2,000 m without losing their velocity and decreasing their probability of hit, to reach out to 3,000+ m accurately. Most of the older guns can also use these rounds, as well. The Russians offer a 30-mm combat coded “CC” round (with 28 sub-projectiles) for use on aircraft guns. It could be a good anti-UAV AD round.

Proximity fuzing permits guns to reach farther and higher, and offsets the inaccuracies of high explosive (HE) rounds compared to kinetic energy (KE) rounds. One proximity-fuzed round is more accurate (because a near miss still detonates the round for a "hit") than ten rounds of HEI. Salvo size and cost per kill are lower with proximity rounds, making existing or older gun systems effective and lethal in the air defense role. However, proximity-fuzed rounds can be counter measured or decoyed when fired in obstructed areas. Environmental clutter such as vehicles and power lines can pre-detonate the rounds. Swedish Bofors developed the 3P HE round in 40-mm and 57-mm calibers with 6-way programmable fuzes that can avoid pre-detonation. One of the fuze modes is gated proximity, which desensitizes the round until near-impact time. Even when engaging helicopters flying nap-of-the earth at low altitude, effects of electronic jammers and clutter are negated. The 40-mm round produces a cloud of 2650 fragments. This is a very affordable option, as fewer rounds are needed and more costly ordnance is selected only for specific targets.



3P 40-mm PFHE



Another round for medium guns is the Swiss Oerlikon AHEAD (Advanced Hit Efficiency And Destruction) round (and similar technology rounds), for use in 30 mm, 35 mm, 40 mm, and 57 mm guns. The rounds, also known as Air Burst Munitions (ABM), can reach ranges of 4000 m, using their electronically-programmed time fuzes to dispense a wall of tungsten sub-projectiles at aerial targets 10-40 m away. A 40 mm gun round dispenses 152 sub-projectiles. From a 35-mm gun, 24 AHEAD rounds (1-2 sec) usually assure a kill against a fleeting aircraft. The round can be used against even small targets, like mini- and micro-UAVs, artillery rounds, and rockets, or for top/direct attack against ground vehicles, dismounted troops, and materiel targets. Russian Aynet tank rounds and BMP-3M high explosive fragmentation (HEF) rounds are also programmable, for AD and against ground targets like AT assets.

One of the most lethal AD calibers continues to be 57 mm, in the Russian 57-mm S-60 and its variants, and Swedish 57-mm naval guns. The rounds are large enough to deliver substantial bursts out to 6000 m. A variety of upgrades are offered for the guns, and proximity and AHEAD rounds are available for effective fires out to the maximum range.

Improvements in ammunition-handling are keeping pace with the weapons systems. Selected AA systems have multiple ammunition feed systems that correspond to the varying types of rounds available. Cased-telescoped (CT) gun systems (and their CT ammunition, shown in the photo right) are a recent development - that may supplant existing designs. Cased rounds are shorter in length, permitting smaller gun breaches that more easily fit inside vehicle turrets and weapon stations. The rounds enable autoloaders to hold more ammo in smaller spaces, and to more easily manipulate rounds inside loading trays. Faster loading and more rounds decrease jams and ammo outages at critical moments.



Medium rounds

Gun/Missile Systems. Another lethality trend which has reinvigorated SHORAD is the widespread fielding of, or conversion to, gun/missile systems. Most SHORAD systems are being converted to configurations equipped with both guns and missiles. Thus the guns, with their links to the AD net and improved FCS, can also serve as missile platforms. The guns and missiles can protect each other to provide lethality beyond the effective range of most guns, reduce or eliminate dead spots for the missiles, and achieve effective lethality despite aircraft countermeasure systems.

A significant amount of SHORAD research and development effort focuses on gun/missile systems. Although we have noted some new SPAAGs that have been marketed without missile capability, most new recently fielded AD gun systems are gun/missile systems, such as BRAM (short for Brahmos Aerospace). A few systems feature robust SAMs. The Russian 2S6M1 was followed by the Pantsir, with 18-km high-velocity missiles and 30-mm twin auto-cannons. The Ukrainian Donets mounts a ZSU-23-4 turret (with four 23-mm AA guns) on a tank chassis. Also mounted on the turret is an SA-13 missile launcher. China's Type 95 pairs 25-mm guns and QW-2 MANPADS. The TY-90 has a 12.7-mm MG and six robust SAMs.

The Russians now offer modular turrets for robust gun/missile systems. The Pantsir-S1-0 turret, for example, can be fitted to a wide variety of chassis. The new turrets can use IFV/APC chassis, are almost visually indistinguishable from them, and are compatible with the mobility and maintainability of supported units. Indigenous installation of modular turrets on existing chassis also reduces fielding costs.

Another turret, the Sosna-R, uses a twin 30-mm AA gun and Sosna-R 8-km laser beam-rider missile. The turret is lighter and less costly than Pantsir, and fits many combat vehicles. Its range, precision, and responsiveness can challenge incoming aircraft and missiles well beyond ADA gun ranges.

Several ground-based gun/missile complexes include robust missile systems. Among the best is Skyguard, which feeds compatible digital fire control and radar data to both guns and missiles. The Chinese PL-11 system is similar. Many countries will co-locate guns and missiles to mass fires and achieve mutual support. Germany employs a "team" that includes Roland SAMs and Gepard SPAAGs. Similarly, the French army mixes the Roland and AMX-13.

Most gun/missile systems exploit the less costly low-technology approach of pairing guns and man-portable SAMs (aka: MANPADS). Vehicles such as the US Avenger, Light Armored Vehicle-Air Defense (LAV-AD), and Blazer use Stinger SAMs. China prefers this upgrade approach. The recent fast attack vehicle (FAV) light strike AD vehicle mounts a ZU-23 gun and twin MANPADS launchers. Russian variants of MT-LB include the MT-LB6MB3 IFSV/APC with 23-mm GSh-23L twin cannon, 30-mm automatic grenade launcher (AGL), and 7.62-mm MG. But the MT-LB6MB5 IFSV has a 2A38 twin 30-mm AD gun, MGs, AGL, and SA-18 SAM launchers. The Polish Sopel tracked system mounts a turreted twin 23-mm gun and twin Grom MANPADS launcher. GMW developed a twin Stinger launcher for mounting on the Gepard AA gun. A French-marketed variant of the Blazer turret features a 25-mm Gatling-type gun and four Mistral MANPADS missiles. The turret also has a radar FCS and it can be fitted on LAVs such as M113.



MT-LB6MB3

The widely fielded ZSU-23-4 SPAAG (6-7,000) is the focus of several upgrade packages. Some entail adding MANPADS, integrated into the fire control system. The Russian ZSU-23M5 mounts one or two Strelets MANPADS modules (each with two SA-18 missiles). The Polish Biala fits four Grom MANPADS launchers onto the turret. A Ukrainian upgrade includes a swing-up launcher with six SA-18 missiles. Other innovations include GPS navigation, new radars for selected systems, ballistic computers and TV FCS with thermal sights, digital communications, NBC protection, side skirts, and smoke grenade launchers. An Iranian version includes an auto-tracker and laser warning system.



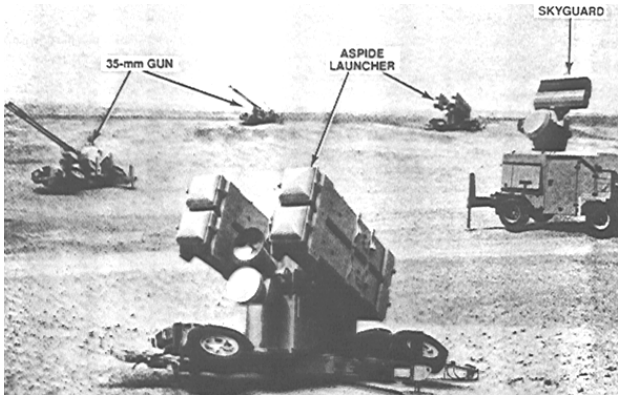
ZSU-23-4

Towed gun systems can also be fitted with missile launchers. The widely fielded Russian ZU-23 offers an –M1 upgrade with a Strelets two-SAM module, also integrated into

the gun FCS. The FCS in the ZU-23M and ZU-23M1 has TV and thermal sights, LRF, IR auto-tracker, and a ballistic computer. The Strelets module (with SA-18 SAMs) can be fitted to many AA systems.

Included in the market for AD guns are turrets, remote weapon stations, and subsystem upgrades for infantry vehicles that enable them to possess capabilities similar to those found on specialized AD guns and gun/missile systems. Developments in this arena for infantry vehicles are discussed in Vol 1. Infantry fire support vehicles in maneuver battalions and below offer mobile and responsive AD and AT support. For more discussion of AD guns, see ***Air Defense/Antitank (ADAT) Vehicles,*** covered elsewhere in this chapter.

Swiss 35-mm Towed AA Gun GDF-003/-005, and Skyguard III System



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designations	Skyguard Gun/Missile Air Defense System (See VARIANTS, Skyguard).	Type	HEI-T
Date of Introduction	Circa 1981-84	Tactical AA Range (m)	4,000 (self-destruct)
Proliferation	At least 3 countries	Tracer Range (m)	3,100+
Crew	3	Effective Altitude (m)	3,100-4,000
Carriage	4-wheeled/2-axle towed chassis	Self-destruct time (sec)	6-12
Combat Weight (kg)	6,400	Type	Semi-armor-piercing HEI-T (SAPHEI-T)
Travel Position Length Overall (m)	7.8	Range (m)	4,000
Firing Position Length Overall (m)	8.83	Tactical AA Range (m)	4,000 (self-destruct)
Length of Barrel (m)	INA	Effective Altitude (m)	4,000 (est)
Travel Position Height (m)	2.6	Self-Destruct Time (sec)	6-12
Firing Position Height (m)	1.72	Penetration (mm, KE)	40 at 1,000m
Travel Position Width Overall (m)	2.26	Type	APDS-T
Firing Position Width Overall (m)	4.49	Range (m)	4,000
Max. Towed Speed (km/h)	60	Tactical AA (m)	4,000
Emplacement Time (min)	1.5	Tracer Range (m)	2,000
Battery Emplacement Time (m)	15	Effective Altitude (m)	4,000 (est)
Displacement Time	5	Penetration (mm, KE)	90 at 1,000 m
ARMAMENT	SPECIFICATIONS	Type	APFSDS-T
Gun Caliber Type	35x228 35-mm autocannon	Range (m)	4,000
Gun Number of Barrels	2	Tactical AA range	4,000
Gun Operation	Gas-operated	Tracer Range (m)	3,100-4,000
Gun Rate of Fire (rd/min)	Cyclic: 1,100 (550/barrel) Practical: INA, bursts up to 25 rounds	Effective Altitude (m)	4,000 (est.)
Gun Loader Type	2x56-rd magazine automatic feed	Penetration (mm, KE)	90 at 1,000 m
Gun Reload time (sec)		Type	APFSDS-T
Traverse (o)	360	Range (m)	4,000
Traverse Rate (o/sec)	120	Tracer Range (m)	3,100-4,000
Elevation Rate (o/sec)	-5 to +92	Effective Altitude (m)	4,000 (est.)

Reaction time (sec): INA	INA	Penetration (mm, KE)	115+ at 1,000 m
FIRE CONTROL SYSTEMS	SPECIFICATIONS	Type	Frangible APDS (FAPDS) The round has higher velocity and flat trajectory of a APFSDS-T round (same gun data), and Frag-HE effects. On impact with the target surface, penetrator breaks into 100s of KE fragments.
On-Carriage Sights	Lead-computing optical sight, or GUN KING electro-optical system on GDF-005		
Off-Carriage		Type	AHEAD (Advanced Hit Efficiency and Destruction), designated AG 35x228. The AHEAD round uses a programmable time fuze and HE charge to dispense a cloud of 152 pellets (3,800 from a 25-round burst) at or in the path of a target helicopter, LAV, or soft target. Other fuze modes include proximity and PD.
Name	Skyguard radar and CP system Platform: Towed compartment		
Platform	Towed compartment		
Sights	SEC-Vidicon. TV Tracking System		
Range (km)	25 day only		
Laser Rangefinder	Yes		
Search and Track Radars			
Name	Skyguard Mk II (SW)		
Function	Dual mode doppler MTI		
Detection Range (km)	25-45		
Tracking Range (km)	25		
Frequency	8-20 GHz, I/J Band		
Rotation Rate/min	60		
Mean Power (W)	200		
Link	System uses a wire link among major components. Digital data is invulnerable to ECM, frequency hops.		

OTHER FIRE CONTROL

GUNS ARE LINKED TO BATTERY/BATTALION NETS AND THE IADS, AND RECEIVE DIGITAL ALERTS OF APPROACHING AIRCRAFT. GUNS, BATTERY, AND BATTALION USE AIR WATCHES AND FORWARD OBSERVERS FOR FAST RESPONSE.

VARIANTS

SKYGUARD: SYSTEM/COMPLEX DESCRIBED FOR THE OPFOR HAS A RADAR, 2 ASPIDE MISSILE LAUNCHERS AND GENERATORS. AD COMPLEXES CAN VARY WIDELY. SINCE THEY ARE ORGANIZED AROUND THE SKYGUARD RADAR/CP UNIT, THEY MAY BE GUNS ONLY OR MISSILE LAUNCHERS ONLY. THE MOST EFFECTIVE AD ARRANGEMENT IS THE ONE NOTED ABOVE, AS A GUN/MISSILE SYSTEM.

GDF-001: SYSTEM HAS A SIMPLE SIGHT.

GDF-002: SYSTEM LINKS TO SKYGUARD.

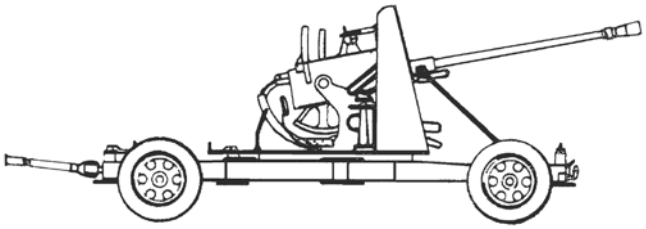
GDF-003: ADDS GUN SYSTEM UPGRADES.

GDF-005: UPGRADE (FOR -003 WITH NDF-C KIT) HAS GUN KING 3-D AUTONOMOUS SIGHT SYSTEM, ONBOARD POWER SUPPLY AND AUTO-LOADER. CAN FIRE AHEAD ROUNDS.

NOTES

ORIGINAL MK I RADAR RANGE WAS 20 KM. SYSTEM CAN ALSO BE USED AGAINST GROUND TARGETS.

RUSSIAN 37-MM TOWED AA GUN M-1939



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation	None	Type	HE, HE-FRAG-T, AP, AP-T, HVAP, HVAP-T, HEI-T
Date of Introduction	1939 (61-K)	Max Range (m)	8,500
Description		Max Effective Range (slant) (m)	3,500
Crew	8, 4 (est) while traveling	Max Effective (ground targets) (m)	3,500
Carriage	Four Wheels	Max Altitude (m)	6,000
Combat Weight (kg)	2,050	Max Effective Altitude (m)	3,000
Length Overall (m)	6.04	Min	0
Length of Barrel (m)	2.73	Armor Penetration (mm)	55 @ 500m
Height Overall (m)	2.11	HE Projectile Weight (kg)	0.74
Width Overall (m)	1.95	AP Projectile Weight (kg)	,77
Prime Movers	Utility Vehicles, Small, and Medium Trucks	HE-FRAG-T Projectile Weight (kg)	0.73
Automotive Performance		HVAP Projectile Weight (kg)	0.62
Max Towed Speed (km/h)	60	HEI-T Projectile Weight (kg)	INA
Cross Country (km/h)	25	HE Muzzle Velocity (m/s)	880
Fording Depth (m)	0.7	AP Muzzle Velocity (m/s)	880
Emplacement Time (sec)	8.5 while traveling. Gun can be fired from a halt without dropping trails. 30 full emplace, to drop trails.	HE-FRAG-T Muzzle Velocity (m/s)	880
Displacement Time (sec)	8 sec while traveling. 30 from full emplacement	HVAP Muzzle Velocity (m/s)	960
ARMAMENT	SPECIFICATIONS	HEI-T Projectile Weight (kg)	INA
Caliber, Type	37-mm Rifled	Self-Destruct (sec)	8 to 12
Number of Barrels	1	Self-Destruct Range (m)	3,700 to 4,700
Breech Mechanism	Rising Block		
Cyclic Rate of Fire (rd/min)	180		
Practical Rate of Fire (rd/min)	80		
Clip Capacity (rds)	5, gun magazine holds 2 clips for 10 rounds		
Loader Type	Manual Gravity Feed		
Reaction Time (sec)	4.5, 4 to stop and fire during a move (without radar)		
Reload Time (sec)	2 per clip		
Traverse (°)	360		
Traverse Rate (°/sec)	61		
Elevation (°) (-/+)	-5/+85		

Elevation Rate: (°/sec)	22		

FIRE CONTROL

SIGHTS WITH MAGNIFICATION: AZP-37 OPTICAL SIGHT, ALSO STEREOSCOPIC RANGEFINDER, COMMANDER'S TELESCOPE.

OTHER FIRE CONTROL: THE GUN IS LINKED TO THE BATTERY NET, AND RECEIVES ANALOG VOICE RADIO ALERTS OF APPROACHING AIRCRAFT, INCLUDING DIRECTION, ALTITUDE, AND AIRCRAFT TYPE. GUNS, BATTERIES, AND BATTALIONS USE AIR WATCHES AND FORWARD OBSERVERS. ALSO AVAILABLE ARE RF 1L15-1 OR SIMILAR AZIMUTH WARNERS TO PROVIDE ALERTS WITH APPROACH DIRECTION, TO READY THE GUNS FOR FAST RESPONSE.

OFF-CARRIAGE FIRE CONTROL SYSTEMS: SEVERAL DIRECTORS CAN BE USED WITH TELESCOPIC SIGHT, AND WITH AN ADDED LASER RANGE-FINDER.

RADAR: CHINESE TYPE 311 OPTIONAL. THIS IS A CONTINUOUS WAVE FIRE CONTROL RADAR WAS DESIGNED AND PRODUCED TO SUPPORT 37-MM AND 57-MM GUNS. THE I/J-BAND TRAILER-MOUNT RADAR WITH COMPUTER AUTOMATION CAN CONDUCT SURVEILLANCE AND TARGET ACQUISITION. IT HAS AT LEAST THREE VARIANTS, WITH RANGES OF 30 KM (311-A), 35 KM (311-B), AND 40 KM (311-C). TARGET TRACKING RANGE IS 25 KM FOR THE -A VARIANT. EMPLACEMENT TIME IS 15 MINUTES. RADAR GIVES USER WEAPONS A NIGHTTIME AND ADVERSE WEATHER CAPABILITY. THE RADAR HAS BEEN EXPORTED.

VARIANTS

M-1939 IS A DERIVATIVE OF THE BOFORS L60.

TYPE 55: CHINESE COPY OF ORIGINAL GUN

TYPE 65: CHINESE TWIN BARREL VERSION, AND OTHER VARIANTS, SEE PAGE 6-44.

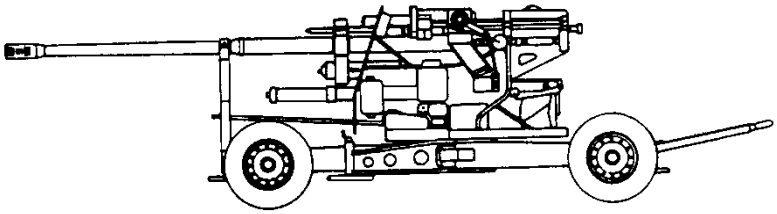
TYPE 74: A CHINESE TWIN GUN WITH A HIGHER RATE OF FIRE (360-380). THE TYPE 311 RADAR IS OFTEN USED WITH THIS GUN SYSTEM. MAX EFFECTIVE RANGE AND ALTITUDE WITH THESE ARE 4,700 M

NOTES

THE M-1939 IS A TOWED 37-MM ANTIAIRCRAFT GUN MOUNTED ON A FOUR-WHEELED CARRIAGE. NORMAL EMPLACEMENT REQUIRES THE WHEELS TO BE REMOVED OR RAISED AND A JACK PLACED UNDER EACH AXLE FOR SUPPORT PRIOR TO FIRING. THE ROUNDS ARE GRAVITY FED INTO THE VERTICALLY OPENING SLIDING BREECH WITH THE EMPTY CARTRIDGES AUTOMATICALLY EXTRACTED.

WHEN USED WITHOUT RADAR, THE M-1939 IS CONSIDERED TO BE EFFECTIVE ONLY DURING DAYLIGHT AND IN FAIR WEATHER.

RUSSIAN 100-MM TOWED AA GUN KS-19M2



SYSTEM	SPECIFICATIONS	FIRE CONTROL	SPECIFICATIONS
Alternative Designation	None	On-Carriages	
Date of Introduction	1949	PO-IM Telescope Field of View (o)	14
Proliferation	At Least 20 Countries	PO-IM Telescope Power	5x
Crew	15	PO-IM Telescope Range (m)	3,500
Carriage	Towed 2-axle, 4-wheel carriage	PG Panoramic Telescope Field of View (o)	10
Combat Weight (kg)	11,000	PG Panoramic Telescope Power	4x
Length Overall (m)	9.3	Off-Carriage	
Travel Position (m)	INA	Rangefinder	D-49 (off carriage)
Firing Position (m)	7.62	Radar Name	SON-9/SON-9A (FIRE CAN)
Width Overall (m)	2.32	Radar Function	Fire Control
Prime Mover	Towing vehicle AT-S or AT-T	Radar Detection Range (km)	80
Automotive Performance		Radar Tracking Range (km)	35
Max. Towed Speed (km/h)	35	Radar Frequency	2.7-2.9 GHz (E/F-band)
Emplacement Time (min)	7	Radar Peak Power (kW)	300
Displacement Time (min)	6	PUAZO 6-19 or 6-19M	fire control director
ARMAMENT	SPECIFICATIONS	Other Fire Control	
Gun		VARIANTS	SPECIFICATIONS
Caliber, Type	100-mm Gun	Type 59	Chinese Variant
Number of Barrels	1	AMMUNITION	SPECIFICATIONS
Service Life of Barrel (rds)	2,800	Types	Frag-HE, AP-T, APC-T
Rate of Fire (rd/min)	Maximum: INA Practical: 10-15	Range With On-Carriage Sight (m)	3,500
Loader Type	Manual	Range With Off-Carriage Radar (m)	12,600
Reload Time (min)	INA	Max Altitude (m)	14,500
Traverse (o)	360	Max Effective Altitude (m)	13,700
Traverse Rate (o/sec)	20	With On-Carriage Sight Altitude (m)	3,500
Elevation (o) (-/+)	-3 to 89	Min	0
Elevation Rate (o/sec)	12	Frag-HE Projectile Weight (kg)	15.61
Reaction Time (sec)	30	AP-T Projectile Weight (kg)	15.89
		APC-T Projectile Weight (kg)	16
		Muzzle Velocity (m/s)	900-1,000
		Fuze Type	Proximity and Time
		Self-Destruct (sec)	30

OTHER FIRE CONTROL

THE GUN IS LINKED TO THE BATTERY NET WHICH RECEIVES ANALOG VOICE RADIO ALERTS FOR APPROACHING AIRCRAFT, INCLUDING DIRECTION, ALTITUDE, AND DIRECTION. GUNS, BATTERIES, AND BATTALIONS USE AIR WATCHES AND FORWARD OBSERVERS. ALSO AVAILABLE IS 1L15-1 OR SIMILAR RF AZIMUTH WARNERS TO PROVIDE ALERTS WITH APPROACH DIRECTION, TO READY THE GUNS FOR FAST RESPONSE.

NOTES

THE KS-19M2 MAY ALSO BE EMPLOYED IN A GROUND SUPPORT ROLE.

RUSSIAN 57-MM TOWED AA GUN S-60



SYSTEM	SPECIFICATIONS	FIRE CONTROL	SPECIFICATIONS
Alternative Designation	None	On-Carriages	
Date of Introduction	1950	Optical mechanical computing sight AZP-57 (m)	
Proliferation	At Least 46 Countries	Target Range (m)	
Crew	7	Rangefinder	D-49
Carriage	Four Wheel	Radar Name	Son-9/Son-9A (NATO FIRE CAN)
Weight (kg)	4,500	Radar Function	Fire Control
Length Overall (m)		Radar Detection Range (km)	80
Travel Position (m)	8.50	Radar Tracking Range (km)	35
Firing Position (m)	8.84	Radar Frequency	2.7-2.9 GHz
Length of Barrel (m)	4.39	Radar Frequency Band	E
Height (m)		Radar Peak Power (kW)	300
Overall		Alternative Radar RPK-1/FLAP WHEEL Range (km)	34
Travel Position	2.37	Type 311	See below
Firing Position	6.02	VARIANTS	SPECIFICATIONS
Width Overall		Type 59	Chinese Variant
Travel Position	2.08	SZ-60	Hungarian Licensed-Built Variant
Firing Position	6.9	AMMUNITION	SPECIFICATION
Prime Mover	Ural-375D	Type	57x348 SR, FRAG-HE, APC-T
Max. Towed Speed (km/h)	60	Preferred Round	UBR-281U APHE
Emplacement Time (min)	1	Max Effective Range (m)	4,000 on-carriage sight 6,000 w/off-carriage radar
Displacement Time (min)	3	Max Effective Altitude (m)	4,300 on-carriage sight 6,000 w/off-carriage radar
ARMAMENTS	SPECIFICATIONS	Min	0
Caliber, Type	57-mm automatic cannon	Projectile Weight (kg)	FRAG-T: 2.81 APC-T: 2.82
Number of Barrels	1 each	Muzzle Velocity (m/s)	1,000
Service Life of Barrel (rds)	INA	Fuze Type	FRAG-T: Point detonating APHE: Base detonating
Cyclic Rate of Fire (rd/min)	105-120	Self-Destruct (sec)	13-17
Practical Rate of Fire (rd/min)	70	Penetration (mm CE)	130 mm at 1000m, APHE
Loader Type	4 Round Clip, Manual		
Reload Type (sec)	4-8		
Traverse (o)	360		
Traverse Rate (o/sec)	40		

Elevation (o) (-/+)	-4 to +87		
Elevation Rate (o/sec)	34		
Reaction time (sec)	4.5		

PRIMARY COMPONENTS

BATTERY USUALLY HAS 6 GUNS, A FIRE-CONTROL RADAR AND A FIRE-CONTROL DIRECTOR. MOBILITY NEEDS AND ORGANIZATIONAL SUBORDINATION DETERMINES VEHICLES AND OTHER EQUIPMENT AVAILABLE.

OTHER FIRE CONTROL

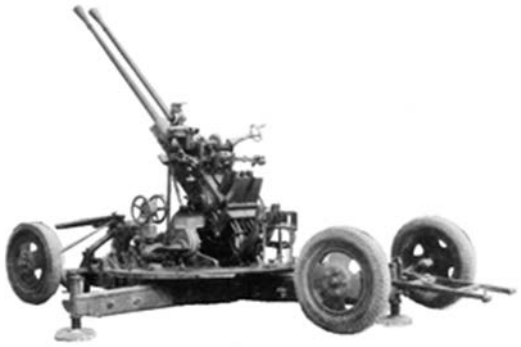
THE GUN IS LINKED TO THE BATTERY NET, AND RECEIVES ANALOG VOICE RADIO ALERTS OF APPROACHING AIRCRAFT, INCLUDING DIRECTION, ALTITUDE, AND TYPE. GUNS AND BATTERY/ BATTALION USE AIR WATCHES AND FORWARD OBSERVERS. ALSO USED BY TIER 1-3 UNITS ARE RF 1L15-1 OR SIMILAR AZIMUTH WARNERS TO PROVIDE ALERTS WITH APPROACH DIRECTION, FOR FAST AA RESPONSE.

NOTES

THE S-60 ALSO HAS AN AMMUNITION READY RACK THAT CAN HOLD 4 FOUR-ROUND CLIPS NEAR AMMUNITION FEED MECHANISM ON LEFT SIDE OF THE BREECH. THE S-60 CAN ALSO BE USED IN A GROUND SUPPORT ROLE. THE S-60 CAN BE FIRED WITH WHEELS UP, OR WITH WHEELS ON THE GROUND.

FIRE CONTROL RADARS SUCH AS THE CHINESE TYPE 311 CAN BE USED WITH THIS WEAPON. THE CHINESE TYPE 311 CONTINUOUS WAVE FIRE CONTROL RADAR WAS DESIGNED AND PRODUCED TO SUPPORT 37-MM AND 57-MM GUNS. THE I/J-BAND TRAILER-MOUNTED RADAR WITH COMPUTER AUTOMATION CAN CONDUCT SURVEILLANCE AND TARGET ACQUISITION. IT HAS AT LEAST THREE VARIANTS, WITH RANGES OF 30 KM (311-A), 35 KM (311-B), AND 40 KM (311-C). TARGET TRACKING RANGE IS 25 KM FOR THE -A VARIANT. EMPLACEMENT TIME IS 15 MINUTES. THE RADAR GIVES USER WEAPONS A NIGHTTIME AND ADVERSE WEATHER CAPABILITY. THIS RADAR HAS BEEN EXPORTED.

Chinese 37-mm Towed AA Gun Type 65



SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations	INA	Gun	
Date of Introduction	Circa 1965	Caliber, Type	37-mm automatic gun
Proliferation	At Least 7 Countries	Number of Barrels	2
Description		Operation	Recoil
Crew	5 to 8	Service Life of Barrel (rds)	2,500+
Carriage	4 Wheeled/ 2 Axle Towed	Barrel Change Time (min)	2-3
Combat Weight (kg)	2,700	Cyclic Rate of Fire (rd/min)	Cyclic: 320-360 (160-180/barrel)
Length Overall (m)	5,490	Practical Rate of Fire (rd/min)	80
Travel Position	6,036	Loader Type	Two 5-Round Clips
Firing Position	INA	Reload Time (sec)	4-8
Length of Barrel (m)	2,729	Traverse (o)	360
Height (m)	2,080	Traverse Rate (o/sec)	INA
Overall	INA	Elevation (o)	-5 to 85
Travel Position	2,105	Elevation Rate (o/sec)	INA
Firing Position	INA	Reaction time (sec)	INA
Width Overall (m)	1,901	AMMUNITION	SPECIFICATIONS
Primer Mover	INA	Types	AP-T, HE-T, HEI-T
Automotive Performance		Max Effective (Slant) Range (m)	3,500
Max Towed Speed (km/h)	60; 25 Cross Country	Max Effective (grnd targets) Range (m)	3,500
Emplacement Time (min)	1 (est.)	Max Effective Altitude	3,000
Displacement Time (min)	3 (est)	Min Altitude	0
Fording Depth (m)	0.7	Self-destruct time (sec)	8-12
Tuning Radius (m)	8	Self-destruct range (m)	3,700-4,700

FIRE CONTROL

SIGHTS W/MAGNIFICATION: OPTICAL MECHANICAL COMPUTING SIGHT

AZIMUTH WARNING RECEIVER: 1L15-1

OFF-CARRIAGE RADAR: OPTIONAL. THE CHINESE TYPE 311 CONTINUOUS WAVE I/J-BAND FIRE CONTROL RADAR WAS DESIGNED AND PRODUCED TO SUPPORT 37-MM AND 57-MM GUNS. THE TRAILER-MOUNT RADAR WITH COMPUTER AUTOMATION CAN CONDUCT SURVEILLANCE AND TARGET ACQUISITION. IT HAS AT LEAST THREE VARIANTS, WITH RANGES OF 30 KM (311-A), 35 KM (311-B), AND 40 KM (311-C). TARGET TRACKING RANGE IS 25 KM FOR THE -A VARIANT. EMPLACEMENT TIME IS 15 MINUTES. RADAR GIVES USER WEAPONS NIGHT-TIME AND ADVERSE WEATHER CAPABILITY. THIS RADAR HAS BEEN EXPORTED.

OTHER FIRE CONTROL:

THE GUN IS LINKED TO THE BATTERY NET WHICH RECEIVES ANALOG VOICE RADIO ALERTS FOR APPROACHING AIRCRAFT, INCLUDING DIRECTION AND ALTITUDE. GUNS AND BATTERY/ BATTALION HAVE AIR WATCHES AND FORWARD OBSERVERS.

VARIANTS

CHINESE DIRECT COPY OF THE SOVIET TWIN BARREL EXPORT VERSION OF THE M-1939.

TYPE 65: A CHINESE TWIN-BARRELED VARIANT OF RUSSIAN M-1939 AD GUN.

TYPE 74 IS A SIMILAR CHINESE TWIN GUN WITH A HIGHER RATE OF FIRE (360-380). THE TYPE 311 RADAR IS OFTEN USED WITH THIS GUN SYSTEM. MAX EFFECTIVE RANGE AND ALTITUDE WITH THESE ARE 4,700 M.

TYPE P793 IS A TYPE 74 ON AN IMPROVED CARRIAGE WITH A GALILEO ELECTRO-OPTICAL FCS, AND AN ELECTRIC MOTOR FOR VERTICAL AND HORIZONTAL SLEWING. THE GUN CAN BE EMPLOYED ON AN SP TRACKED VEHICLE MOUNT.

M1985: NKPA HAS MOUNTED THE DUAL 37-MM TYPE 65 GUN ON AN OPEN TURRET VTT APC CHASSIS. SLANT RANGE AND EFFECTIVE ALTITUDE ARE 2,500 M WITH AN OPTICAL SIGHT. GROUND TARGET RANGE IS 3,500 M. THIS SYSTEM APPEARS TO SOMETIMES BE CONFUSED WITH THE M1992 SPAAG, WHICH HAS 30-MM GUNS. THERE IS NO 37-MM SPAAG CALLED M1992.

TYPE 88 IS A CHINESE SPAAG WITH THE TYPE P793 GUN ON THE TYPE 69-III TANK CHASSIS. THE VEHICLE HAS AN ELECTRO-OPTICAL FIRE CONTROL SYSTEM, IFF, AND FIRE CONTROL RADAR WITH A RANGE OF 15 KM.

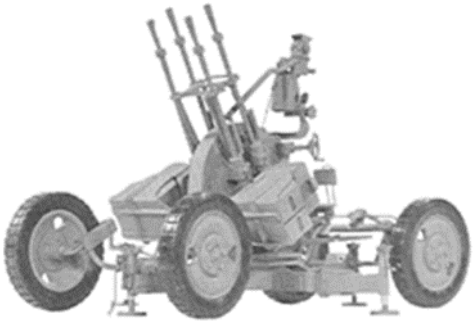
NOTES

STRENGTHS: HIGHLY RELIABLE, RUGGED AND SIMPLE TO OPERATE. AMMUNITION IS INTERCHANGEABLE AMONG TYPES 55, 65, AND 74 AA GUNS.

WEAKNESSES: SHORT RANGE, SMALL PROJECTILE. TYPE 65 HAS NO ORGANIC RADAR. BECAUSE IT LACKS A RADAR AND POWERED GUN LAYING MOTORS, THE TYPE 65 AND MOST OTHER TOWED 37-MM GUNS, WHEN USED WITHOUT A RADAR, ARE CONSIDERED TO BE EFFECTIVE ONLY DURING DAYLIGHT AND IN FAIR WEATHER. THE TYPE 74 AND OTHER LATER SYSTEMS ADD RADARS TO CORRECT THAT WEAKNESS.

ALSO AVAILABLE ARE RF 1L15-1 OR SIMILAR AZIMUTH WARNERS TO PROVIDE ALERTS WITH APPROACH DIRECTION, TO READY THE GUNS FOR FAST RESPONSE.

Russian 14.5-mm Heavy Machinegun ZPU-4



SYSTEM	SPECIFICATIONS	FIRE CONTROL	SPECIFICATIONS
Alternative Designation	None	On-Carriage	Optical mechanical computing sight Telescope, ground targets
Date of Introduction	1949	Off-Carriage	Generally, there is no organic radar except with variants NK Type 56 and M1983. Many radars are available Optional Radar: SON-9/SON-9A, aka FIRE CAN (NATO)
Proliferation	At Least 45 Countries	Function	Fire Control
Description		Detection Range (km)	80
Crew	5	Tracking Range (km)	35
Carriage	4 wheeled/2 axle towed chassis	Frequency	2.7-2.9 GHz
Combat Weight (kg)	1,810	Frequency Band	E
Length Overall (m)		Peak Power (kW)	300
Travel Position	4.53	AMMUNITION	SPECIFICATIONS
Firing Position	4.53	Types	API, API-T, HEI, AP-T, HEI-T
Length of Barrel (m)	1,348	Max Range (m)	8,000
Height (m)		Max. Effective (slant) Range (m)	1,400
Overall	INA	Max Altitude (m)	5,000
Travel Position	2.13	Max Effective Altitude	0-1,400
Firing Position	INA	Name	BZT-44M API-T
Width Overall (m)	1.72	Max Range (m)	8,000
Prime Mover	INA	Max. Effective (slant) Range (m)	2,200
Automotive Performance		Max Altitude (m)	5,000
Max. Towed Speed (km/h)	35	Effective Altitude (m)	0-2,200
Emplacement Time (min)	2		
Displacement Time (min)	2		
ARMAMENT	SPECIFICATIONS		
Caliber, Type	14.5 mm machinegun		
Number of Barrels	4		
Service Life of Barrels (rds)	INA		
Max Rate of Fire (rd/min)	2,200-2,400 (600/barrel)		
Practical Rate of Fire (rd/min)	600 (150/barrel)		
Loader Type	Belt of 150 rds		
Reload Time	15		
Traverse (o)	360		

Traverse Rate (o/sec)	48		
Elevation (o)	-8 to +90		
Elevation Rate (o/sec)	29		
Reaction time (sec)	8		
The ZPU-4 can be fired from a brief stop (<10 sec) with wheels in travel position.			

OTHER FIRE CONTROL

THE GUN IS LINKED TO AD NETS, AND RECEIVES ANALOG VOICE RADIO ALERTS OF APPROACHING AIRCRAFT, E.G. TYPE, ALTITUDE, AND DIRECTION.

GUNS AND AD BATTERY/BATTALION HAVE AIR WATCHES AND FORWARD OBSERVERS.

UNITS CAN ADD RF 1L15-1 OR SIMILAR AZIMUTH WARNERS TO PROVIDE ALERTS WITH APPROACH DIRECTION, FOR FAST AA RESPONSE.

VARIANTS

ZPU-4: THE MEMBER OF THE ADA GUN FAMILY (ZPU-1, ZPU-2) WITH THE HIGHEST RATE OF FIRE.

TYPE 56: CHINESE AND NK VARIANT. IT IS USUALLY USED WITH DRUM TILT FIRE CONTROL RADAR.

M1983: NK SP VERSION WITH A ZPU-4 TYPE GUN ON A VTT-323 APC CHASSIS, WITH AN OPEN TURRET, AND A MANPADS LAUNCHER. IT ALSO TOWS DRUM TILT FIRE CONTROL RADAR.

MR-4: ROMANIAN SINGLE AXLE VARIANT

VTT-323: NORTH KOREAN APC WITH A TWIN ZPU GUN.

NOTES

IT MAY ALSO BE EMPLOYED IN A GROUND SUPPORT ROLE.

STRENGTHS: HIGHLY RELIABLE, RUGGED AND SIMPLE TO OPERATE. IT HAS QUICK-REACTION TIME, IS WIDELY DEPLOYED, AND HAS AN EXPLOSIVE ROUND.

WEAKNESSES: THE SHORT-RANGE SMALL PROJECTILE REQUIRES A DIRECT HIT.

RUSSIAN 23-MM TOWED AA GUN ZU-23



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation	ZU-23-2	Can fire the same ammunition as ZSU-23-4. Best mix for modern versions (ZU-23M and ZU-23M1) is 1,200 APDS-T and 1,200 FAPDS. Rounds are ballistically matched and no HEI is required.	
Date of Introduction	1962	Type	APDS-T and Oerlikon FAPDS-T (Frangible APDS-T). NOTE: FAPDS-T is ballistically matched to the APDS-T round.
Proliferation	At Least 50 Countries	Max Effective Range (m)	2,500+
Crew	5	Max Effective Altitude (m)	1,500+
Carriage	Two-Wheeled	Projectile Weight (kg)	INA
Combat Weight (kg)	950	Muzzle Velocity (m/s)	1,180
Travel Position Length Overall (m)	4.57	Fuze Type	API-T: Base igniting
Firing Position Length Overall (m)	4.60	Self-Destruct (sec)	11
Length of Barrel (m)	2.01	Penetration (mm KE)	19 @ 1000 m API-T INA for APDS-T 16+ @ 1500 m, FAPDS-T (helicopter simulant laminate array)
Travel Position Height Overall (m)	1.87	Type	23x152 HE-I, HEI-T, API-T, TP
Firing Position Height Overall (m)	1.28	Max Effective Range	2,500, 2,000 against light armored ground targets such as LAVs
		Max Effective Altitude (m)	1,500
Travel Position Width Overall (m)	1.83	Min Altitude (m)	Min: 0
Firing Position Width Overall (m)	2.41	HE-I Projectile Weight (kg)	0.18
Prime Movers	MTLB-T, GAZ-69 4 x 4 truck, BMD-2, BMD-3, BTR-3	HEI-T Projectile Weight (kg)	0.19
Automotive Performance		Muzzle Velocity (m/s)	970
Max. Towed Speed (km/h)	70	HE-I Fuze Type	Point detonating
Emplacement Time (min)	15-20 Can fire from travel position in emergencies.	HEI-T Fuze Type	Point detonating
Displacement Time (min)	35-40	Self-Destruct (sec)	11
ARMAMENT	SPECIFICATIONS	FIRE CONTROL	SPECIFICATIONS
Caliber, Type	23-mm, gas-operated gun, 2A14 or 2A14M	Sights with Magnification	Optical mechanical sight for AA fire. Straight tube telescope for ground

			targets.
Number of Barrels	2	Range (m)	2,000
Breech Mechanism	Vertical Sliding Wedge	Azimuth warning receiver	1L15-1
Cyclic Rate of Fire (rd/min)	1,600-2,000		
Practical Rate of Fire (rd/min)	400 in 10-30 rd bursts		
Feed	50-rd ammunition canisters fitted on either side of the upper mount assembly		
Loader Type	Magazine		
Reload Time	15		
Traverse (o)	360		
Traverse Rate (o/sec)	INA		
Elevation (o)	-10°to +90°		
Elevation Rate (o/sec)	54		
Reaction time (sec)	8 (est)		

OTHER FIRE CONTROL

GUN LINKED TO BATTERY NET WHICH RECEIVES ANALOG VOICE RADIO ALERTS FOR APPROACHING AIRCRAFT, INCLUDING DIRECTION, ALTITUDE, AND DIRECTION. FIRE CONTROL RADARS CAN BE USED OFF-CHASSIS WITH THE SYSTEM. A SIMPLE OPTIONAL ADDITION IS THE FARA-1 BSR. IT CAN BE ATTACHED AND BORE-LINED TO THE GUN.

GUNS AND AD UNITS USE AIR WATCHES AND FORWARD OBSERVERS.

VARIANTS

ZU-23-2M: RUSSIAN UPGRADE VARIANT REPLACES OPTICAL SIGHT WITH AN EO FIRE CONTROL SYSTEM EMPLOYING A BALLISTIC COMPUTER WITH DAY TV, THERMAL NIGHT CHANNEL, A LASER RANGEFINDER, AND AN AUTO-TRACKER. HIT PROBABILITY INCREASES 10-FOLD OVER THE ZU-23.

ZU-23-2M1: UPGRADE ADDS A TWIN MANPADS LAUNCHER (SA-16 OR SA-18), WHICH CAN AIM, TRACK, AND LAUNCH USING ABOVE FCS. THE FCS ALSO ADDS A DIGITAL MONITOR. OPERATOR CAN USE MANPADS AT RANGE OUT TO 6,000 M, AND THEN SHIFT TO GUN WHEN THE TARGET IS IN GUN RANGE.

ZUR-23-2KG JODEK-G: POLISH UPGRADE AND EXPORT VERSION OF ZU-23-2M1 WITH FAPDS-T ROUNDS AND GROM MISSILES.

BTR-ZD: IS BTR-D WITH TOWED OR PORTED ZU-23 AND MANPADS. THE BTR-ZD IMPROVED IS A BTR-D WITH PORTEED ZU-23M1 GUN AND SA-18S MANPADS.

NOTES

THIS IS A HIGHLY MOBILE AIR-DROPPABLE SYSTEM. THE ZU-23 CAN ALSO BE USED IN A GROUND SUPPORT ROLE AGAINST PERSONNEL AND LIGHT ARMORED VEHICLES.

RUSSIAN 23-MM SP AA GUN SYSTEM BTR-ZD/BTR-ZD IMPROVED



VARIANTS	SPECIFICATIONS	VARIANTS	SPECIFICATIONS
Alternative Designation	BTR-3D, incorrect name from translation error	Can fire the same ammunition as ZSU-23-4. Best mix for modern versions (ZU-23M and ZU-23M1) is 1,200 APDS-T and 1,200 FAPDS. Rounds ballistically matched. No HEI required.	
Date of Introduction	1979-1980	Type	APDS-T and Oerlikon FAPDS-T (Frangible APDS-T). NOTE: FAPDS-T is ballistically matched to the APDS-T round.
Proliferation	At Least 1 Country	Range (m)	0-2,500+ Effective
Crew	7, 2 for vehicle and 5 for gun	Altitude (m)	0-1,500+ Effective
Combat Weight (mt)	8 (est.)	Projectile Weight (kg)	0.189 API-T
Chassis	BTR-D APC chassis	Muzzle Velocity (m/s)	1,180
Chassis Length Overall (m)	5.88	Fuze Type	API-T: Base igniting
Height Overall (m)	6.3	Self-Destruct (sec)	11
Width Overall (m)	2.63	Penetration (mm)	19 @ 1000 m API-T 16+ @1500m FAPDS-T (helicopter simulant laminate array)
Automotive Performance	See BTR-D. The BTR-ZD is one of only a few SP air defense systems which can swim.	Type	23x152 HE-I, HEI-T, API-T, TP
Radio	R-123	Max Effective Range (m)	2,500, 2,000 against light armored ground targets such as LAVs
Protection	See BTR-D	Altitude (m)	0-1,500
ARMAMENT	SPECIFICATION	HE-I Projectile Weight (kg)	0.18
Caliber, Type	23-mm, gas-operated	HEI-T Projectile Weight (kg)	0.19
Name	ZU-23	Muzzle Velocity (m/s)	970
Number of Barrels	2	HE-I Fuze Type	Point detonating
Breech Mechanism	Vertical Sliding Wedge	HEI-T Fuze Type	Point detonating
Rate of Fire (rd/min)	Cyclic: 1,600-2,000 Practical: 400 /10-30rd Bursts	Self-Destruct (sec)	11
Loader Type	Magazine	Missiles	
Reload Time (sec)	15	Name	SA-18 Tier 2, SA-18S Tier 1
Traverse (o)	360	Range (m)	500-6,000+
Traverse Rate (o/sec)	INA	Altitude (m)	10 (0 degraded Ph) - 3,500
Elevation (o)	-10°to +90°	Other Missiles	Tier 3 is SA-16, 4 is SA-14
Elevation Rate (o/sec)	54		
Reaction time (sec)	8 (est)		

Fire on the Move	No, in 8 sec stop		
Missile Launcher	Use SAM noted for each tier. For Tier 2 use SA-18. For Tier 1 use SA-18S.		

FIRE CONTROL

SIGHTS WITH MAGNIFICATION: OPTICAL MECHANICAL SIGHT FOR AA FIRE STRAIGHT TUBE TELESCOPE FOR GROUND TARGETS OPTIONAL SIGHTS: SEE ZU-23M/ZU-23M1 BELOW MISSILE SUPPORT EQUIPMENT: GUN/LAUNCHER HAS A NIGHT SIGHT (THERMAL, MOWGLI-2 2 GEN II, OR II NIGHT VISION GOGGLES). ONE MAN OPERATES A 1L15-1AZIMUTH PLOTTING BOARD AND PELENGATOR RF DIRECTION-FINDER.

OTHER FIRE CONTROL

FIRE CONTROL RADARS CAN BE USED OFF-CHASSIS. A SIMPLE OPTIONAL ADDITION IS THE FARA-1 OR MT-12R MMW BSR. IT CAN BE ATTACHED AND BORE-LINED TO THE GUN. GUNS USE AIR WATCHES AND FORWARD OBSERVERS, AND ARE LINKED TO AD NETS.

VARIANTS

BTR-ZD: CAN TOW OR PORTEE-MOUNT THE SYSTEM. USUALLY, THE VEHICLE AND GUN ARE LANDED APART. THE GUN IS TOWED OUT OF THE LANDING ZONE, THEN MOUNTED ON THE VEHICLE. VEHICLE HOLDS 2 SAM LAUNCHERS. IN THE EARLIEST UNITS, THE VEHICLE HAD NO AA GUN, RATHER HAD 6 MANPADS LAUNCHERS, RELOAD RACKS, AND LAUNCH CREWS (1-2).

TIER CONFIGURATIONS INCLUDE EMPLOYING UPDATED VERSIONS OF THE GUN SYSTEM AND SAMS. IN EARLY VERSIONS (TIERS 2 - 4), THE SAM LAUNCHERS ARE SHOULDER-MOUNTED. IN THE LATEST VERSION (TIER 1), THEY ARE MOUNTED ON THE GUN. THE SAMS USUALLY LAUNCH FIRST AT APPROACHING TARGETS.

ZU-23M: REPLACES OPTICAL SIGHT WITH AN EO FIRE CONTROL SYSTEM EMPLOYING A BALLISTIC COMPUTER WITH DAY TV, THERMAL NIGHT CHANNEL, LASER RANGEFINDER, AND AUTO-TRACKER. HIT PROBABILITY INCREASES 10-FOLD OVER THE ZU-23.

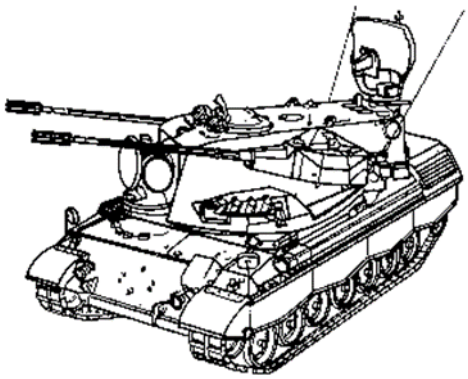
FOR OPFOR SIMULATIONS, THIS IS THE TIER 2 AIRBORNE (ABN) SPAAG CAPABILITY.

ZU-23M1: UPGRADE MOUNTS A STRELETS SA-18 /18S/24 MANPADS LAUNCHER, WHICH CAN AIM, TRACK, AND LAUNCH WITH THE ZU-23M FCS. THE FCS ADDS A DIGITAL MONITOR. A SINGLE OPERATOR CAN USE THE MISSILE AT RANGES OUT TO 6,000+ M, THEN SHIFT TO GUN WHEN THE TARGET IS IN RANGE.

NOTES

VEHICLE MOUNT ARRANGEMENTS CAN BE EXECUTED IN THE FIELD. SIMILAR AD HOC MOUNTING OF AD GUN, MACHINEGUN, ROCKET, OR GRENADE LAUNCHERS IS USED BY PARAMILITARY FORCES WITH COMMERCIAL OR MILITARY TRUCKS, PICK-UP TRUCKS, CARS OR UTILITY VEHICLES TO CREATE "TECHNICALS". WHEN THE GUN IS MOUNTED ON THE VEHICLE, IT CAN TOW A TRAILER WITH ADDITIONAL AMMO AND SUPPLIES. THE GUN CAN ALSO BE USED IN A GROUND SUPPORT ROLE, INCLUDING USE FOR HIGH-ANGLE FIRE IN URBAN AND DEFILADE ENVIRONMENTS.

GERMAN/SWISS 35-MM SP AA GUN SYSTEM GEPARD



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation	5PFZ-B2L Upgrade variant known as FlakPz 1A2	Type	HEI-T
Date of Introduction	1976 Original	Tactical AA range (m)	3,500 (self-destruct)
Proliferation	At Least 5 Countries	Tracer Range (m)	3,500
Crew	3	Effective Altitude (m)	3,100
Combat Weight (mt)	46	Min Altitude (m)	0
Chassis	Leopard 1 tank chassis	Self-Destruct (sec)	6-12
Chassis Length Overall (m)	7.16	Type	Semi-armor-piercing HEI-T (SAPHEI-T)
Radar Up Height (m)	4.23	Range (m)	4,000
Radar Down Height (m)	3.01	Tactical AA Range (m)	3,500 (self-destruct)
Width Overall (m)	3.25	Effective (m)	3,500 (est)
Engine Type	830-hp Diesel	Self-Destruct Time (sec)	6-12
Max Road Speed Cruising Range (km)	65	Penetration (mm KE)	40 to 1,000 m
Fording Depths (m)	2.25	Typ3	APDS-T
Auxiliary power unit has 90-hp engine	Type	Range (m)	4,000
ARMAMENT	SPECIFICATIONS	Tactical AA Range (m)	3,500
Caliber, Type	35x228 gun, KDA	Tracer Range (m)	2,000
Number of Barrels	2	Effective Altitude (m)	3,100
Rate of Fire (rd/min)	1,100 (550/barrel	Penetration (mm KE)	90 at 1,000
Reaction Time (sec)	6-10	Type	APFSDS-T
Ammunition Loader	Twin Belt	Range (m)	4,000
Reload Time (sec)	INA	Tactical AA Range (m)	3,500
Elevation (o)	-10 to +85°	Tracer Range (m)	INA
Fire on the Move	Yes (est)	Effective Altitude (m)	3,100
FIRE CONTROL	SPECIFICATIONS	Penetration (mm KE)	115+ at 1,000 m
FC System	EADS digital computer-based FCS	Frangible APDS (FAPDS) for upgrades. On impact with the target surface, the penetrator breaks into several KE fragments. The round has Frag-HE effects with the higher velocity and flat trajectory of a sabot round.	
Sights With Magnification	Stabilized video sights for -1A2 upgrade	Other Ammunition Type	HEI
Magnification	INA		
Field of View (°	INA		
Night Sights	Thermal for -1A2 upgrade		
IFF	Yes, MSR-400		
Navigation System	Computerized		
Laser Rangefinder	ND Yag (1.06μ)		
Linked to Air Defense Net	Yes		

Radars			
Name	INA, Siemens Manufacture		
Function	Target Acquisition		
Detection Range (km)	15		
Tracking Range (km)	INA		
Frequency Band	S		
Search on the Move	Yes		
Name	INA		
Function	Fire Control		
Detection Range (km)	15		
Tracking Range (km)	15		
Frequency Band	Ku		

ARMORED COMMAND VEHICLE

SYSTEM WILL LINK TO AN ACV WHICH MAY HAVE A RADAR FOR EW AND TARGET ACQUISITION. FOR EXAMPLE, SEE SBORKA ACV AND RADAR (PG 6-15).

OTHER RADARS

LINKS TO INTEGRATED AIR DEFENSE SYSTEM (IADS) FOR EARLY WARNING AND TARGET ACQUISITION DATA FROM RADARS: GIRAFFE AMB AT SEPARATE BRIGADE AND DIVISION, LONG TRACK OR SIMILAR EW/TA RADAR ECHELONS ABOVE DIVISION, AND RADARS IN SAM UNITS, E.G., SA-10.

OTHER FIRE CONTROL

GUNS USE AIR WATCHES AND FORWARD OBSERVERS AND ARE LINKED TO AD NETS

VARIANTS

GEPARD 1A2: UPGRADE VARIANT WITH NEW FCS, INCLUDING STABILIZED THERMAL SIGHT AND VIDEO AUTO-TRACKER, INTEGRATED C2, INCREASED RANGE, REDUCED REACTION TIME, AND FAPDS.

GEPARD CA1: DUTCH VARIANT (ALSO CALLED 95 CHEETAH) USES SIGNAAL I-BAND MTI RADAR AND DUAL I-BAND K-BAND TRACKING RADARS.

PRTL-35MM GWI: UPGRADE DUTCH VARIANT, WITH UPGRADES SIMILAR TO 1A2 AND NEW RADIOS, BUT WITH DIFFERENT RADARS. RANGE WITH FAPDS IS CLAIMED TO BE 3,500-4,500.

NOTES

KMW IS DEVELOPING AN UPGRADE WITH 2X STINGER MANPADS MISSILE LAUNCHERS ADDED TO A GUN, AND INTEGRATED WITH THE FCS.

RUSSIAN 23-MM SP AA GUN ZSU-23-4



SYSTEM	SPECIFICATIONS	AMMUNITION	SPECIFICATIONS
Alternative Designation	Shilka	Can fire the same ammunition as ZU-23. Best mix for modern versions (ZU-23M and ZU-23M1) is 1,200 APDS-T and 1,200 FAPDS. Rounds ballistically matched. No HEI required.	
Date of Introduction	1965	Type	APDS-T and Oerlikon FAPDS-T (Frangible APDS-T). NOTE: FAPDS-T is ballistically matched to the APDS-T round.
Proliferation	At Least 28 Countries	Max Effective Range (m)	2,500+
Crew	4	Max Effective Altitude (m)	1,500+
Combat Weight (mt)	20.5	Projectile Weight (kg)	INA
Chassis	GM-575 Tracked, six road wheels, no track support rollers	Muzzle Velocity (m/s)	1,180
Length (m)	6.5	Fuze Type	None
Height (m)	Radar up: 3.75 Radar down: 2.60	Self-Destruct (sec)	11
Width (m)	3.1	Penetration (mm KE)	INA APDS-T, 16+ @ 1500m FAPDS-T (helicopter simulant laminate array)
Automotive Performance		Type	23x152 HE-I, HEI-T, API-T, TP
Engine Type	V6R-1 diesel	Max Effective Range (m)	2,500, 2,000 against light armored ground targets such as LAVs
Cruising Range (km)	450	Max Effective Altitude (m)	1,500
Max Road Speed (km/h)	50	Min Altitude (m)	0
Radio	R-123	HE-I Projectile Weight (kg)	0.18
Protection NBC Protection System	Yes	HEI-T Projectile Weight (kg)	0.19
ARMAMENT	SPECIFICATIONS	API-T Projectile Weight (kg)	0.189
Caliber, Type, Name	23-mm liquid-cooled AA 2A7/2A7M	TP Projectile Weight (kg)	0.18
Cyclic Rate of Fire (rd/min)	850-1,000	Muzzle Velocity (m/s)	970
Practical Rate of Fire (rd/min)	400, in 10-30 rd bursts	HE-I Fuze Type	Point detonating
Reload Time (min)	20	HEI-T Fuze Type	Point detonating
Elevation (o)	-4° to +85°	API-T Fuze Type	Base igniting
Fire on the Move	Yes	Self-Destruct (sec)	11
Reaction Time (sec)	12-18	Penetration (mm KE)	19 @ 1000 m API-T
FIRE CONTROL	SPECIFICATIONS		
Sights with Magnification			

Day and Night Vision Devices			
Driver Periscope	BMO-190		
Driver IR Periscope	INA		
Commander Periscope	TPKU-2		
Commander IR Periscope	TKH-ITC		
IFF	INA		
Radar	1RL33M1		
Name	GUN DISH		
Function	Acquisition and Fire Control		
Detection Range (km)	20		
Tracking Range (km)	13		
Frequency	14.8 to 15.6 GHz		
Frequency Band	J		
RPK-2	Optical-mechanical computing sight and part of FC subsystem		
Armored Command Vehicle			
Name	Sborka (9S80-1 or PPRU-M1)		
Chassis	MTLB-U		
Radar	DOG EAR (use in OPFOR units)		
Function	Target Acquisition		
Frequency	F/G band		
Range (km)	80 detection, 35 tracking ACV links to supported tactical unit nets.		
Other Radars	Using the above ACV, if an Integrated Air Defense System (IADS) is available, ZSU-23-4 links indirectly for early warning and target acquisition data from radars.		
Other Fire Control	Guns use air watches and forward observers, and are linked to AD nets		

VARIANTS

ZSU-23-4M4: RUSSIAN MODERNIZED GUN/MISSILE VEHICLE WITH 2 STRELETS LAUNCH MODULES (4 MISSILES) WITH AN UPGRADE RADAR, AND COMPUTER-BASED FCS WITH CCD TV SIGHT AND NIGHT CHANNEL.

DONETS: UKRAINIAN ZSU-23-4 UPGRADE, WITH A NEW RADAR SYSTEM REPLACING GUN DISH, PLUS A SENSOR POD BELIEVED TO INCLUDE DAY/NIGHT CAMERA, AND A LASER RANGEFINDER. MOUNTED ABOVE THE RADAR/SENSOR POD IS A LAYER OF 6 RUSSIAN SA-18 MANPADS LAUNCHERS.

BIALA: POLISH UPGRADE WITH THERMAL SIGHT, GROM MANPADS, FAPDS-T.

NOTES

AMMUNITION IS NORMALLY LOADED WITH A RATIO OF THREE HE ROUNDS TO ONE AP ROUND. ZSU 23-4 IS CAPABLE OF ACQUIRING, TRACKING AND ENGAGING LOW-FLYING AIRCRAFT (AS WELL AS MOBILE GROUND TARGETS WHILE EITHER IN PLACE OR ON THE MOVE). RESUPPLY VEHICLES CARRY AN ESTIMATED ADDITIONAL 3,000 ROUNDS FOR EACH OF THE FOUR ZSUS IN A TYPICAL BATTERY.

RUSSIAN 57-MM SELF PROPELLED SP AA GUN ZSU-57-2



SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designation	None	Gun, Caliber, Type	57-mm recoil-operated air-cooled cannons, S-68
Date of Introduction	1955	Number of Barrels	2
Proliferation	At Least 16 Countries	Rate of Fire (rd/min)	Cyclic: 210-240 (105-120/gun) Practical: 140 (70/gun)
Description		Loader Type	Two 5-round clips, manual, 10 rds
Crew	6	Reload Time (sec)	4-8
Carriage	4 road wheels/T-54 modified chassis	Traverse (o)	360
Combat Weight (mt)	28.0	Traverse Rate (o/sec)	30
Length Overall (m)	8.4	Elevation (o)	-5 to +85
Length of Barrel (m)	INA	Elevation Rate (o/sec)	20
Height Overall (m)	2.75	VARIANTS	SPECIFICATIONS
Width Overall (m)	3.270	Type 80 Chinese variant on Type 69-II main battle tank chassis	
Prime Mover	A shortened T-54 chassis with thinner armor and only four road wheels.	AMMUNITION	SPECIFICATIONS
Emplacement Time (min)	N/A	Types	57 x 348 SR APHE, Frag-T, APC-T, HVAP-T, HE-T. Uses same ammo as the towed single S-60
Displacement Time (min)	N/A	Max Effective Range (m)	4,000
Engine Power (hp)	520	Max Effective Altitude (m)	4,237 at 65o
Max Road Speed (km/h)	50	Min Altitude (m)	0
Cruising Range (km)	400	Frag-T Projectile Weight (kg)	2.81
Fording Depth (m)	1.4	APC-T Projectile Weight (kg)	2.82
Armor Protection	13 mm front hull and turret	HE-T Projectile Weight (kg)	2.85
		Muzzle Velocity (m/s)	1,000
		Frag-T Fuze Type	Point Detonating
		APC-T Fuze Type	Base Detonating Fuze
		HE-T Fuze Type	(Yugoslavian, impact [super quick] action with pyrotechnical self-destruct)
		Self-Destruct Time (sec)	13-17
		Armor Penetration (mm CE)	130 at 1,000m, APHE 96 APC-T at 1,000 m

FIRE CONTROL

SIGHTS W/MAGNIFICATION: OPTICAL MECHANICAL COMPUTING REFLEX SIGHT (NOT RADAR CONTROLLED) LATER VARIANTS WERE FITTED WITH A MORE SOPHISTICATED SIGHTING SYSTEM, IDENTIFIED BY TWO SMALL PORTS IN FORWARD UPPER PORTION OF THE TURRET.

OTHER FIRE CONTROL:

ABSENCE OF A TRACKING RADAR, A NIGHT VISION DEVICE, AND AN ENCLOSED TURRET MAKES THIS A DAYLIGHT, FAIR WEATHER WEAPON SYSTEM ONLY. OFF-CARRIAGE RADARS, SUCH AS THE SON-9/SON-9A (NATO FIRE CAN), RPK-1/FLAP WHEEL, OR TYPE 311 CAN BE USED THE GUN IS LINKED TO THE BATTERY NET WHICH RECEIVES ANALOG VOICE RADIO ALERTS FOR APPROACHING AIRCRAFT, INCLUDING DIRECTION, ALTITUDE, AND DIRECTION. GUNS AND BATTERY/ BATTALION HAVE AIR WATCHES AND FORWARD OBSERVERS.

NOTES

THE ZSU-57-2 CAN BE EMPLOYED IN A GROUND SUPPORT ROLE. NO NBC SYSTEM AND NO AMPHIBIOUS CAPABILITY. FUEL DRUMS CAN BE FITTED ON REAR OF HULL. THE GUN HAS AUTO-TRAVERSE WITH MANUAL BACKUP.

MAN-PORTABLE AIR DEFENSE SYSTEMS (MANPADS) AND TRENDS

In units with dismounted teams or squads, the most effective air defense asset is the MANPADS launcher. This system requires moderate training to achieve proficiency, and offers high probabilities of hit and kill. Although its cost is greater than most small arms, it offers an asymmetric possibility of causing high enemy damage compared to its relative cost, and it retains its effectiveness over time. With an infrared (IR) homing guidance system, a MANPADS permits the user to engage a target, then quickly displace to avoid a lethal response. These systems also offer insurgents and others an asset capable of downing costly military and civilian aircraft targets.

Basic components of legacy MANPADS include the following: grip-stock with attached sight, inserted battery coolant unit (BCU), launch tube (canistered) with sling and missile, and possible protective pads. Missile components consist of the warhead with seeker, missile body with propulsion motor and guidance fins, and an eject motor for soft launch. A 2-3 man team usually includes the operator, an assistant to provide support equipment and spare missiles, and perhaps a loader/transporter. Support assets can provide advance warning of aircraft approach. Once a target is in sight, the launcher signals lock-on with visual/audio cues. A trigger squeeze launches the missile. MANPADS seekers detect engine heat, so they offer longer range at target side and rear aspects.

Aircraft have added many changes and countermeasures to defeat MANPADS. They include IR flare dispensers, low detection designs, and evasive tactics (e.g., low terrain flying modes, use of terrain defilade, and night missions). MANPADS have also added improvements since their inception (1960s). Grip-stocks added optical or electro-optical sights to augment post-and-blade sights. Support assets include radio links to forward observers, AD nets, azimuth plotting boards that provide alerts and flight path warning, and even helmet-mounted RF receivers to give operators warning and direction. Man-portable surveillance radars can be positioned nearby, or linked with RF display units such as the Chinese QW-1A.

The greatest improvements are in the missile designs. Missile motors and eject motors now use faster, low-smoke propellants. These, combined with improved steering systems, mean reduced warning time, higher speeds, and higher G-force turns to challenge adversary aircraft evasion capability. Seekers have been shifted to improve detector arrays capable of 2-color vs earlier 1-color IR tracking. Microcircuits and superior filter algorithms offer higher contrast and less background clutter. Some systems added spikes to reduce lens heating, and mirrors to widen field of view. These mean higher hit probability (Ph) and greater IR flare rejection. Ground target discrimination allows MANPADS to fly lower (0-10 m) against helicopters flying in nap-of-the-earth mode. Warheads have greatly improved in lethality, with HMX replacing RDX explosives, fuel detonation fuzing, and proximity fuzes to increase Ph. Warheads are growing, from earlier HE versions at <1 kg, to Frag-HE/frangible rod designs to 3 kg.

Given the number of older MANPADS located around the world, especially those modeled on the Russian SA-7a, arms manufacturers offer refurbishing and upgrades for older systems. Although systems, when stored well, can last for decades, the BCUs may need replacement. New ones are available through the international arms market. In addition, the Russian firm LOMO offers a replacement 9E46M 2-color IR seeker to replace the older 1-color seeker. With the newer seeker, the SA-7 missile and foreign copies can approach the higher Ph (including flare rejection) of more modern systems. Other parts, e.g., eject motors and sights, can be replaced or upgraded. Variants have added changes. The Chinese incorporated many changes to existing fielded systems. Other users then modified those designs.

Some producers compensated for aircraft countermeasures (CM) by improving effectiveness of their MANPADS with new guidance systems. British designers developed the Blowpipe system in the early

1970s, but its RF command line-of-sight (CLOS) guidance proved difficult to keep on target. The Javelin RF semi-automatic line-of-sight (SACLOS) system appeared in the mid-80s. It requires only that the crosshairs stay on target. These systems are unaffected by IR flares and have good head-on range, but are subject to RF jamming. In 1976 Sweden fielded the laser beam-rider (LBR) RBS-70 SACLOS system. RBS-90 offered improved fire control and support. British Starstreak also adopted LBR guidance systems. Now British Shorts offers a Javelin upgrade to LBR with the Starburst system. LBR SACLOS systems cannot be jammed or decoyed, but, all SACLOS systems are challenged to stay fixed on evading aircraft. Starstreak II added an auto-tracker to maintain target lock-on until impact. SACLOS launchers also cannot move until impact has occurred on the target. Starstreak's answer is high velocity and long range: to kill aircraft beyond the range of their weapons systems. Later seekers were fielded with IR/ultraviolet (UV) homing, and with semi-active laser-homing (SAL-H) guidance.

As new MANPADS have emerged with new features, weight for some has crept up considerably. Several have exceeded weight limits for truly man-portable systems. A more accurate term for these is "portable". It means that several are not generally shoulder-launched, but rather launched from vehicles or pedestal ground launchers. RBS-70 and 90, and Mistral fit on these launchers. Other makers also offer pedestal launchers for true MANPADS, for convenient use by MANPADS teams. The Russian Djigit is a pivoting twin launcher with separate triggers and a convenient EO sight system. Pedestal launchers can also mount on vehicles, such as on truck beds, for easy mobile conversions. Also modular launch pods like the Mistral Albi system and Russian Strelets offer multiple launchers with superior FCS. MANPADS can be mounted on helicopters, guns and vehicles to exploit the superior FCS of these platforms.

Selected MANPADS Systems

Name	Export Country	Weight (kg)	Range (km)	Altitude (km)	Munition Type	Guidance	Remarks
Red Eye	US	13.1	.2-5.5	.05-2.7	Frag 2	1-C IR-H	Obsolete
Blowpipe	UK	20.7	.6-3	.01-2	Frag 2.2 P	RF CLOS	Low hit probability
Javelin	UK	24.3	.3-5.5	.01-3	Frag 2.7 P	RF SACLOS	Blowpipe upgrade
Starburst	UK	20.9	.3-5.5	0-3	Frag 2.7 P	LBR SACLOS	Javelin upgrade
RBS-70	SW	86.5	.2-7	0-4	Frag .9 P	LBR SACLOS	Mk 2 and RBS-90
HN-5/5B	CH	15	.8-4.4	.05-2.5	HE .6	1-C IR-H	SA-7 variant
FN-6	CH	17	.5-5.5	.015-3.8	INA	2-C IR/UV-H	Mistral variant
QW-1	CH	16.5	.5-5	.03-4	Frag .57	2-C IR-H	SA-7b variant
QW-2	CH	18.4	.5-6	.01-4	Frag 1.4	2-C IR-H	SA-14/16 variant
QW-3	CH	29.7	.8-8	.004-5	HE rod	IR SAL-H	Fielding INA
Sakr Eye	EG	18	.8-4.4	.05-2.4	Frag	1-C IR-H	SA-7 variant
Anza Mk I	PK	15	1.2-4.2	.05-2.5	Frag .37	2-C IR-H	HN-5 variant
Anza Mk II	PK	16.5	.5-5	.03-4	Frag .55	2-C IR-H	QW-1 variant
Anza Mk III	PK	18	.5-7	.01-3.5	Frag 1.4	2-C IR-H	QW-2 variant

Misagh-1	IR	16.9	.5-5	.3-4	Frag 1.4	2-C IR-H	QW-1 variant

Developments continue. New thermal night sights are offered. One particularly active area for MANPADS is in support assets. Passive support systems include acoustic detection systems, unattended ground sensors, and remote passive IR camera systems. Radars and links to IADS can link directly with MANPADS or indirectly through the transport/fire support vehicles.

RUSSIAN MAN-PORTABLE SAM SYSTEM SA-7B/GRAIL



SYSTEM	SPECIFICATIONS	Length (m)	1,40
Alternative Designation	9K32M Strela-2M	Diameter (mm)	70
Date of Introduction	1972	Weight (kg)	9.97
Proliferation	Worldwide	Missile Speed (m/s)	580
Target	FW, heli	Propulsion	Solid fuel booster and solid fuel sustainer rocket motor. Guidance: Passive 1-color IR homing (operating in the medium IR range)
Crew	1, Normally 2 with a loader	Guidance	Passive 1-color IR homing (operating in the medium IR range)
ARMAMENT	SPECIFICATIONS	Seeker Field of View (o)	1.9°
Launcher		Tracking Rate (o/sec)	6°
Name	9P54M	Warhead Type	HE
Length (m)	1.47	Warhead Weight (kg)	1.15
Diameter (mm)	70	Fuze Type	Contact (flush or grazing)
Weight (kg)	4.71	Probability of Hit (Ph%)	30 FW/40 heli
Reaction Time (acquisition to fire) (sec)	5-10	Self-Destruct (sec)	15
Time Between Launches (sec)	INA	Countermeasure Resistance	The seeker is fitted with a filter to reduce effectiveness of decoy flares and to block IR emissions.
Reload Time (sec)	6-10	FIRE CONTROL	SPECIFICATIONS
Fire on the Move	Yes, in short halt	Sights with Magnification	Launcher has a sighting device and a target acquisition indicator. The gunner visually identifies and acquires the target.
Missile		Field of View (o)	INA
Name	9M32M	Night Sight	None Standard
Range (m)	500-5,000	Acquisition Range (m)	INA
Max Altitude (m)	4,500	IFF	Yes (see NOTES)
Min Altitude (m)	18, 0 with degraded Ph		

VARIANTS

THE MAIN DIFFERENCE BETWEEN THE SA-7 AND SA-7B IS THE IMPROVED PROPULSION OF THE SA-7B. THIS IMPROVEMENT INCREASES THE SPEED AND RANGE OF THE NEWER VERSION.

SA-N-5: NAVAL VERSION

HN-5A: CHINESE VERSION

STRELA 2M/A: YUGOSLAVIAN UPGRADE

SAKR EYE: EGYPTIAN UPGRADE

STRELA-2M2: SA-7/7B AND STRELA-3 /SA-14 MISSILES CONVERTED WITH A LOMO UPGRADE 2-COLOR IR SEEKER FOR DETECTION/IRCM RESISTANCE SIMILAR TO SA-18.

SA-7B CAN BE MOUNTED IN VARIOUS VEHICLES, BOATS, AND VESSELS IN FOUR, SIX, AND EIGHT-TUBE LAUNCHERS. IT CAN ALSO MOUNT ON HELICOPTERS (INCLUDING MI-8/17, MI-24/35 AND S-342 GAZELLE).

NOTES

THIS MISSILE IS A TAIL-CHASING HEAT (IR) SEEKER THAT DEPENDS ON ITS ABILITY TO LOCK ON TO HEAT SOURCES OF USUALLY LOW-FLYING FIXED- AND ROTARY-WING AIRCRAFT. WHEN LAUNCHED TOWARD A RECEDING AIRCRAFT, THE MANPADS CAN BE USED TO SCAN THE DIRECTION AND LOCK ON WITHOUT THE TARGET BEING VISUALLY ACQUIRED IN THE SIGHTS.

AN IDENTIFICATION FRIEND OR FOE (IFF) SYSTEM CAN BE FITTED TO THE GUNNER/OPERATOR'S HELMET. FURTHER, A SUPPLEMENTARY EARLY WARNING SYSTEM CONSISTING OF A PASSIVE RF ANTENNA AND HEADPHONES CAN BE USED TO PROVIDE EARLY CUE ABOUT THE APPROACH AND ROUGH DIRECTION OF AN ENEMY AIRCRAFT.

THE GUNNER MAY HAVE AN OPTIONAL 1L15-1 PORTABLE ELECTRONIC PLOTTING BOARD, WHICH WARNS OF LOCATION AND DIRECTION OF APPROACHING TARGET(S) WITH A DISPLAY RANGE OF UP TO 12.5 KM.

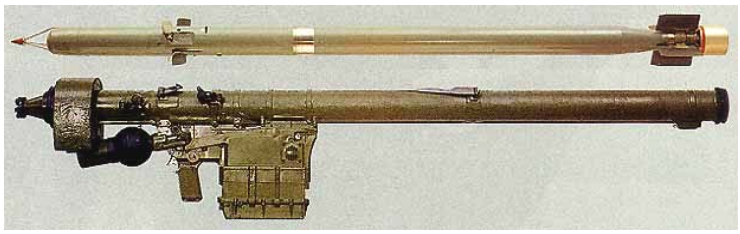
A VARIETY OF NIGHT SIGHTS ARE AVAILABLE, INCLUDING 1 GEN II (2,000-3,500), 2 GEN II (4,500), AND THERMAL SIGHT (5,000-6,000). BRITISH RING SIGHTS PERMIT II NIGHT SIGHT TO BE MOUNTED TO ANY MANPADS.

RUSSIAN MAN-PORTABLE SAM SYSTEM SA-14/GREMLIN



SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designation	9K34 Strela-3	Name	9P59
Date of Introduction	1978	Length (m)	1.40
Proliferation	Worldwide	Diameter (mm)	75
Target	FW, heli	Weight (kg)	2.95
Description		Reaction Time (sec)	25
Crew	1, Normally 2 with a loader	Fire on the Move	Yes, in short halt
FIRE CONTROL	SPECIFICATIONS	Name	9M36 or 9M36-1
Sights with magnification	Launch tube has simple sights	Max Range (m)	6,000
Gunner		Min Range (m)	600
Gunner Field of View (o)	INA	Max Altitude (m)	6,000
Gunner Acquisition Range (m)	INA	Min Altitude (m)	10; 0 with degraded Ph
Gunner Night Sight	None standard, but available	Length (m)	1.4
Acquisition Range (m)	6,000	Diameter (mm)	75
IFF	Yes	Fin Span (mm)	INA
		Weight (kg)	10.3
		Missile Speed (m/s)	600
		Propulsion	2-stage solid-propellant rocket
		Guidance	1-color passive IR homing
		Seeker Field of View	INA
		Tracking Rate	INA
		Warhead Type	Frag-HE
		Warhead Weight (kg)	1.0
		Fuze Type	Contact/grazing
		Missile Speed (m/s)	600

RUSSIAN MAN-PORTABLE SAM SYSTEM SA-16/GIMLET



SA-16 MISSILE, AND LAUNCHER WITH PROTECTIVE PAD AND MISSILE CAP FOR TRANSPORT

SYSTEM	SPECIFICATIONS
Alternative Designation	9K310 Igla-1
Date of Introduction	1981
Proliferation	At Least 34 Countries
Target	FW, heli, cruise missile, UAV
Description	
Crew	1, Normally 2 with a loader
FIRE CONTROL	**SPECIFICATIONS**
Sights with Magnification	Front hooded ring, rear optical
Gunner	
Day Sight	Field of View (o): INA Acquisition Range (m): 5,200+
Night Sight	Ring mount with II NVG Field of View (o): INA Acquisition Range (m): 3,500
IFF	Yes

VARIANTS

THE SA-16 IS A VARIANT OF THE IGLA (SA-18) DESIGN. BECAUSE OF DELAYS IN THE IGLA PROGRAM, THE IGLA-1WITH A SIMPLER AND SLIGHTLY LESS CAPABLE SEEKER WAS RUSHED INTO PRODUCTION AND FIELDED 2 YEARS PRIOR TO ITS PROGENITOR. THE SA-16 IS DESIGNED ESPECIALLY TO BE ABLE TO ENGAGE HELICOPTERS.

IGLA-1E: RUSSIAN EXPORT VARIANT. UNLIKE THE BASE SYSTEM, FUEL REMNANTS ARE NOT FUZED ALONG WITH THE WARHEAD. IFF INTERROGATOR CAN BE TAILORED TO CUSTOMER SPECIFICATIONS.

IGLA-1M: EXPORT VARIANT SIMILAR TO -1E, BUT LACKING AN IFF INTERROGATOR.

SPECIALIZED APPLICATIONS INCLUDE AN LUAZ UTILITY CARRIER DESIGNED FOR A MANPADS FIRING UNIT. THE VEHICLE HAS A RACK FOR MOUNTING FIVE 9P322 SA-16 LAUNCHER TUBES. THIS RACK COULD BE USED IN OTHER MAN-PORTABLE AD UNIT VEHICLE APPLICATIONS.

DJIGIT: RUSSIAN TWIN LAUNCHER COMPLEX MOUNTED ON A RAIL FRAME WITH OPERATOR'S SEAT AND TRIPOD. MISSILES CAN BE SIMULTANEOUSLY LAUNCHED USING CENTRALLY MOUNTED SIGHT. A HUNGARIAN MOUNT WITH THIS SYSTEM ON A GAZ-630 4X4 TRUCK IS CALLED IGLA-1E.

Armament	Specifications
Launcher	
Name	9P322 launch tube 9P519 launcher grip-stock
Length (m)	1.708
Diameter (m)	0.08 tube, 0.33 overall
Weight (kg)	7.1
Reaction Time (sec)	5-7 Seconds
Time Between Launches	INA
Reload Time (sec)	<60
Fire on the Move	Yes, in short halt
Missile	
Name	9M313
Max Range (m)	5,200 other aspects; 4,500 approaching
Min Range (m)	600
Max Altitude	3,500 receding slow 3,000 slow approach 2,500 receding fast 2,000 fast approach
Min Altitude (m)	10; 0 w/ degraded Ph
Length (mm)	1,593
Diameter (mm)	72
Weight (kg)	10.8
Missile Speed (m/s)	570
Guidance	Passive 2-color IR homing
Seeker Field of View	80° Unusually wide FOV permits the missile to respond more quickly to maneuvering targets, such as helicopters.
Tracking Rate	INA
Warhead Type	Frag-HE. Also, fuel residue is ignited to enhance warhead blast
Warhead Weight (kg)	1.27

STRELETS IS A TWIN MISSILE LAUNCH MODULE TO MOUNT SA-16/SA-18/SA-24 SAMS ON GUNS, PLATFORMS AND VEHICLES.	Fuze Type	Contact
	Probability of Hit (Ph%)	60 FW/70 heli
	Self-Destruct (sec)	14-17
	Countermeasure Resistance	See Notes

NOTES

TO PORTRAY THE SYSTEM AS A 2ND TIER MANPADS, INCLUDE GEN2 II NIGHT SIGHT. FOR A 3RD TIER SYSTEM, GEN1 II SIGHT MAY BE USED. OTHER ACQUISITION AIDSAIRCRAFT APPROACH WARN SYSTEM: VEHICLE ALARM AZIMUTH WARN SYSTEM: 1L15-1 PLOTTING BOARD OTHER: PELENGATOR RF DIRECTION-FINDER SYSTEMTHESE WILL BE FOUND IN TIER 2 MECH INFANTRY UNITS, AND IN TIER 3 AT BRIGADE LEVEL.

LAUNCHER DEPLOYMENT TIME IS 5-13 SECONDS. MISSILES ARE PRELOADED IN THE LAUNCH TUBE FOR QUICK LOADING TO THE GRIPSTOCK. A TUBE CAN BE USED UP TO FIVE TIMES. THE MISSILE IS COOLED BY A DISPOSABLE BOTTLE OF REFRIGERANT. THE BOTTLE AND LAUNCHER BATTERY ARE USEABLE FOR 30 SECONDS AFTER ACTIVATION. BECAUSE THE NOSE EXTENDS PAST THE LAUNCHER TUBE, THE NOSE IS PROTECTED WITH AN EXTENDED CAP WHICH IS REMOVED BEFORE LAUNCHING.

ONCE THE OPERATOR REACHES THE LAUNCH AREA, HE WILL OFTEN REMOVE THE PROTECTIVE PAD, AND WILL REMOVE THE MISSILE CAP PRIOR TO USE.

MAXIMUM SPEED FOR TARGETS ENGAGED VARIES FROM 320 M/S REAR ASPECT, RECEDING TARGETS, TO 360-400 M/S HEAD-ON, APPROACHING TARGETS.

THE GUNNER MAY HAVE AN OPTIONAL PORTABLE ELECTRONIC PLOTTING BOARD, WHICH WARNS OF LOCATION AND DIRECTION OF APPROACHING TARGET(S) WITH A DISPLAY RANGE OF UP TO 12.5 KM. FOR TIER 1 AND TIER 2 OPFOR SIMULATIONS AND UNITS OPERATING FROM VEHICLES, THIS SYSTEM AND PELENGATOR ARE LIKELY.

MISSILE SEEKER FEATURES A TWO-COLOR SEEKER WITH IMPROVED PROPORTIONAL CONVERGENCE LOGIC, AND AN IGLA (NEEDLE) DEVICE ON THE SEEKER, WITH MIRROR AND TRIPOD TO COOL THE SEEKER AND FACILITATE MORE RIGOROUS G-LOAD TURNS WITH REDUCED SEEKER WARMING. WITH THESE FEATURES, THE SA-16 OFFERS SUPERIOR MANEUVER AND COUNTERMEASURE RESISTANCE OVER THE PREVIOUS MANPADS, AND A BASE LEVEL OF PRECISION AGAINST MANEUVERING AIRCRAFT THAT IS SIMILAR TO THE SA-18. NEVERTHELESS, THIS MISSILE IS MORE VULNERABLE TO EO/IR DECOY COUNTERMEASURES THAN THE LATER SA-18.

RUSSIAN MAN-PORTABLE SAM SYSTEM SA-18/GROUSE, AND SA-24/IGLA-SUPER





SYSTEM	SPECIFICATIONS	FIRE CONTROL	SPECIFICATIONS
Alternative Designation	9K38 Igla	Sights with Magnification	
Date of Introduction	1983	Gunner Day sight Acquisition Range (m):	6,000+
Proliferation	At least 6 countries At least 4 countries for SA-24	Gunner Night Sight Mowgli-2 2 gen II Acquisition Range (m)	4,500
Target	FW, heli, CM, UAV	Other Acquisition Aids	
Description		Pelengator RF Direction Finding (DF) system	See Notes
Crew	Crew: 1, Normally 2 with a loader	IFF	Yes

ARMAMENT	SPECIFICATIONS	VARIANTS
Launcher	The launcher can launch either SA-18 or SA-16 missiles.	IGLA-D: LAUNCHER USED IN AIRBORNE FORCES. IT CAN BE SEPARATED IN TWO PARTS FOR EASIER PORTABILITY, BUT THIS ADDS 60 SECONDS TO THE REACTION TIME. IGLA-N: INCREASED LETHALITY DUE PRIMARILY TO THE WARHEAD MASS INCREASED TO 3.5 KG, AND CAN BE SEPARATED IN TWO PARTS. IGLA-V: AIR-TO-AIR VERSION IGLA-1 (SA-16): ECONOMICAL VARIANT OF THE IGLA MANPADS ESPECIALLY SUITED FOR OUT-MANEUVERING HELICOPTERS. STRELA-2M2: UPGRADE VERSION SA-7/STRELA-2 MISSILE WITH IMPROVED LOMO SEEKER GIVES IT NEAR SA-18 CAPABILITY. SA-24/IGLA-SUPER (IGLA-S): IMPROVED MISSILE WITH LASER PROXIMITY/PD FUZE, A HEAVIER EXPLOSIVE CHARGE AND SEGMENTING ROD (2.5 KG) WARHEAD WITH INCREASED FRAGMENTATION EFFECTS. PROPORTIONAL NAVIGATION FURTHER RESISTS FLARES AND OTHER IRCM. THUS, THE MISSILE GREATLY INCREASES P-HIT AND P-KILL EVEN AT LOW ALTITUDES AND AGAINST CM. LAUNCHER NOSE IS MODIFIED TO FIT. IT HAS BEEN EXPORTED TO SEVERAL COUNTRIES. THE SAM FITS A SA-16/18 GRIPSTOCK WITH TRIGGER CHANGE. GROM-1: POLISH COPY OF SA-18 DJIGIT: RUSSIAN TWIN LAUNCHER PEDESTAL MOUNTED ON A RAIL FRAME WITH OPERATOR'S SEAT AND TRIPOD.
Name	9P39	
Length (m)	1.708	
Diameter	INA	
Weight (kg)	1.63	
Reaction Time (sec)	6-7	
Time Between Launches	16	
Reload Time (sec)	10	
Fire on the Move	Yes, in short halt	
Missile		
Name	9M39	
Range (m)	500-6,000+	
Max Altitude (m)	3,500	
Min Altitude (m)	10; 0 with degraded Ph	
Length (mm)	1,708	
Diameter (mm)	70	
Weight (kg)	10.6	
Missile Speed (m/s)	Mach 2 (570 m/s) mean velocity	
Propulsion	Solid fuel booster and dual-thrust solid fuel sustainer rocket motor.	
Guidance	2-color IR/UV homing	

Seeker Field of View	INA	STRELETS IS A TWIN MISSILE LAUNCH MODULE AND COOLANT UNIT, WITH TWO LAUNCHERS MOUNTED AND REMOTELY LINKED TO A SIGHTING AND LAUNCH CONTROL SYSTEM. THE STRELETS MOUNTS DUAL SA-16/SA-18/SA-24 SAMS ON GUNS, PLATFORMS AND VEHICLES, AND INTEGRATE THEM INTO ROBUST FCS AND COMPLEXES. IT CAN LAUNCH TWO MISSILES SIMULTANEOUSLY AT A SINGLE TARGET. STRELETS IS USED AS A PAIR, OR CAN BE LINKED FOR 4-LAUNCHER, 8-LAUNCHER OR OTHER ARRANGEMENTS. AN EARLY APPLICATION IS THE ZU-23M1 AIR DEFENSE GUN/MISSILE SYSTEM WITH A LAUNCH MODULE MOUNTED ON THE TOWED GUN CHASSIS AND LINKED TO A GUN-MOUNT FCS ON A NOTEBOOK COMPUTER WITH FLIR NIGHT SIGHT. SA-18 LAUNCHER VEHICLES: RUSSIA, FOLLOWING A TREND IN AD SYSTEMS, DEVELOPED A VARIETY OF MOUNTS FOR LAUNCHERS ON AD GUNS AND VEHICLES. THE DJIGIT TWIN-LAUNCHER CAN BE MOUNTED ON A TUV TO FORM A LOW-COST AD LAUNCHER VEHICLE WITH REMOTE SIGHTING AND DUAL MISSILE LAUNCH CAPABILITY. THE FENIX AIR DEFENSE SYSTEM CONSISTS OF THE VODNIK TUV WITH AN IR AUTO-TRACKER PASSIVE FCS AND FOUR STRELETS LAUNCHER MODULES (8 MISSILES). IGLA SAM SYSTEM TURRET FOR MOUNT ON APC, IFV, OR OTHER CHASSIS FEATURES AN SA-13 TYPE 1-MAN TURRET WITH EO FCS AND 4 STRELETS (8 LAUNCHERS). THE TURRET HAS BEEN DISPLAYED ON MT-LB AND BRDM-2. LUAZ/IGLA FEATURES STRELETS LAUNCHERS ON THE AMPHIBIOUS TUV, AS AN ALL-TERRAIN AD VEHICLE. A MODERNIZED ZSU-23-4 SP GUN IS NOW A GUN/MISSILE VEHICLE WITH 2 LAUNCH MODULES (4 MISSILES) LINKED TO A COMPUTER-BASED FCS WITH LLLTV SIGHT.
Tracking Rate	INA	
Warhead Type	Frag HE	
Warhead Weight (kg)	1.27	
Fuze Type	Impact and Proximity	
Probability of Hit (Ph%)	70 FW, 80 heli	
Self-Destruct (sec)	15	
Countermeasure Resistance	Seeker resists and degrades all pyrotechnic and electronically operated IR CM	

NOTES

IN TIER 1 AND 2 UNITS, PELENGATOR RF HELMET-MOUNT DIRECTION-FINDER SYSTEM PERMITS THE MISSILE OPERATOR TO SLEW TO TARGET, AND RANGES 20+ KM.

AVAILABLE NIGHT SIGHTS INCLUDE 1-3 GEN II AND THERMAL SIGHTS. BRITISH RING SIGHTS PERMIT AN II NIGHT SIGHT TO BE MOUNTED TO ANY MANPADS.

BRITISH AIR DEFENSE/ANTI-ARMOR (HIGH VELOCITY) MISSILE SYSTEM STARSTREAK



SYSTEM	SPECIFICATIONS	MISSILE	SPECIFICATIONS
Alternative Designation	Man-portable is Shoulder-Launched (SL) Starstreak	Range (m)	300-7,000 max (guided)
Date of Introduction	1997 vehicle (SP HVM), 2000 man-portable (-SL)	Altitude (m)	0-5,000
Proliferation	2-6 Countries	Length (mm)	1,400
Target	FW, heli, ground vehicles	Diameter (mm)	127
Description	(SL configuration)	Weight (kg)	14.0
Crew	2 with a loader (one possible)	Max Missile Speed (m/s)	1,364 m/s, Mach 4
ARMAMENT	SPECIFICATIONS	Propulsion	Canister launch booster, bus missile, and 3 darts (sub-missiles)
Name	Aiming Unit	Flight Time to Max Range (sec)	5-7
Dimensions (m)	See Missile	Guidance	Laser beam rider SACLOS
System Weight (kg)	24.3 with missile	Warhead Type	Three 25-mm darts-tungsten KE tip and case & HE fill
Reaction Time (sec)	<6	Penetration (mm KE)	120+ all LAVs (Equal to 3 x 40-mm APFSDS-T rds) HE detonates after for frangible effects
Time Between Launches	<30 sec	Fuze Type	Contact with time delay
Reload Time (sec)	<25 sec est.	Probability of Hit (%)	60 FW, >95 heli (each dart 67 vs heli)
Fire on the Move	Yes, in short halt	Self-Destruct (sec)	Yes, INA
		FIRE CONTROL	SPECIFICATIONS
		Day sight	Avimo stabilized optical sight with lead bias system
		Field of View (o)	INA
		Acquisition Range (m)	7000+
		Night sight Thales clip-on thermal sight Acquisition Range (km)	4-5 est.

NOTES

GROUND-BASED AD SYSTEM OPTIMIZED FOR USE AGAINST ARMORED HELICOPTERS AND LOW FLYING FIXED-WING AIRCRAFT. MISSILE EMPLOYS SMOKELESS PROPELLANT FOR MINIMAL SIGNATURE. FLIGHT TIME (5-8 SEC) AND LBR GUIDANCE MAKE IT ESSENTIALLY IMMUNE TO COUNTERMEASURES. BECAUSE OF THE HIGH VELOCITY, THE SYSTEM EXCEEDS THE HIT PROBABILITY OF COMPETING SYSTEMS AGAINST HIGH -SPEED AIRCRAFT ON RECEDING FLIGHT PATHS.

THE STARSTREAK'S LOWER COST AND CAPABILITIES AS A MULTI-ROLE MISSILE SYSTEM OFFERS VARIED USES. TWO CONSIDERATIONS ARE THE SEMI-AUTOMATIC COMMAND LINE-OF-SIGHT (SACLOS) GUIDANCE AND CONTACT FUZES WHICH MAKE IT LESS EFFECTIVE AGAINST AGILE FIXED-WING AIRCRAFT FROM SOME ASPECTS. THUS A MORE PRACTICAL COURSE WOULD BE TO REPLACE 33-50% OF THE MANPADS. WITH THE LOWER COST OF STARSTREAK AND ITS MULTI-ROLE CAPABILITY, IT COULD REPLACE A PORTION OF THE EXPENSIVE SINGLE-ROLE MANPADS WITH STARSTREAKS. FOR INSTANCE, AN 18-MANPADS BATTERY COULD BE REDUCED 33% TO 12 MANPADS WHILE ADDING 12 STARSTREAKS, WITH THE LATTER USED AS A MULTI-ROLE SYSTEM. WITH 50% OF THE MANPADS REPLACED, THE MIX WOULD BE 9 MANPADS AND 18 STARSTREAKS. ADDED ANTI-ARMOR CAPABILITY IS A BONUS. SUBSTITUTION COULD VARY WITH THE EXPECTED ADVERSARY TARGET MIX.

OTHER MISSILES

STARSTREAK II: IMPROVED MISSILE HAS 8-KM RANGE AND BETTER PRECISION. FIELDED 2010.

LIGHTWEIGHT MULTI-ROLE MISSILE/LMM: A MULTI-ROLE MISSILE OPTION WITH A SINGLE 3-KG TANDEM (HEAT/HE) WARHEAD AND PROXIMITY FUZE. AT 13 KG, THE LOWER-COST MISSILE FLIES 8-KM AT 1.5 MACH. IT IS DUE IN 2013, AND WAS SUCCESSFULLY LAUNCHED BY A CAMCOPTER S-100 UCAV VARIANT. OTHER PROJECTED UPGRADES ARE SEMI-ACTIVE LASER-HOMING AND/OR DUAL-MODE (LBR/SAL-H).

OTHER ACQUISITION AIDS

ADAD: BRITISH PASSIVE THERMAL IR SCANNERS ON REMOTE TRIPOD OR VEHICLE MOUNT WITH 240 O FOV AUTOMATIC CUEING. MISSILE TEAM EMPLOYS AN AZIMUTH PLOTTING BOARD (E.G., RUSSIAN 1L15-1), FOR DIRECTION OF APPROACH ON AERIAL TARGETS.

VARIANTS

STARBURST: JAVELIN SAM LAUNCHER ADAPTED FOR STARSTREAK LBR GUIDANCE- IN PRODUCTION

LIGHTWEIGHT MULTIPLE LAUNCHER (LML): PEDESTAL LAUNCHER FOR THREE MISSILES (ABOVE). THE LAUNCHER CAN ALSO MOUNT ON A LIGHT VEHICLE, E.G., TUV. A DEMONSTRATOR IS LML ON A PANHARD TACTICAL TRUCK.

STARSTREAK II: IMPROVED LAUNCHER USES STARSTREAK OR STARSTREAK II MISSILE. IT HAS AN AUTO-TRACKER FOR HANDS-FREE GUIDANCE. IT WAS FIELDED IN 2010.

STARSTREAK LIGHTWEIGHT VEHICLE (LWV): LAND ROVER TRUCK CONVERTED INTO AN SP SAM SYSTEM WITH A 6-CANISTER LAUNCHER, ADAD AUTO-TRACKER, AND TV/ THERMAL FCS. THIS LAUNCHER CAN BE MOUNTED ON OTHER VEHICLES.

ARMORED STARSTREAK OR (SP HVM): VEHICLE IS A STORMER TRACKED APC CHASSIS, WITH AN 8-MISSILE LAUNCHER. THE PASSIVE IR FIRE CONTROL SYSTEM USES ADAD, AN AUTO-TRACKER AND THERMAL SIGHT. THE LAUNCHER CAN BE MOUNTED ON OTHER VEHICLES.

SEASTREAK: SINGLE-STAGE MISSILE NAVAL VARIANT IN A 12-MISSILE LAUNCHER, WITH MM-WAVE RADAR FCS.

OPTIONAL USE: AS A LOW-COST AIR DEFENSE/ANTI-ARMOR (MULTI-ROLE) SYSTEM, STARSTREAK CAN BE EMPLOYED AGAINST GROUND TARGETS, SUCH AS LIGHT ARMORED VEHICLES, AND SNIPERS IN BUNKERS OR BUILDINGS. THE MISSILE AND ITS DARTS, WITH A UNIQUE COMBINATION OF PENETRATOR AND FOLLOWING FRAG-HE, HAVE BEEN SUCCESSFULLY TESTED AGAINST VEHICLE TARGETS. WITH A MISSILE COST OF 1/2 TO 1/3 OF COMPETING MANPADS, THE SYSTEM COULD BE USED AS A FIRE SUPPORT ASSET TO COMPLEMENT ATGM LAUNCHERS AND VEHICLE WEAPONS.

THOR: BRITISH MULTI-MISSION AIR DEFENSE SYSTEM IS A RWS, WITH 4 MISSILE LAUNCHERS, TV, FLIR, AND AN AUTO-TRACKER. WEIGHING .5 MT, IT MOUNTS ON TRUCKS, VANS, TUVS, APCS, ETC., WITH A REMOTE OPERATOR. DESIGNED FOR STARSTREAK, LAUNCHERS, IT CAN ALSO MOUNT OTHER MANPADS, AND ATGMS, SUCH AS INGWE, TOW, HELLFIRE, MOKOPA, SPIKE, ETC.

U.S. MAN-PORTABLE SAM SYSTEM STINGER



SYSTEM	SPECIFICATIONS	FIRE CONTROL	SPECIFICATIONS
Alternative Designation	FIM-92A Basic Stinger	Sights with Magnification	
Date of Introduction	1981	Day Sight	Ring and bead, most launchers Optical sight with lead bias available.
Proliferation	At least 22 countries, base and all variants	Day Sight Field of View (o)	INA
Crew	1, Normally 2 with a loader	Day Sight Field of View (o)	INA
System	Grip-stock (with battery coolant unit, IFF, impulse generator, and seeker redesign), missile, night sight, radio and other acquisition aides	Day Sight Acquisition (m)	4000+
ARMAMENT	SPECIFICATIONS	Night Sight	Optional AN/PAS-18, Wide-Angle Stinger Pointer System (WASP) thermal sight.
Launcher		Night Sight Field of View (o)	20o x 12 o
Name	Stinger grip-stock	Night Sight Acquisition Range (km)	20-30 side or tail aspect, 10 head-on aspect
Length	1.52+ launch tube	IFF	AN/PPX-1 trigger-activated on grip-stock, with battery belt-pack
Diameter	INA	Target Alert Display Set (TADDS)	US portable graphic display set w/audio alert, VHF radio, and IFF.
System Weight	15.2 launch-ready 2.6 belt-pack IFF	ADAD	British passive thermal IR scanners on remote tripod or vehicle mount with 240 o FOV automatic cueing system.
Reaction Time (sec)	6 tracking and missile activation (3-5 cooling)	Radar Equipment Providing Omni-directional Reporting of Targets at Extended Ranges (REPORTER)	German/Dutch EW system with I/J band radar and IFF. Range: 40 km. Altitude: 15-4000 m.
Time Between Launches (sec)	INA	Several U.S. and foreign radars are available for use with Stinger.	
Reload Time (sec)	<10	VARIANTS	

Fire on the Move	Yes, in short halt	STINGER-PASSIVE OPTICAL SEEKER TECHNIQUE (POST) / FIM-92B: LIMITED PRODUCTION UPGRADE IN 1983 ADDED AN IR/UV SEEKER WITH IMPROVED SCAN TECHNIQUE IMPROVED FLARE CM RESISTANCE. SEEKER ADDS TARGET ADAPTIVE GUIDANCE (TAG), WHICH SHIFTS IMPACT POINT FROM THE EXHAUST PLUME TO A MORE CRITICAL AREA OF THE TARGET. MAX RANGE INCREASES TO 4,800 M, AND MAX ALTITUDE INCREASES TO 3,800 M. STINGER-REPROGRAMMABLE MICRO-PROCESSOR: (RMP) / FIM-92C: PRODUCTION BEGAN IN 1989. THE UPGRADE PERMITS UPLOADING NEW CCM SOFTWARE. EXPORT VERSION LACKS REPROGRAM CAPABILITY BUT USES AN EMBEDDED IRCM PROGRAM. THE MANPADS HAS BEEN ADAPTED FOR LAUNCH FROM APC OR IFV CHASSIS. IT HAS ALSO BEEN ADAPTED FOR LIGHT UTILITY VEHICLES AND COMBAT SUPPORT VEHICLES, SUCH AS THE GERMAN WIESEL-BASED FLIEGERFAUST-2 (FLF-2). A VARIETY OF AIR DEFENSE LAUNCHER SYSTEMS CAN USE STINGER, MISTRAL, OR OTHER MANPADS. PEDESTAL MOUNTED STINGER (MULTIPLE LAUNCHER WITH STINGER MANPADS AND INTEGRATED FCS). DUEL MOUNTED STINGER IS A DANISH EASILY MOUNTED TRIPOD LAUNCHER WITH OPERATOR SEAT AND CONSOLE, WHICH CAN BE MOUNTED ON BOAT OR TRUCK BED. AN AIRCRAFT MOUNT IS AIR-TO-AIR STINGER - ATAS.
Name	FIM-92A	
Max Range (m)	4,000+	
Min Range (m)	200	
Max Altitude (m)	3,500	
Length (mm)	1.52	
Diameter (mm)	70	
Weight (kg)	10.0	
Target Maneuver Limit	Up to 8 g	
Missile Speed (m/s)	745 m/s, Mach 2.2	
Propulsion	Solid fuel, dual-thrust (ejector motor and sustainer motor)	
Guidance	Cooled 2nd gen passive IR homing (4.1-4.4 μm)	
Seeker Field of View	INA	
Tracking Rate	INA	
Warhead Type	Frag-HE	
Warhead Weight (kg)	1.0	
Fuze Type	Contact with time delay	
Probability of Hit (Ph%)	INA	
Self-Destruct (sec)	20	

NOTES
A NUMBER OF U.S. UPGRADES AND STINGER APPLICATIONS ARE IN DEVELOPMENT.

FRENCH MANPADS LAUNCHER VEHICLE ALBI/MAN-PORTABLE SAM SYSTEM MISTRAL 2





SYSTEM	SPECIFICATIONS	FIRE CONTROL	SPECIFICATIONS
Alternative Designation	VBR Mistral	Sights with Magnification	
Date of Introduction	2000-2001 Albi and Mistral 2, 1988 original Mistral	Day Sight	EO/IR sight: Range (m): 6,000 or more
Proliferation	25+ countries for missile, at least 2 for launcher vehicle	Night Sight	Alis or MATIS thermal sight Range (m): 5,000-6,000
Target	FW, heli, CM, UAV	Other Acquisition Aides	
Description	System includes Mistral Coordination Post and up to 12 fire units	Weapon Terminal links to alert system and provides azimuth of approaching aircraft.	French Army Samantha digital alert system with GPS or export Aida terminal linking to MCP
Description	Tactical utility vehicle with foldable MANPADS launcher turret	IFF	Thompson SB14 on MCP or other
Name	Albi for turret, and vehicle	ASSOCIATED SYSTEMS	SPECIFICATIONS
Crew	2-3; driver, gunner, assistant gunner	Name	Samantha aircraft warning station
Chassis	VBL tactical utility vehicle	Chassis	VBL
Vehicle Description	See VBL	Radar	Griffon TRS 2630
Automotive Performance	See VBL	Function	Target acquisition radar
Radio	INA	Band	S
Protection	See VBL	Range (km)	15-20
ARMAMENT	SPECIFICATIONS	Name	Mistral Coordination Post
Name	Albi twin launcher on turret	Chassis	LAV or other, such as Unimog
Reaction Time (sec)	5 stopped, 3 with warning and azimuth	Radar	SHORAD
Time Between Launches (sec)	<5	Function	Alerting radar, target acquisition
Reload Time (min)	<1.5	Range (km)	25
Fire on the Move	No, stop or short halt	VARIANTS	
Launcher Elevation (°)	0/+80	THE MISTRAL PORTABLE LAUNCHER EMPLOYS TRIPOD, SEAT, AND SINGLE LAUNCHER STAND. ORIGINAL MISTRAL 1 MISSILE WAS MORE VULNERABLE TO IR COUNTERMEASURES. ALAMO: CYPRIOT MOUNT OF SINGLE MISTRAL LAUNCHER ON 4X4 TUV. ALBI CAN BE MOUNTED ON A VARIETY OF VEHICLES. ASPIC: 4-MISSILE LAUNCHER FOR VEHICLE MOUNT ATLAS: A TWIN LAUNCHER ON A PORTABLE STAND. HUNGARY PURCHASED UNIMOG 4X4 LIGHT TRUCKS WITH ATLAS PLATFORM-MOUNTED LAUNCHERS. THE LAUNCHERS CAN BE QUICKLY REMOVED FROM A VEHICLE AND GROUND MOUNTED.	
Emplace/Displace Time (min)	0.08		
Missile			
Name	Mistral 2		
Max Range (m)	6,000		
Min Range (m)	600		
Max Altitude (m)	3,000		
Min Altitude (m)	5, 0 with degraded Ph		
Length (mm)	1.86		
Diameter (mm)	90		
Weight (kg)	18.7		
Missile Speed (m/s)	870 (Mach 2.7)		

Maximum Target Speed (m/s)	INA	ONE BLAZER AD VEHICLE VARIANT USES MISTRAL AND 25-MM AUTO-CANNON. GUARDIAN IS HMMWV W/MISTRAL LAUNCHERS. SANTAL: TURRET 6-MISSILE LAUNCHER, FOR USE ON ARMORED VEHICLES. AIR-TO-AIR MISTRAL (ATAM): TWIN MISSILE POD FOR USE ON HELICOPTERS. THE FRENCH NAVY USES A VARIETY OF LAUNCHER CONFIGURATIONS, E.G., SADRAL, SIMBAD, SIGMA, TETRAL, AND LAMA. FN-6: RECENT CHINESE MANPADS-A LIKELY COPY OR VARIANT OF MISTRAL ON A LIGHTWEIGHT MAN-PORTABLE LAUNCHER. IT WILL BE EXPORTED TO MALAYSIA AND OTHER COUNTRIES. YTIAN/TY-90 IS AAM/VEHICLE LAUNCH VERSION OF MISTRAL WITH 8- LAUNCHER TURRET, 3-D RADAR, AND EO. TURRET FITS ON LAV, TUV, OR TOW CARRIAGE. THE MISTRAL HAS BEEN EVALUATED AND TESTED AS AN UPGRADE MANPADS OPTION FOR A VARIETY OF LAUNCHERS ON VERY SHORT RANGE AIR DEFENSE (VSHORAD) VEHICLES, AND AS AN AIR-TO-AIR MISSILE FOR USE ON HELICOPTERS.
Propulsion	Solid motor plus booster motor	
Guidance	Passive IR/UV homing with digital multi-cell pyramidal seeker	
Warhead Type	HE with Tungsten Balls	
Warhead Weight (kg)	3	
Fuze Type	Laser proximity/contact	
Probability of Hit (Ph%)	70 FW, 80 heli	
Self-Destruct (sec)	INA	
Countermeasure resistance	Mistral 2 resists nearly all IR countermeasures.	
Auxiliary Weapon		
Caliber, Type, Name	7.62-mm MG, AAT 52	
Cyclic Rate of Fire (rd/min)	900 cyclic, in bursts	
Practical Rate of Fire (rd/min)	250 (est)	
Loader Type	200-rd Magazine	
Ready/Stowed Rounds	200/1,000	
Fire on the Move	Yes	

NOTES

THIS SYSTEM IS AN IDEAL VSHORAD VEHICLE TO PROVIDE MOBILE AND RESPONSIVE AD FOR AIRBORNE, AMPHIBIOUS, MOTORIZED, AND RAPID RESPONSE FORCES. VEHICLES ARE FAIRLY VULNERABLE NEAR FRONT LINES, BUT OFFER FLEXIBLE PROTECTION FOR DEEPER BRIGADE HIGH-VALUE ASSETS. THEY OFFER A LOWER-COST BUT LESS EFFECTIVE SUBSTITUTE FOR SYSTEMS SUCH AS 2S6M. AN ALBI COULD REPLACE A MANPADS SQUAD (APC/IFV, TUV, ETC, AND TWO MANPADS LAUNCHERS).

ALBI RESPONSE TIME MOVING IS 15 SEC AFTER STOP. HOWEVER, MOST OF THE TIME, THE VEHICLE IS STOPPED AND CONDUCTING OVERWATCH RATHER THAN MOVING. ALSO, THANKS TO THE MISSILE WARNING SYSTEM, THE VEHICLE HAS AMPLE TIME TO BE STOPPED AND READY TO LAUNCH PRIOR TO AIRCRAFT APPROACH. WITH A TWO-MAN CREW, THE MISSILE RELOAD CAPACITY IN THE REAR CAN BE INCREASED TO 10 OR MORE. A 3-MAN CREW WITH 8 MISSILES IS A RATIONAL COMPROMISE, PERMITTING THE THIRD CREWMAN TO MONITOR THE WEAPON TERMINAL TO RAPIDLY RESPOND TO ALERTS, AND TO ASSIST IN RELOADING THE LAUNCHERS.

RUSSIAN 30-MM SP AA GUN/MISSILE SYSTEM 2S6M1



SYSTEM	SPECIFICATIONS	FIRE CONTROL	SPECIFICATIONS
Alternative Designation	2K22M, Tunguska-M, Tunguska-M1	Sights with Magnification	
Date of Introduction	1990	Gunner Sights - Day	Stabilized EO 1A29M Magnification: 8x Field of View (°): 80
Proliferation	At Least 2 Countries	Gunner Sights - Night	1TPP1 thermal Range: 18 km, 6 ground targets
Target	FW, heli, cruise missile, UAV, ground targets	Commander's Day/Night Sight	IR
Crew	4 (cdr, radar op, gunner, driver)	IFF	Yes
Combat Weight (mt)	34	Radars	HOT SHOT
Chassis	GM-352M tracked vehicle	Name	1RL144 (TAR)
Chassis Length Overall (m)	7.93	Function	Target Acquisition
Height (m)	TAR up: 4.02 TAR down: 3.36	Detection Range (km)	18-20
Width Overall (m)	3.24	Tracking Range (km)	INA
Engine Type	V-12 turbo diesel	Frequency	2-3 GHz (E Band)
Cruising Range (km)	500	Name	1RL144M (TTR)
Speed (km/h)	Max. Road: 65 Max. Swim: INA	Function	Fire Control
Fording Depths (m)	INA	Detection Range (km)	16
Radio	R-173	Tracking Range (km)	INA
Protection NBC Protection System	Yes	Frequency	10-20 GHz (J band)
Altitude	Max. Altitude: 6000 for S6M1 Min. Altitude: 0 for 2S6M1 0 w/ degraded Ph 2S6M	Armored Command Vehicle	
Dimensions	Length (m): 2.83	Name	Sborka AD ACV
Weight (kg)	57 (in container)	Chassis	MTLB-U
Missile Speed (m/s)	600-900	Radar	DOG EAR (use in OPFOR units)
Guidance	Radar SACLOS	Function	Target Acquisition (EW to 80 km)
Seeker Field of View (°)	INA	Frequency	F/G band
Tracking Rate	INA	Range (km)	80 detection, 35 tracking

			ACV also links to tactical nets.
Warhead Type	Frag-HE	AMMUNITION	SPECIFICATIONS
Warhead Weight (kg)	9	Types	Frangible APDS-T is the preferred round. Other Rounds: AP-T, APDS, Frag-T, HE-I, API
Fuze Type:	Proximity, 5 m radius	Type	Frangible APDS-T
Probability of Hit (Ph%)	65 FW, 80 heli	Range (m)	Max: 4,000 Min: 0
Simultaneous Missiles per target	2	Altitude (m)	Max: 3,000 Min: 0
Self-Destruct (sec)	INA	Penetration (mm KE)	25 at 60° 1,500 m, APDS
System Reaction Time (sec)	6-12	VARIANTS	
Fire on Move	Yes, short halt or slow move	2S6: PRE-PRODUCTION DESIGN MOUNTING 4 MISSILES 2S6M: FIELDED SYSTEM BEFORE UPGRADES. 2S6M1: UPGRADE VERSION WITH IMPROVED FCS AND DIGITAL C2 INTEGRATION, 9M11-1M MISSILE, IMPROVED ECM RESISTANCE, AND 0 M MIN ALTITUDE. UPGRADE 9M311-1M MISSILE HAS A PULSE CODED XENON BEACON FOR RESISTANCE TO IRCM, A NEW RF PROXIMITY FUZE, IMPROVED KINETICS FOR A 10 KM RANGE TO ALL TARGETS, AND OPERATING ALTITUDES OF 0 - 6000 M WITH HIGH PRECISION AND HIGH PH. THE MISSILE MAY BE SUITABLE AS AN UPGRADE ON EXISTING 2S6M LAUNCHERS.	

NOTES

MAIN OPERATING MODE IS RADAR MODE, WITH DAY/NIGHT CAPABILITY. OTHER MODES OFFER REDUCED RADAR SIGNATURE. THERMAL SIGHT LISTED IS OPTIONAL, REPRESENTING A RATIONAL UPGRADE TO EXISTING 2S6M AND IS STANDARD ON 2S6M1SYSTEM.

OTHER RADARS: LINKS TO INTEGRATED AIR DEFENSE SYSTEM (IADS) FOR EARLY WARNING AND TARGET ACQUISITION DATA FROM RADARS: GIRAFFE AMB AT SEPARATE BRIGADE AND DIVISION, LONG TRACK OR SIMILAR EW/TA RADAR ECHELONS ABOVE DIVISION, AND RADARS IN SAM UNITS, E.G., SA-10.

RUSSIAN GUN/MISSILE SYSTEM PANTSIR-S1 AND PANTSIR-S1-0



Pantsir-S1-0 System with Unified Turret on BMP-3 Chassis

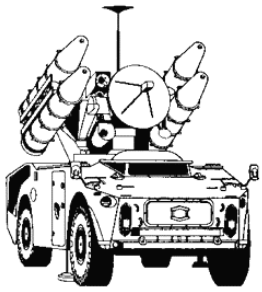
SYSTEM	SPECIFICATIONS	FIRE CONTROL	SPECIFICATIONS
Alternative Designation	SA-22E. Pantsyr, Pantzyr, Pantzir.	Sights with Magnification	
Date of Introduction	By 2004	Gunner	1TPP1 stabilized day/night, dual channel thermal sight
Proliferation	At least 3 countries, with tracked version under export contract	Field of View (°)	1.8 x 2.6
Target	FW, heli, CM, ASM, UAV, guided bomb	Acq Range (km)	18 air targets, 4-6 grd IR Auto-tracker: Dual Infrared/video tracker
Primary Components	System (battery) has a command post, up to 6 combat vehicles (gun/missile launch vehicles), and 73V6-E transloaders (1 per 2 CVs).	Commander's position IR day/night sight Auto-tracker	Dual Infrared/video tracker
Combat Vehicle Description		IFF	Yes
Crew	3 (cdr, gunner, driver)	Countermeasure Resistance	Passive acquisition modes. Resists IR and most RF SAM CM and suppression systems.
Combat Weight (mt)	20 est	Radars	
Chassis	BMP-3 (and see VARIANTS)	Name	INA, 3D Phased Array
Chassis Length Overall (m)	6.73	Function	Target Acquisition
Height (m)	INA	Detection Range (km)	36-38
Width Overall (m)	3.15	Frequency Band	INA
Automotive Performance	Performance data based on BMP-3	Simultaneous Target Detection	20 Targets
Engine Type	500-hp diesel	Name	1RS2-1E for export version
Cruising Range (km)	600	Function	Fire control and guidance
Speed (km/h)	Max. Road: 65-70 est Max. Swim: 10 est	Tracking Range (km)	24-30
Fording Depths (m)	Amphibious	Scan Sector	90° x 90°
Radio	R-173, R-173P	Frequency Band	Ku and Ka
Protection		Signal Processing	Digital
NBC Protection System	Yes	Guidance Channels	Two simultaneous
ARMAMENT	SPECIFICATIONS	C3 Modes	Netted, battery, autonomous
Caliber, Type, Name	30-mm, 30x165 2A38M auto-cannon	Target Handling Rate	Up to 2 targets/min Up to 12/min btry
Rate of Fire (rd/min)	4,800 (2 twin guns)	Name	Ranzhir ACV or Sborka ACV
Reload Time (min)	15-16 min, gun ammunition and missiles	Chassis	MTLB-U

Elevation (°)	-5 to + 87	ACV also links to supported tactical unit nets.	
Fire on Move	Yes	AMMUNITION	SPECIFICATIONS
Missile		Optimized mix uses 2 rounds, with each having similar ballistics. The below rounds offer flat trajectory, long range, armor penetration, high P-hit, and frangible round (KE/'CE) effects.	
Name	57E6-E/9M335/SA-22E	Type	Frangible
Range (m)	Max. Range: 12,000 below 1,500 m 18,000 above 1,500m Min. Range: 1,500	Range (m)	200-4,000
Altitude (m)	Max. Altitude: 10,000 Min. Altitude: 5, 0 with degraded Ph	Altitude (m)	0-3,000
Dimensions	Length (m): 3.2 in canister Diameter (mm): 170/90 second stage	Type	APFSDS-T, M929
Weight (kg)	65, 85 in container	Range (m)	200-2,500+
Missile Speed (m/s)	1,300	Altitude (m)	0-3,000
Guidance	Radar SACLOS, ACLOS, Home-on-Jam	Penetration (mm CE)	45 (RHA) 2,000 m
Seeker Field of View (°)	INA	Other Ammunition Types	Earlier 30 x 165 rounds: Frag-HE and HEI-T, API, API-T, APDS
Warhead Type	Fragmenting rod and HE	VARIANTS	
Warhead Weight	16	PANTSYR-S1: THE GUN/MISSILE SYSTEM MODULE CAN BE MOUNTED ON VARIOUS CHASSIS. THE EARLY VERSION IS MOUNTED ON A URAL-5323 TRUCK, USED FOR SITE DEFENSE OF STATIONARY TARGETS. IT HAD THREE RADARS AND 2A72 GUN. A PRODUCTION VERSION HAS NEWER RADARS, GUNS, AND 12 MISSILE LAUNCHERS. PANTSIR-S1-0: "UNIFIED ARMAMENT TURRET" WITH 8 LAUNCHERS (12 SAMS) AND 2 GUNS MOUNTS ON VARIOUS CHASSIS (E.G., TRUCKS, BTR-80, BMP-3, BMD-3, TRAILERS, AND STANDS). RUSSIANS NOW OFFER THIS VARIANT ON THE 2S6 CHASSIS. A LOW COST VERSION HAS MISSILES AND ONLY EO GUIDANCE	
Fuze Type	Proximity, PD, and KE impact		
Probability of Hit (Ph) %	80 un-degraded		
Simultaneous Missiles	3 (1-3 per target)		
Self-Destruct (sec)	INA		
System Reaction time (sec)	5-6		
Fire on Move	Yes, short halt or slow move		
Simultaneous Targets	2 per vehicle		

NOTES

THE GUNS CAN BE USED TO ENGAGE GROUND TARGETS, PRIMARILY FOR SELF-DEFENSE.
LINKS TO INTEGRATED AIR DEFENSE SYSTEM (IADS) FOR EARLY WARNING, AND DATA FROM TARGET ACQUISITION RADARS, ESP. GIRAFFE AMB OR LONG TRACK AT SEPARATE BRIGADE AND DIVISION, EW/TA RADAR ECHELONS ABOVE DIVISION, AND RADARS IN SAM UNITS, E.G., SA-10.

FRENCH SAM SYSTEM CROTALE 5000 AND CHINESE FM-90



SYSTEM	SPECIFICATIONS	FIRE CONTROL	SPECIFICATIONS
Alternative Designation	TSE 5000	Sights with Magnification	
Date of Introduction	4000 in 1988	Day Camera	TV tracker, low elevation Range (km): 14.0
Proliferation	At least 9 countries	Optical Sight	back-up binocular tracker
Target	FW, heli, CM, ASM also ARM for FM-90	Day/Night Camera	Thermal sight is on most Crotale 4000, all HQ-7 FM-90 Field of view (°): 8.1/2.7 Elevation (°): 5.4/1.8 Range (km): 19.0
Description	Battery has 2 platoons (4 TELARs), tech, and resupply vehicles	Missile Tracker	IR, for remote control
TELAR	P4R 4x4	Countermeasures	Digital C2 and ECM
Crew	3 launcher vehicle	IFF	Yes, dipole on ACU (See Notes)
Combat Weight (mt)	15.0	Radar	
Length (m)	6.22	Name	Mirador IV pulse doppler
Height (m)	3.41	Function	Target acquisition, surveillance
Width (m)	2.72	Antenna Rotation Rate (rpm)	60
Engine Type	INA	Detection Range (km)	18.5
Cruising Range (km)	600	Altitude Coverage (m)	0 - 4,500
Max Road Speed (km/h)	70	Target Detection	30 targets per rotation
Fording Depths (m)	0.68	Multiple Target Tracking	12 targets
Radio	INA	Frequency Band	E
Protection		Radar	
Armor Protection (mm)	3-5	Name	INA, on launcher vehicle
NBC Protection System	No	Function	Fire Control
ARMAMENT	SPECIFICATIONS	Targets Tracked	1
Name	Crotale	Missile Guidance, Simultaneous	2
Weight (mt)	INA	Detection Range (km)	17
Set-up Time (min)	5	Altitude Coverage (m)	0 – 5,000
Reaction Time (sec)	6.5	Frequency (GHz)	12-18
Time Between Launches (sec)	2.5	Frequency Band	J, Monopulse
Reload Time (min)	2	Associated Radar	I-band (8-10 GHz) cmd
Fire on Move	No	VARIANTS	
Name	R440	SYSTEM IS MOUNTED ON VEHICLES, SHELTER, SHIPS CROTALE 1000: INITIAL VERSION 1971 W/CABLE LINK CROTALE 2000: VARIANT WITH TV AND IFF. CROTALE 3000: VARIANT HAS TV AUTO-TRACKER.	
Range (m)	Max: 10,000, 14,600 heli 15,000 FM-90 17,000 ARM FM-90		

	Min. Range: 500	CROTALE 4000: HAS RADIO DATA LINK AND THERMAL CROTALE 5000: ADDS IR AUTO-TRACKER, AND NEW SURVEILLANCE ANTENNA. THE LAUNCHER CAN ADD 2 MISTRAL MISSILES. CROTALE IMPROVED: AN AIR FORCE UPGRADE HAS PLANAR RADAR, IMPROVED ECCM. CROTALE NAVAL: FEATURES A DOPPLER-FUZED R440N MISSILE. CROTALE-S SYSTEM FOR SAUDI ARABIA IS A PASSIVE ALL-WEATHER SYSTEM, WHICH CAN BE FITTED TO PREVIOUS NAVAL SYSTEMS. CACTUS: SAUDI VARIANT FOR SAHV-3 MISSILE. FM-80/HQ-7: CHINESE IMPROVED VERSION WITH E/F-BAND TA RADAR, EO RANGE OF 15 KM, IR LOCALIZER AND HQ-7 MISSILE RANGE OF 12 KM. SHAHAB THAQUEB: IRANIAN FM-80 VARIANT WITH THE 45KM SKYGUARD RADAR (25 TRACKING) /CP UNIT. RANGE IS 12 KM. ECCM DEFEATS ALL CM. FM-90: CHINESE 1998 FIELDED AND EXPORTED UPGRADE WITH: NEW DIGITAL C2, THERMAL SIGHT, DUAL BAND TA TRACKING RADAR (RANGE 25 KM). A NEW FASTER MISSILE HAS A RANGE OF 15 KM IN EO/ RADAR MODES, A NEW FUZE SYSTEM, AND 17 KM RANGE IN ANTI-RADIATION MISSILE MODE. MAX ALTITUDE IS 6 KM. DIGITAL ECCM HAS NEAR JAM-PROOF FCS. LAUNCHER CAN ENGAGE THREE SIMULTANEOUS TARGETS IADS LINK CAN FEED REMOTE FC RADAR GUIDANCE. SHAHINE: UPGRADE HAS R460 15-KM MISSILE ON AMX-30 TANK CHASSIS. SHAHINE 2 FEATURES RADAR RANGE TO 19.5 , M3.5 VELOCITY, AND 5-M MINIMUM ALTITUDE (SLOW MOVERS). THE RADAR CAN RACK 40 TARGETS AND ASSIGN 12 PER BATTERY.
Altitude (m)	Max. Altitude: 5,000 Min. Altitude: 15, 7 w/blast radius	
Dimensions (mm)	Length: 2890 Diameter: 150	
Weight (kg)	84, 100 with canister	
Missile Speed (m/s)	750	
Maneuver Capability (Gs)	27	
Propulsion	Solid propellant motor	
Guidance	RF CLOS	
Warhead Type	Focused frag-HE, 15 kg	
Lethal Radius (m)	8, proximity fuze	
Probability of Hit (Ph%)	80 FW, heli	
Simultaneous Missiles	2 per target	

NOTES

THE ALL-WEATHER SYSTEM IS DEPLOYED IN PLATOONS. A PLATOON INCLUDES AN ACQUISITION AND COORDINATION UNIT (ACU) VEHICLE AND 2-3 "FIRING UNITS" (LAUNCHER VEHICLES). A BATTERY INCLUDES TWO PLATOONS. BATTERY RELOADS ARE DELIVERED ON TRUCKS. AN ACU USES THE SAME P4R CHASSIS AND A SURVEILLANCE RADAR, IFF INTERROGATOR, BATTLE MANAGEMENT COMPUTER, DIGITAL RF DATA LINK, AND VHF RADIOS. WITH RF DATA LINK, INTERVAL CAN BE UP TO 10 KM BETWEEN ACUS, AND UP TO 3 KM BETWEEN ACU AND LAUNCHER VEHICLES. OFF-CHASSIS REMOTE CONTROL SYSTEM CAN BE USED TO GUIDE THE MISSILE.

THE SAM SYSTEM LINKS TO THE IADS TO GET DIGITAL AD DATA AND WARNINGS. ASSOCIATED RADAR FOR EW AND TA DATA IS RADAR AT BRIGADE AND DIVISION TIER 1 AND 2. SYSTEM CAN ALSO PASS DATA TO THE NET.

EUROPEAN SAM SYSTEM CROTALE-NEW GENERATION



XA-181 SAM Launcher Vehicle

SYSTEM	SPECIFICATIONS	FIRE CONTROL	SPECIFICATIONS
Alternative Designations	Crotale-NG, XA-181 (Finnish Launcher vehicle) This is not a modification to Crotale. It is a completely new modular system.	Day Camera	Mascot, CCD TV Field of view (°): 2.4 Elevation (°): 1.8 Range (km): 15
Date of Introduction	1991-1992	Night Camera	Castor, thermal Field of view (°): 8.1/2.7 Elevation (°): 5.4/1.8 Range (km): 19
Proliferation	At least 5 countries, all variants	Missile Tracker	IR missile localizer on CCD camera for passive TV tracking
Target	FW, heli, CM, ASM, UAV	IFF	Yes
Description		Radar	
TELAR	XA-181 is XA-180 (PASI) 6x6 APC with Crotale NG launcher	Name	TRS 2630 Griffon
Crew	4	Function	Target acquisition
Combat Weight (mt)	23.0 launch-ready	Antenna	Planar array Detection Range (km): Aircraft: 20
Length (m)	7.35	Hovering Rotary Wing Aircraft	11
Height (m)	2.3 for vehicle hull +2-3 m	Altitude Coverage (m)	0-5000
Width (m)	2.9	Multiple Target Tracking	Automatic track-while-scan for up to 8 targets.
Automotive Performance		Frequency Band	S
Engine Type	240-hp diesel	ECCM	Low sidelobes, wide-band frequency agility, search on the move capability
Cruising Range (km)	800	Radar	
Max Road Speed (km/h)	80	Name	
Swim Capability	No	Function	Fire Control, tracking
Radio	INA	Detection Range (km)	30
Protection		Frequency (GHz)	35 doppler TWT (travelling wave tube)
Armor Protection (mm)	6-12mm	Frequency Band	Ku
NBC Protection System	No	ECCM	Wideband frequency agile
ARMAMENT	SPECIFICATIONS	VARIANTS	

Launcher	TELAR	SYSTEM IS IN A MODULAR POD, DESIGNED TO FIT ON SHIPS, VEHICLES, AND ON STATIONARY PLATFORMS. THE MODULAR ALL-WEATHER SYSTEM INCLUDES ACQUISITION, TRACKING, LAUNCH, AND SUPPORTING COMPUTER UNITS INTEGRATED ON ONE VEHICLE, FOR MANAGEMENT BY A SINGLE SYSTEM OPERATOR. VEHICLE PLATFORMS INCLUDE APCS, E.G., M113, KOREAN IFV, PIRANHA 10X10, AND THE XA-180 AS NOTED. THE SYSTEM CAN BE RETROFITTED ONTO EXISTING CROTALE LAUNCHER VEHICLES. PEGASUS: SOUTH KOREAN SYSTEM WITH A DIFFERENT MISSILE
Name	VL-VT-1	
Weight (mt)	4.8	
Reaction Time (sec)	<6	
Time Between Launches (sec)	1-2	
Reload Time (min)	10	
Fire on Move	No	
Missile		
Name	VT-1	
Range (m)	Max. Range: 11,000 Min. Range: 500	
Altitude (m)	Max. Altitude: 6,000 Min. Altitude: 5 0 with degraded Ph	
Dimensions (mm)	Length: 2300 Diameter: 170	
Weight (kg)	75	
Missile Speed (m/s)	1.250	
Maneuver Capability (Gs)	35	
Propulsion	Solid propellant motor	
Guidance	RF CLOS	
Warhead Type	Focused frag-HE, 14 kg	
Lethal Radius (m)	8	
Fuze Type	Proximity	
Probability of Hit (Ph %):	80 FW, heli	
Simultaneous missiles	2 per target	

SYSTEM IS IN A MODULAR POD, DESIGNED TO FIT ON SHIPS, VEHICLES, AND ON STATIONARY PLATFORMS. THE MODULAR ALL-WEATHER SYSTEM INCLUDES ACQUISITION, TRACKING, LAUNCH, AND SUPPORTING COMPUTER UNITS INTEGRATED ON ONE VEHICLE, FOR MANAGEMENT BY A SINGLE SYSTEM OPERATOR.
VEHICLE PLATFORMS INCLUDE APCS, E.G., M113, KOREAN IFV, PIRANHA 10X10, AND THE XA-180 AS NOTED.
THE SYSTEM CAN BE RETROFITTED ONTO EXISTING CROTALE LAUNCHER VEHICLES.
PEGASUS: SOUTH KOREAN SYSTEM WITH A DIFFERENT MISSILE

NOTES

RUSSIAN FAKEL VL-VT-1 LAUNCHER GIVES THE VT-1 HYPERVELOCITY MISSILE (HVM) VERTICAL 40-M RISE BEFORE PITCH-OVER TO TARGET. IT PERMITS 360 LAUNCH WITHOUT NEED TO RE-ORIENT THE VEHICLE, AND A SHORTER REACTION TIME.

THE SAM SYSTEM LINKS TO THE IADS TO GET DIGITAL AD DATA AND WARNINGS. ASSOCIATED RADAR FOR EW AND TA DATA IS RADAR AT BRIGADE AND DIVISION TIER 1 AND 2. SYSTEM CAN ALSO PASS DATA TO THE NET.

RUSSIAN SAM SYSTEM SA-8B/GECKO MOD 1 AND SA-8P/STING



SYSTEM	SPECIFICATIONS	Guidance	RF CLOS
Alternative Designation	Osa-AKM Osa-AKM-P1for Polish upgrade	Warhead Type	Frag-HE
Date of Introduction	1973, 1980 for AKM	Warhead Weight (kg)	16
Proliferation	At least 25 countries	Fuze Type	Contact and Proximity
Target	FW, heli, CM, ASM, UAV, bomb	Probability of Hit (Ph %):	80 FW, 65 heli 65 against heli w/EO
Description	Battery includes 4 TELARS, 2 TZM transporter -loaders, PU-12M battery CP, 9V914 survey vehicle, maintenance vehicle	Simultaneous missiles	2 per Target
Launcher Vehicle		Self-Destruct (sec)	25-28
Name	9A33BM3 for updated version	Performance	
Description	TELAR	With Radar	Range (m): 1,500-10,000 Altitude (m): 25-5,000 Preferred (passive) mode Range (m): 2,000-6,500 Altitude (m): 10-5,000 FW
Chassis	BAZ-5937 6x6 vehicle	With EO Sight	Passive mode for low flyers and ECM. Range (m): 2,000-6,500 Altitude (m): 10-5,000 FW 0-5,000
Crew	3	FIRE CONTROL	SPECIFICATIONS
Combat Weight (mt)	9	Sights with Magnification	LLLTV with EO IR assist; range (km): 6
Length (m)	9.14	Onboard Radar System	
Height (m)	4.2 TA radar folded down	Name	LAND ROLL
Width (m)	2.75	Function	Dual (TA and FC)
Automotive Performance		Can System Operate Autonomously	Yes
Engine Type	D20K300 diesel	Radar Antenna	
Cruising Range (km)	250	Function	Search (target acquisition)
Speed (km/h)	60 max road 30 off-road 10 cross-country	Detection Range (km)	45 in -AKM
Max Swim	8	Tracking Range (km)	20-25
Radio	R-123M	Frequency	6-8 GHz
Protection		Frequency Band	H
Armor (mm)	None	Radar Antenna	
NBC Protection System	Yes	Function	Fire control (monopulse TTR)
ARMAMENT	SPECIFICATIONS	Detection Range (km)	20-25

Launcher		**Tracking Range (km)**	**20-25**
Name	**9P35M2**	**Frequency**	**14.2-14.8 GHz**
Dimensions	**Length (m): 3.2** **Diameter (mm): INA**	**Frequency Band**	**J**
Weight (mt)	**35**	**Radar Antenna**	
Reaction Time (sec)	**18-36**	**Function**	**Fire control (missile guidance)**
Time Between Launches (sec)	**4**	**Frequency Band**	**I**
Reload Time (min)	**No**	**Counter-countermeasures**	**2-channel FH agile**
Fire on Move	**No**	**VARIANTS**	
Emplacement Time (min)	**4 or less**	**SA-8A: INITIAL PRODUCTION MODEL THAT CARRIED FOUR MISSILES ON EXPOSED RAILS.** **OSA-1T, SA-8B MOD 1: BELORUSSIAN SYSTEM ON MZKT-69222 CHASSIS, WITH A VARIETY OF UPGRADES (E.G., NIGHT SIGHTS, INTEGRATED DIGITAL C3 AND IMPROVED MISSILES) ARE AVAILABLE. RANGE IS 1.5-14 KM. WARHEAD LETHALITY IS INCREASED 25%. ALTITUDE IS 100-5,000 M.** **T-38/STILET, WITH OSA-1T MISSILE, RANGE OF 12 KM, ALTITUDE 8,000 M. P-HIT /KILL IS 85%.** **SA-8P/OSA-AKM-P1/STING: POLISH UPGRADE WITH SIC 12/TA FCS (TV DAY SIGHT, 3RD GEN FLIR SIGHT, IR AUTO-TRACKER, AND LRF. PASSIVE EO RANGE IS 40 KM. REGA-2 AUTOMATED C2 HAS INERTIAL AND GPS NAV. DIGITAL SYSTEM LINKS TO MODERN IADS NETS. DAY/NIGHT RANGE WITH THE OSA-1T MISSILE IS 12,000 M, ALTITUDE 0-8,000 M. THE FIRST SCHEDULED EXPORT CUSTOMER IS INDIA.FUTURE GOAL IS TO ADD FIRE-AND-FORGET MISSILES.**	
Displacement Time (min)	**<4 (est.)**		
Missile			
Name	**9M33M3 latest fielded**		
Dimensions (mm)	**Length: 3158** **Diameter: 209.6**		
Weight (kg)	**170**		
Missile Speed (m/s)	**1,020**		
Propulsion	**Solid propellant motor**		

NOTES

THIS IS ONE OF THE LONGEST-RANGE FIELDED AMPHIBIOUS SYSTEMS IN THE WORLD. THIS SYSTEM IS ALSO AIR-TRANSPORTABLE AND CROSS-COUNTRY CAPABLE. ONE TRANSLOADER VEHICLE (CARRYING 18 MISSILES BOXED IN SETS OF THREE) SUPPORTS TWO TELARS.

ASSOCIATED RADAR FOR EW AND TA DATA IS GIRAFFE AMB AT SEPARATE BRIGADE AND DIVISION TIER 1 AND 2, OR LONG TRACK AT TIER 3 AND 4. THE SA-8B CAN ALSO LINK TO THE IADS TO GET ANALOG AD DATA FROM: SBORKA AD BATTERY ACV, RADARS IN ECHELON ABOVE DIVISION SAM UNITS (E.G., SA-10).

RUSSIAN SAM SYSTEM SA-9/GASKIN



SYSTEM	SPECIFICATIONS	Missile	
Alternative Designation	Strela-1M	Name	9M31
Date of Introduction	1968	Range (m)	Max. Range: 4,200 (6,100 tail aspect) Min. Range: 800
Proliferation	At Least 30 Countries	Altitude (m)	Max. Altitude: 3,500 Min. Altitude: 30 0 with degraded Ph
Target	FW, heli	Dimensions	Length: 1.80 Diameter: 120
Description	SA-9 platoon complex (9K31) includes four 9A31M TELs. One SA-9a TEL has a passive RF DF system Platoon ACV is the PU-12M or PPRU CP.	Weight (kg)	32
		Missile Speed (m/s)	580
		Propulsion	Single-stage solid propellant
Launcher Vehicle		Guidance	Photo contrast IR-homing, 1-3µm
Name	9A31M	Warhead Type	Frag-HE
Description	Transporter-Erector-Launcher	Warhead Weight (kg)	2.6
Crew	3	Fuze Type	Proximity and Contact
Chassis	BRDM-2	Probability of Hit (Ph %):	60 FW, 70 heli
Combat Weight (mt)	7.0	Simultaneous missiles	2 per Target
Length (m)	Launch position: 5.8 Travel position: 5.8	Self-Destruct (sec)	Yes
Height (m)	TEL up: 3.8 TEL down: 2.3	Auxiliary Weapon	None
Width (m)	2.4	FIRE CONTROL	SPECIFICATIONS
Automotive Performance		Sights with Magnification	
Engine Type	V-8 gasoline	Electro-optical/ Infrared System	Day Range (m): 6,500 Night Range (m): 2,000 tail chase only
Cruising Range (km)	750	Navigation	Inertial
Speed (km/h)	Max. Road: 100.0 Max Swim: 10	IFF	INA
Radio	INA	RF Direction-Finder	FLAT BOX
Protection		ASSOCIATED SYSTEMS	SPECIFICATIONS
Armor (mm)	14 Front	Name	PPRU-1/Ovod AD ACV
NBC Protection System	Collective	Chassis	MTLB-U
ARMAMENTS	SPECIFICATIONS	Radar	DOG EAR (use in OPFOR units)
Launcher		Function	Target Acquisition
Name	9P31	Frequency	F/G band
Reaction Time (sec)	6	Range	80 detection, 35 tracking

Time Between Launches (sec)	5	Other Radars	The SA-9 can also link to the IADS to get analog AD data and warnings.
Reload Time (min)	5	Radar	GUN DISH
Fire on Move	No, stop or short halts	VARIANTS	
Emplacement Time (min)	<2.0	UPGRADE 9M31M MISSILE HAS A 1-5 □M SEEKER WITH IMPROVED RANGE (8 KM ALL ASPECT, 11 KM AGAINST SLOW MOVERS AND TAIL CHASE). ALTITUDE INCREASES TO 6,100M. NIGHT RANGE IS 4,000+ M. THE IMPROVED AND COOLED SEEKER MAKES THIS MISSILE FAIRLY RESISTANT TO IR COUNTERMEASURES. SYSTEM WITH THIS MISSILE IS CALLED GASKIN MOD 1. TARGET: FW, HELI, CM, UAV	
Displacement Time (min)	<2.0		

NOTES

GENERALLY, THE SYSTEM WOULD BE EXPECTED TO HAVE THE FLAT BOX-A BUT NOT THE GUN DISH RADAR IN THE PLATOON. THE INSENSITIVE MISSILE SEEKER WAS DIFFICULT TO LOCK ON TARGET AND WAS FAIRLY EASILY COUNTERMEASURED FROM ANY ASPECT EXCEPT THE TAIL ASPECT.

SYSTEM CAN USE THE SBORKA PPRU-M1 UPGRADE ACV. HOWEVER, THE ABOVE SYSTEM MATCHES THE LOWER TIER TECHNOLOGY AND EARLIER FIELDING OF SA-9.

RADARS:

FLAT BOX: A PASSIVE SYSTEM USES SEVERAL PELENGATOR SENSORS MOUNTED ON THE VEHICLE TO DETECT AIRCRAFT NAVIGATION SIGNALS FOR EARLY WARNING AND DF OF APPROACH AZIMUTH. DETECTION RANGE IS UP TO 30 KM. MANY FORCES WITH THIS OLDER AIR DEFENSE SYSTEM ARE NOT PROFICIENT IN USING THE RF DF SYSTEM.

GUN DISH: IN THE EARLIER UNIT CONFIGURATION, AN SA-9 PLATOON IS EMPLOYED IN AN AD BATTERY/ BATTALION WITH ZSU-23-4 SPAA GUNS. THE RADAR ON THOSE SYSTEMS SUPPORTS THE SA-9 PLATOON BY PROVIDING DETECTION AND WARNING. SOME OF THE USERS EMPLOY TRUCK-MOUNTED J-BAND GUN DISH ACQUISITION RADAR IN THE PLATOONS, INSTEAD OF THE PELENGATOR SYSTEM.

RUSSIAN SAM SYSTEM SA-13B/GOPHER



SYSTEM	SPECIFICATIONS	Propulsion	Single-stage solid
Alternative Designation	Strela-10M3, 9K35M3	Guidance	Photo-contrast / dual-band
Date of Introduction	1981	Warhead Type	HE with fragmenting rod
Proliferation	At Least 22 Countries	Warhead Weight (kg)	5 (4 m lethal radius)
Target	FW, heli, CM, selected UAV	Fuze Type	Laser proximity (3 m), contact
Description	Battery has 6 TELARs, Sborka ACV (CP/radar vehicle), and truck.	Probability of Hit (Ph %):	60 FW, 70 heli
Launcher Vehicle		Simultaneous missiles	2 per target
Name	9A34M3/ 9A35M3 (see NOTES)	Self-Destruct (sec)	29
Description	TELAR/Platoon Cmd TELAR	CM Resistance	Resists nearly all IR CMs.
Crew	3	Auxiliary Weapons	
Chassis	MT-LB	Caliber, Type, Name	7.62-mm MG, RPK
Combat Weight (mt)	12.3	Rate of Fire (rds/min)	600/150 practical, bursts
Length (m)	Launch position: 6.45 Travel position: >6.45	Loader Type	40/75-rd magazine
Height (m)	TAR up: 3.8 TAR down: 2.22	Ready/Stowed Rounds	1000/1000
Width (m)	2.85	Fire on Move	Yes
Automotive Performance		FIRE CONTROL	SPECIFICATIONS
Engine Type	290-hp diesel	Sights with Magnification	
Cruising Range (km)	500	Electro-optical/IR system with auto-slew, electro-mechanical aiming, and auto-tracker	Range (km): 10 helicopter, 5 FW; Night Sight: passive IR; Strizh TV/thermal, Range (m): 6,000 IR, 12,000 thermal
Speed (km/h)	Max. Road: 61.5 Max Swim: 6	IFF	1RL246-10-2/PIE RACK (RF)
Radio	INA	Onboard Radar	
Protection		Name	9S86/SNAP SHOT on 9A34M3
Armor (mm)	7.62-mm anti-bullet	Function	Range Only
NBC Protection System	Yes	Detection Range (km)	10
ARMAMENTS	SPECIFICATIONS	Frequency Band	K-Band
Launcher		Other Onboard Sensors	9S16/FLAT BOX -B
Reaction Time (sec)	7-10	ASSOCIATED SYSTEMS	SPECIFICATIONS
Time Between Launches (sec)	<5	Name	Sborka AD ACV
Reload Time (min)	3	Chassis	MTLB-U
Fire on Move	No, stop or short halts	Radar	DOG EAR
Launcher Elevation (°)	-5/+80	Function	Target Acquisition
Emplacement Time (min)	0.67	Frequency	F/G band
Displacement Time (min)	<1.0	Range	80 detection, 35 tracking

Auxiliary Power Unit	Yes, gasoline power	Previous Battery	PU-12M
Note	The SA-13 can launch SA-9 SAMs, and can mix the SAMs.	VARIANTS	
Missile		SA-13A: EARLIER SYSTEM WITH SA-9 MISSILE - 7 KM RANGE, BUT LOWER OVERALL LETHALITY. MISSILE VARIANTS: STRELA-10M HAS UNCOOLED LEAD SULPHIDE (PBS) IR SEEKER. STRELA-10M2 HAS UNCOOLED PBS SEEKER OR COOLED INDIUM ANTIMONIDE MID-IR SINGLE-MODE SEEKER. STRELA-10M3 DETECTION RANGE 10 KM DAY/NIGHT, ENGAGE UAVS TO 4,000M. CZECH SNAP SHOT RADAR: VERSION WITH HEIGHT ADJUSTMENT CAPABILITY, AND IMPROVED AUTOMATION AND COMMUNICATIONS SAVA: YUGOSLAV VARIANT OF STRELA-10M/ SA-13A ON A BVP M80A IFV CHASSIS. STRIJELA-10CROAL: CROATIAN VARIANT WITH A TAM 150.B 6X6 VEHICLE CHASSIS, TV-BASED FIRE CONTROL AND THERMAL NIGHT SIGHT. 9A34A: UPGRADE TELAR WITH THERMAL SIGHT, BETTER INTEGRATED C2, IMPROVED FCS, AND A PKM MACHINEGUN. DETECTION RANGE WITH THE FCS IS 10-12 KM. MUROMTEPLOVOZ OFFERS A LAUNCHER VEHICLE WITH THE LAUNCHER ON A BTR-60 CHASSIS.	
Name	9M333/Strela-10M3		
Range (m)	Max. Range: 5,000, fly-out to 7,000+ m Min. Range: 800		
Altitude (m)	Max. Altitude: 3,500 Min. Altitude: 10, 0 with degraded Ph		
Dimensions	Length: 2,223 Diameter: 120		
Weight (kg)	42		
Missile Speed (m/s)	Up to 800/517 average		
Max Target Speed (m/s)	420		

NOTES

THE SA-13A REPLACED SA-9 WITH AN UPDATED LAUNCHER MOUNTED ON A DIFFERENT CHASSIS. THE MT-LB HULL OFFERS HALF THE PROTECTION OF THE SA-9 BRDM-2 CHASSIS, BUT WITH MORE MOBILITY. THE BATTERY SET USES CENTRALIZED DIGITAL TARGET WARNING NET; BUT EACH LAUNCHER MUST INDIVIDUALLY ACQUIRE AND LAUNCH AGAINST TARGETS. ASSOCIATED EQUIPMENT INCLUDES A 9V915M MAINTENANCE VEHICLE, 9I11 EXTERNAL POWER SUPPLY SYSTEM, AND A 9V839M TEST VEHICLE. THE PLATOON CMD LAUNCHER (9A35M/TELAR-1) HAS A FLAT BOX -B, AND CAN PASS DATA TO THE OTHER LAUNCHERS (9A34M/TELAR-2.

RUSSIAN SAM SYSTEM SA-15B/GAUNTLET



SYSTEM	SPECIFICATIONS	FIRE CONTROL	SPECIFICATIONS
Alternative Designation	9K331 Tor-M1	Sights with Magnifications	
Date of Introduction	1990	Electro-optical (EO) television system W/IR auto-track (km)	20
Proliferation	At Least 5 Countries	IFF	Yes
Target	FW, heli, CM, ASM, UAV, bomb	Radar	
Description	Battery system includes 4 TELARs a CP vehicle, trans-loaders, maintenance vehicles	Name	SCRUM HALF
Launcher Vehicle		Function	Target acquisition (TAR)
Name	9A331	Detection Range (km)	25+
Description	TELAR	Tracking Range (km)	25
Crew	3	Targets Tracked	10
Chassis	GM-355 tracked vehicle	Frequency Band	G/H-band 3D doppler, Stabilized for use on move
Combat Weight (mt)	34	Target Detection Time (sec)	1.5-3.0
Length (m)	7.5	Radar	
Height (m)	5.1 (TAR up)	Name	INA, sometimes called "Tor" Also SCRUM HALF, some sources
Width (m)	3.3	Function	Dual - acquisition and fire control (includes tracking and guidance)
Automotive Performance		Detection Range (km)	25+
Engine Type	V-12 Diesel	Tracking Range (km)	25, farther with slower reaction time
Cruising Range (km)	500	Targets Engaged Simultaneously	2
Speed (km/h)	Max. Road: 65	Frequency Band	J/K-band Doppler phased array
Radio	INA	ASSOCIATED SYSTEMS	SPECIFICATIONS
Protection		Name	Sborka AD ACV
Armor (mm)	Small Arms (est)	Chassis	MTLB-U (same as Ranzhir)
NBC Protection System	Yes	Radar	DOG EAR
Armaments		Function	Target Acquisition
Launcher		Frequency	F/G band
Name	INA, Vertical Launch	Range	80 detection, 35 tracking
Dimensions	Length (m): INA		

	Diameter (mm): INA		
Weight (kg)	INA	Name	Ranzhir/Rangir/9S737 AD ACV
Reaction Time (sec)	3-8, +2 halt from move	Chassis	MTLB-U
Time Between Launches (sec)	see NOTES	Radar	None, via radar reports from SA-15b
Reload Time (min)	10	VARIANTS	
Fire on Move	Yes	SA-N-9: NAVAL VERSION TOR-M1T: VERSIONS ON THE GROUND OR TOWED TRAILERS. THE CREW SITS 50 M AWAY FROM THE ANTENNA/LAUNCHER TRAILER. THE -M1TA HAS A BOX-BODY (BB) CREW TRUCK. THE –M1TB HAS A BB TRAILER. A GROUND-MOUNT VERSION IS TOR-M1TS. ONLY DIFFERENCES ARE EMPLACE/ DISPLACE TIMES, AND 0 VERSUS 1, OR 2 TRUCKS. TOR-M2: VERSION WITH LAUNCHER ON ARMORED KAMAZ 6X6 TACTICAL TRUCK CHASSIS. TOR-M2E EXPORT VERSION HAS A NEW JAM-RESISTANT TA RADAR. MAX ENGAGEMENT ALTITUDE IS 10,000 M.	
Emplacement Time (min)	5		
Displacement Time (min)	Less than 5		
Missile			
Name	9M331		
Range (m)	Max. Range: 12,000 Min. Range: 1,000		
Altitude (m)	Max. Altitude: 6,000 Min. Altitude: 10 0 with degraded Ph		
Dimensions	Length: 2,900 Diameter: 235		
Weight (kg)	167		
Missile Speed (m/s)	850		
Propulsion	INA		
Guidance	Command		
Warhead Type	Frag-HE		
Warhead Weight (kg)	15		
Fuze Type	RF Proximity		
Probability of Hit (Ph%):	90 FW, 80 heli		
Simultaneous missiles	2 per target		

NOTES

SA-15B IS DESIGNED TO BE A COMPLETELY AUTONOMOUS AIR DEFENSE SYSTEM (AT DIVISION LEVEL), CAPABLE OF SURVEILLANCE, COMMAND AND CONTROL, MISSILE LAUNCH AND GUIDANCE FUNCTIONS FROM A SINGLE VEHICLE. THE BASIC COMBAT FORMATION IS THE FIRING BATTERY CONSISTING OF FOUR TLARS AND THE RANGIR BATTERY COMMAND POST. THE TLAR CARRIES EIGHT READY MISSILES STORED IN TWO CONTAINERS HOLDING FOUR MISSILES EACH. THE SA-15B HAS THE CAPABILITY TO AUTOMATICALLY TRACK AND DESTROY 2 TARGETS SIMULTANEOUSLY IN ANY WEATHER AND AT ANY TIME OF THE DAY.

ASSOCIATED RADAR FOR EW AND TA DATA IS GIRAFFE AMB AT SEPARATE BRIGADE AND DIVISION TIER 1 AND 2. IT LINKS TO THE IADS TO GET DIGITAL AD DATA FROM: SBORKA AD BATTERY ACV, RADARS IN ECHELON ABOVE DIVISION SAM UNITS (E.G., SA-10). THE SA-15B CAN ALSO PASS DATA TO THE NET

RECENT DEVELOPMENTS IN MEDIUM-RANGE AIR DEFENSE (MRAD) SYSTEMS

In the past, the US and Russia dominated military markets in medium-range SAM systems. Most well-fielded MRAD systems are Russian systems, or license-produced copies or variants of those systems. Most still have some effectiveness for AD, especially with upgrade programs. But new systems and new producers are expanding options for their MRAD choices.

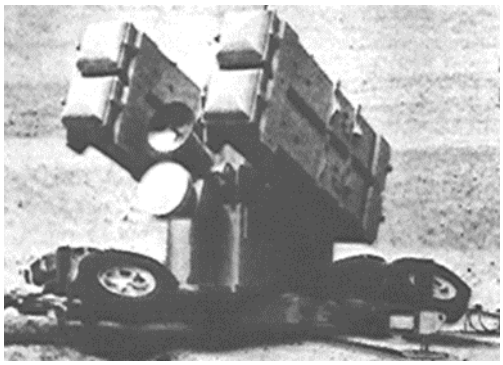
For military forces in most countries, with substantial portions of their territory lacking strategic targets or vulnerabilities, MRAD SAMs (aka: MSAMs) are more practical AD systems than the more expensive and restricted mobile long-range SAM systems. Requirements for these systems include ranges from <1 km to 20-50 km, and altitudes of 5 m to 6-50 km. Many MRAD SAMs operate within these range limits, which are less than LRAD SAMs, but offer high-altitude protection against flight profiles of most fixed-wing aircraft and many missiles.

The most proliferated MRAD SAMs are either those formerly included in inventories of former Warsaw Pact nations (the SA-2, SA-3, SA-3b, SA-6/SA-6b, SA-11, Buk-M1-2), or the US HAWK and I-HAWK. These include towed semi-mobile and vehicle-mounted mobile systems. Most legacy systems have seen many upgrades. In recent years the pace of upgrade implementation has increased thanks to the availability of digital data systems, computer integration, imaging fire control systems, and radar improvements. Improved supporting target acquisition and fire control radars are increasing overall systems capabilities. Several systems that were once towed can now be mounted on vehicle chassis. Missile improvements include motor/range upgrades, new warhead designs, and improved guidance modes. Many MRAD systems are upgraded to meet recent AD challenges (e.g., stealth, SEAD, cruise missiles, low-flying helicopters, air-launched munitions, UAVs, and ballistic missiles).

The widely fielded Russian SA-6/Kub system has seen many upgrades, including improved missiles (Kub-M1 and Kub-M3), and unit changes. In the Soviet era, it was being obsolesced by SA-11/Buk systems. Most SA-6 units were upgraded and converted to SA-6b. SA-11 units also saw upgrades. Dissolution of the USSR left Russia with fewer modern units and many older Kub units. New upgrade packages were fielded, and also offered for sale to export customers. Meanwhile, delays and cost issues with the forecasted SA-17 led the Russians to drastically modernize their existing Buks by introducing the Buk-M1-2. An economical and clever change was to add launcher-loaders to batteries, to increase TELAR missile loads and increase launch rates. New Russian MRAD designs, such as Vityaz, are in development. The trend for increased missile loads on Russians LRADs will further delay domestic fielding of MRAD systems. The SA-17 is not well fielded; but Russia is upgrading and exporting AD systems, as well as modernization options for existing systems.

Other countries are interested in producing their own indigenous MRAD systems. A number of air-to-air missiles have been adapted for existing ground mounts as medium-range SAMs. Others are indigenous developments that offer export potential and the flexibility needed to meet varying customer needs. The following page shows some of the many variants of the Italian Aspide 2000 missile. Sweden has developed the robot system (RBS) 23/BAMSE; Israel has the Surface-to-Air Python and Derby-Medium Range (SPYDER-MR). Israel is also developing Arrow as an anti-theater ballistic missile (ATBM) system. India and several other countries have foreign system acquisition/upgrade programs, as well as indigenous development programs underway. These include France, with its SAMP-T (French acronym for ground-to-air medium range missile system); and Norway with its NASAMS (Norwegian Advanced Surface to Air Missile System) and AMRAAM (advanced medium range air-to-air missile). Turkey and South Korea are also developing MRADS, and China is offering the KS-2A system on the international arms market. Firms in NATO countries are currently adapting the IRIS-T (infrared imaging system-tail/thrust vector controlled) air-to-air missiles for use in ground launchers.

ITALIAN ASPIDE 2000 MEDIUM-RANGE SAM SYSTEM



Aspide 4-canister configuration

SYSTEM	SPECIFICATIONS	FIRE CONTROL	SPECIFICATIONS
Alternative Designation	Aspide Mk II, Skyguard	Onboard Fire Control	Remote K-band tracking radar and RC illuminator radars, I/J-band on launcher.
Date of Introduction	1986 for Mk I	Name	Skyguard II radar and CP unit
Proliferation	At Least 18 Countries	Platform	Towed compartment
Target	FW, heli, CM, UAV, ASM	EO Sights	SEC-Vidicon TV system
Launcher		EO Auto-Tracker	TV tracking system
Name	INA	Range	25 km day only
Description	Towed 4/6 canister MEL	Laser Rangefinder	Yes
Reaction Time (sec)	11	Radars	
Time Between Launches (sec)	INA	Name	Skyguard Mk II (SW)
Fire on Move	No	Function	Dual (TA and FC)
Number of Fire Channels	2	Detection Range (km)	45
Emplacement Time (min)	15	Tracking Range (km)	25
ARMAMENTS	SPECIFICATIONS	FC Radar Frequency	-20 GHz
Missile		Frequency Band	I/J doppler MTI
Name	Aspide 2000	Rotation Rate/min	60
Range (km)	Max. Range: 45 Min. Range: 0.75	Mean Power (W)	200
Altitude (m)	Max. Altitude: 6,000+ Min. Altitude: 10 0 with degraded Ph	Link	Invulnerable to ECM, including frequency jumps
Dimensions	Length (m): 3.65 Diameter (mm): 203	VARIANTS	
Weight (kg)	230	SKYGUARD ADA COMPLEXES CAN VARY WIDELY. ORGANIZED AROUND THE SKYGUARD RADAR AND CP UNIT, THEY MAY HAVE GUNS ONLY OR MISSILES ONLY. THE MOST EFFECTIVE CONFIGURATION IS A GUN/MISSILE SYSTEM. ASPIDE 2000: THE SYSTEM CAN BE MISSILES ONLY OR GUN/MISSILE, WITH THE SKYGUARD II RADAR, TRUCKS AND GENERATORS. SKYGUARD II/ASPIDE 2000: OPFOR TIER 2 GUN/MISSILE SYSTEM, WITH RADAR/CP AND MISSILE AND GDF-005 GUN. IT ALSO LINKS TO GIRAFFE OR OTHER RADARS. A BATTERY HAS 2 GUNS AND 2 MISSILES.	
Missile Speed (m/s)	1,288		
Velocity (mach)	4.0		
Maneuver Capability (Gs)	35-40		
Propulsion	Solid fuel booster		
Guidance	J-band semi-active radar homing, active or passive homing, and home-on-jam		
Warhead Type	Frag-HE		
Warhead Weight (kg)	33		
Fuze Type	Proximity and Contact		
Probability of Hit (Ph%):	80 FW and heli		
Simultaneous missiles	2 per Target		

	SKYGUARD III: GDF-005 GUN, SKYGUARD III I-BAND RADAR AND SKYGUARD RETROFIT KIT. SKYGUARD III/ASPIDE 2000: OPFOR TIER 1 GUN/MISSILE SYSTEM WITH ABOVE CHANGES. SKYGUARD IS COMPATIBLE WITH OTHER DIGITAL ADA FCS FORMATS. GDF-003 GUN AND ALLENIA ASPIDE MISSILE ARE ALSO EMPLOYED WITH RADAR AND CP UNITS OTHER THAN SKYGUARD. SKYGUARD MK I RADAR RANGE WAS 20 KM. SKYGUARD RETROFIT KIT: GUN UPGRADE FCS, RADAR, AND FITTED FOR AHEAD AMMUNITION. OTHER GUNS AND MISSILES CAN BE USED WITH THE SKYGUARD RADAR AND CP UNIT. AMOUN: EGYPTIAN ASPIDE/SPARROW SYSTEM ARAMIS: BRIGADE SAM SYSTEM WITH 6-CANISTER LAUNCHER. LY-60: CHINESE NAVAL VARIANT PL-11: CHINESE VARIANT WITH UPGRADES. RANGE FOR PL-11C IS 75 KM. SPADA: ITALIAN AIR FORCE LAUNCHER VERSION. SPADA 2000: KUWAITI SYSTEM USES ABOVE LAUNCHER AND ASPIDE 2000 MISSILE. SPARROW: SYSTEM FROM WHICH ASPIDE WAS DERIVED - INTERCHANGEABLE IN THE LAUNCHER. OTHER COMPATIBLE MISSILES INCLUDE: ADATS, ASRAD, AIM-7E/SPARROW, SAHV-IR, AND LY-60.

NOTES

GPS IS USED FOR SURVEYING SYSTEMS IN POSITION. SKYGUARD CONNECTION LINK IS 1,000-M CABLE LINK OR 5000-M RADIO LINK.

TO COUNTER SEAD JAMMING OPERATIONS, THE FIRE CONTROL SYSTEM TRACKER IS K-BAND. THE ASPIDE MISSILE SEEKER CAN USE HOME-ON-JAM MODE. SKYGUARD FIRE CONTROL SYSTEM INTEGRATES ACQUISITION RADAR WITH REMOTE CONTROLLED ILLUMINATION (GUIDANCE) RADARS.

SKYGUARD LINKS TO THE IADS TO GET DIGITAL AD WARNINGS AND. DATA. ASSOCIATED RADAR FOR EW AND TA DATA IS RADAR AT BDE AND DIV TIER 1 AND 2. SYSTEM CAN ALSO PASS DATA TO THE NET.

RUSSIAN SAM SYSTEM SA-2/GUIDELINE RUSSIAN SAM SYSTEM



SYSTEM	SPECIFICATIONS	FIRE CONTROL	SPECIFICATIONS
Alternative Designation	Volga-75SM, S-75 Dvina, V-75 Volkhov	Radar	
Date of Introduction	1959	Name	FAN SONG, A-F variants
Proliferation	At Least 41 Countries	Function	Fire control
Target	FW, heli, CM	Control Range (km)	60-120 A, B; 70-145 for C, D, E INA for F
ARMAMENT	**SPECIFICATIONS**	Frequency Band	E/F for A-B, G for C-E, INA for F
Launcher		Location	Within battery formation
Description	Single-rail, ground-mounted,	Radar:	
Name	INA	Name	SPOON REST, P-12
Dimensions	INA	Function	Target acquisition, early warning
Weight (kg)	INA	Detection Range (km)	275
Reaction Time (sec)	8 lock-on 2-3 Volga-M	Frequency Band	A=A (VHF). B=VHF below A
Time Between Launches (sec)	INA	Location	Outside battery formation
Reload Time (min)	10-12	Radar	
Fire on Move	No	Name	FLAT FACE, P-15
Emplacement Time (min)	< 4 hours	Function	Target acquisition, early warning,
Displacement Time (min)	< 4 hours	Detection Range (km)	250
Simultaneous Missiles	3 at 6-second intervals	Frequency Band	C
Missile	V750K/Volga Volga-2A	Location	At regimental HQ
Name	INA	Radar	
Range (m)	Max. Range: 35,000-50,000 60,000 Volga-2A Min. Range: 6,000-7,000	Name	SIDE NET, PRV-11
Altitude (m)	Max. Altitude: 30,000 Min. Altitude: 100	Function	Height finding radar
Dimensions	Length (m): 10.6 to 10.8 Diameter (m): 0.50	Detection Range (km)	180
Weight (kg)	2,300-2,450 at launch	Frequency Band	E
Missile Speed (mach)	4.5	Radar	
Propulsion	Solid fuel booster 5-sec; Sustainer liquid <70 sec	Name	KNIFE REST A
Guidance	Command RF	Function	Early warning radar
Warhead Types	HE, Nuc	Detection Range (km)	370
Warhead Weight (kg)	195 HE	Frequency Band	A
Bursting Radius (m)	125-135	Location	INA older system
Kill Radius (m)	65	**VARIANTS**	
CEP (m)	76.3	SA-2A (MOD 0): FAN SONG A	
Fuze Type	Proximity or Command	SA-2B (MOD 1): FAN SONG B, LONGER MISSILE	
Probability of Hit (Ph%)	50 FW, 40 heli, Volga-2A: 75 FW, 60 heli	SA-2C (MOD 2): FAN SONG C, LONGER RANGE, LOWER ALT SA-2D (MOD 3): FAN SONG E, EW ENHANCED	

Simultaneous Missiles	3 per Target	SA-2E (MOD 4): FAN SONG E NUC VARIANT SA-2F (MOD 5): FAN SONG F, EW ENHANCED BACKUP OPTICAL, SA-N-2: NAVAL TEST VERSION, UNSUCCESSFUL HQ-2: CHINESE VARIANT (CSA-1), WITH A 30 KM RANGE. HQ-2B: CHINESE UPGRADE, WITH GIN SLING FC RADAR AND IMPROVED MISSILE, DIGITAL ENCRYPTED C2, COMPUTER FCS, EO PASSIVE ALTERNATIVE FC, AND TRACKED LAUNCH VEHICLE. IRAQI MOD: INFRARED TERMINAL GUIDANCE/MISSILE. KS-1A/HQ-12: CHINESE HQ-2 TO 50 KM, ON WHEELED. VOLGA-M: MID 90'S UPGRADE, WITH DIGITAL SUBSYSTEMS, 41 MILES RANGE, LESS MAINTENANCE. SYSTEM USES VOLGA-2A.
Command Destruction at (sec)	115	

NOTES

THE SA-2/GUIDELINE IS A TWO-STAGE MEDIUM-TO-HIGH ALTITUDE, RADAR-TRACKING SAM. BECAUSE ITS RANGE IS GENERALLY IN THE 35-50-KM BAND, IT IS MORE MRAD SYSTEM THAN LRAD. THE WEAPON IS A NATIONAL-LEVEL ASSET USUALLY FOUND IN THE REAR AREA WITH THE MISSION OF SITE DEFENSE OF STATIC ASSETS SUCH AS SUPPLY AND COMMAND INSTALLATIONS. IT IS FIRED FROM A SINGLE-RAIL GROUND-MOUNTED LAUNCHER THAT CAN BE MOVED BY A TRUCK. THE MISSILES ARE CARRIED ON A SPECIAL TRANSLOADER-SEMI-TRAILER TOWED BY A ZIL TRUCK. AN SA-2 REGIMENT CONSISTS OF THREE BATTALIONS, EACH HAVING A SINGLE FIRING BATTERY. EACH BATTERY HAS SIX LAUNCHERS ARRANGED IN A STAR FORMATION, CENTRALLY POSITIONED FAN SONG FIRE CONTROL RADAR, AND A LOADING VEHICLE. THE TWO FORWARD BATTERIES USUALLY LOCATE 40 TO 50 KM BEHIND FRONT LINES; THE THIRD BATTERY LOCATES APPROX 80 KM BEHIND.

UPGRADED RADARS MAY BE ASSOCIATED WITH THIS SYSTEM. FOR INSTANCE, P-12M AND SPOON-REST-B/P-12NP UPGRADES ARE FIELDED.

LIMITATIONS INCLUDE LIMITED EFFECTIVENESS AGAINST UPDATED ECM, RESTRICTED MOBILITY, AND LIMITED EFFECTIVENESS AGAINST LOW-ALTITUDE TARGETS.

RUSSIAN SAM SYSTEM SA-3/GOA, PECHORA-2M LAUNCHER



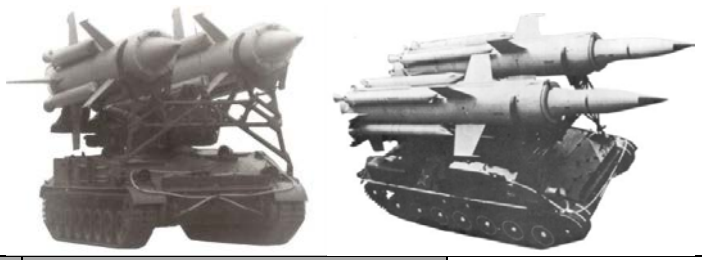
SYSTEM	SPECIFICATIONS	FIRE CONTROL	SPECIFICATIONS
Alternative Designations	S-125 Neva, S-125 Pechora	Radar	
Date of Introduction	Twin launcher 1961/ quadruple launcher 1973.	Name	LOW BLOW
Proliferation	At least 39 countries	Function	Fire control (tracking and command guidance)
Target	FW, heli, CM Also ASMs, UAVs Pechora-M	Control Range (km)	85
LAUNCHER		Detection Range (km)	110
Description	Towed twin or quad-rail	Frequency Band	I
Name	INA	Tracking Capacity	1 target (1-2 missiles) 2 tgts UNV Model 1999 mod
Dimensions	INA	Radar	
Weight (kg)	INA	Name	FLAT FACE/P-15
Reaction Time (sec)	8, 2-3 Pechora-M	Function	Target acquisition
Time Between Launches (sec)	INA	Detection Range (km)	250
Reload Time (min)	50 (quad launcher)	Frequency Band	C
Displacement Time (min)	100, 30 Pechora-M	Radar	
ARMAMENT	SPECIFICATION	Name	SQUAT EYE/P-15M
Missile:		Function	Target acquisition (low alt)
Name	5V24, Pechora-2A, 5V27DE	Detection Range (km)	128
Range (m)		Frequency Band	C
Max Range (m)	25,000, 28,000 Pechora-2A, 35,000 5V27DE Coun	Tracking Capability	6 targets
Min Range (m)	2,400	Radar	
Altitude (m)		Name	Kasta-2E2for Pechora-M/-2/-2M
Max Altitude (m)	18,300	Function	Target acquisition and EW
Min Altitude (m)	20, 7.5 blast radius	Detection Range (km)	150 EW 95 TA FW 55 heli
Dimensions		Frequency Band	INA
Length (m)	6.1	Tracking capability	50 targets
Diameter (mm)	550	Countermeasure	Frequency agile, phase modulation
Weight (kg):	946	VARIANTS	
Missile Speed (m/s):	650-1,150	SA-3A: TWO-AIL LAUNCHER. MISSILES WITHOUT INTERSTAGE FINS. SA-3B (GOA MOD 1): TWO-RAIL LAUNCHER. MISSILES HAVE INTER-STAGE FINS. SA-3C: FOUR-RAIL LAUNCHER.	
Velocity (mach):	3.5		
Propulsion	Solid fuel booster		
Guidance:	Command RF		
Warhead Type	Fragmenting Rod-HE		

Warhead Weight (kg):	73	NEWA SC: POLISH MODERNIZED SYSTEM PECHORA-M: UPGRADE FIELDED IN 1994 AND USED IN AT LEAST 3 COUNTRIES. IT HAS DIGITIZED FCS, AND LASER/EO/THERMAL AUTO-TRACKER FOR USE WITHOUT A RADAR. IT ADDED THE KASTA-2E2 TA EW RADAR. PECHORA-2/UNV MODEL 1999: FURTHER UPGRADE WITH TRUCK-MOUNTED LOW BLOW FC RADAR), TRACKS 2 TARGETS. IT IS RESISTANT TO AIRCRAFT ECM. PECHORA-2M: RUSSIAN MOBILE VARIANT OF -2, WITH LAUNCHER MOUNTED ON A TRUCK CHASSIS MODIFIED INTO A TRANSPORTER-ERECTOR-LAUNCHER (TEL). OTHER CHANGES: THE 2-RAIL LAUNCHER HAS A STORAGE COMPARTMENT UNDERNEATH FOR SUPPORT AND TEST EQUIPMENT. NAVIGATION AND AUTOMATED FIRE CONTROL TERMINAL ARE MOUNTED ONBOARD. THE CAB HAS ROOM FOR TWO OR THREE CREW MEMBERS. THE LATEST MISSILE IS 5V27DE. THE TRAILER-MOUNTED UNV MODEL 1999 FC RADAR (UP TO 300 M AWAY) CAN EMPLACE AND DISPLACE IN 5 MINUTES OR LESS. THIS SYSTEM HAS BEEN EXPORTED TO SEVERAL COUNTRIES.
Kill Radius (m)	12.5	
Fuze Type	Proximity RF, 20 m detection	
Probability of Hit (Ph%)	70 FW, 70 heli 80 Pechora-M, -2M	
Simultaneous missiles	2 per target	

NOTES

THE SA-3/GOA IS A TWO-STAGE, LOW- TO MEDIUM-ALTITUDE SAM. TWO READY MISSILES TRAVEL IN TANDEM ON A MODIFIED TRUCK OR TRACKED VEHICLE FROM WHICH THE CREW LOADS THE MISSILES ONTO A GROUND-MOUNTED, TRAINABLE LAUNCHER FOR FIRING. IT IS PRINCIPALLY A POINT/SMALL AREA DEFENSE WEAPON. SA-3 IS NOT MOBILE. IT IS MOVABLE, WITH CONSIDERABLE DISPLACEMENT TIME. PECHORA-2M (ABOVE) IS A HIGHLY MOBILE SYSTEM, IS PICKING UP SALES.

RUSSIAN SAM SYSTEM SA-4B/GANEF MOD 1



SYSTEM	SPECIFICATIONS	Guidance	RF command, Semi-active radar-homing
Alternative Designations	Krug-M1, 2K11 or ZRD-SD	Missile Beacon	CW radar transponder
Date of Introduction	1974 for -M1 variant	Warhead Type	Frag-HE
Proliferation	At least 8 countries for SA-4	Warhead Weight	135
Target	FW, RW, CM	Fuze Type	RF command or prox
Description	System of3 twin-launch TELs, 4x TZM trans-loaders, guidance	Probability of Hit (Ph%)	70 FW and heli
Launcher Vehicle		Simultaneous missiles	2 per target
Name	2P24M1 or SA-4b	FIRE CONTROL	SPECIFICATIONS
Description	Transporter-Erector-Launcher	Launcher	
Chassis	GM 123, 7-roadwheel tracked chassis	Sights w/Magnification	Mounted on TEL, EO day, IR night
Crew	3-5	Missile Guidance Station	
Combat Weight (mt)	28.2	Name:	1S32
Length (m)	7.5, 9.46 with missiles	Chassis	GANEF tracked variant
Height (m)	4.47	Function	Battery fire control vehicle
Width (m)	3.2	Radar	PAT HAND
Automotive Performance		Frequency Band	H
Engine Name, Type	520-hp diesel	Function	Fire control and guidance
Cruising Range (km)	450	Range (km):	
Speed (km/h)		Detection:	120-130
Max Road	35-45	Tracking/Guidance	80-90
Max Off Road	20-30	IFF	Yes
Fording Depth (m)	1.5	ASSOCIATED SYSTEMS	SPECIFICATIONS
Radio	R-123M, initial system	Radar	
Protection		Name:	LONG TRACK
Armor, Turret Front (m)	15	Chassis:	AT-T tracked P-40 variant
NBC Protective System	Collective	Unit level	AD brigade
ARMAMENT	SPECIFICATIONS	Detection Range (km)	167
Launcher		Tracking Range (km)	150
Name	2P24M1 (same as above vehicle)	Frequency:	2.6 GHz
Time Between Launches		Frequency Band	E
Simultaneous Target Launcher	1	Radar	
Simultaneous Targets Battery	1, 3 if launchers are operating autonomously in the battery	Name	THIN SKIN on Prw-16 vehicle
Simultaneous Missiles per Battery	1-6	Function	Height finding
Simultaneous Missiles Launcher	1or 2	Chassis	AT-T tracked variant
Reaction Time (min)	1	Unit and Level	AD brigade

Reload Time (min)	10-15 per missile	Detection Range (km)	240
Emplace/Displace time (min)	5	Tracking Range (km)	INA
Fire on Move	No	Frequency Band	H
Missile		Trans-loader	
Name	9M8M2/SA-4b	Name	TZM (generic)
Range (m)		Chassis	URAL-375 truck
Max Range	50,000	Unit and Level	AD battery and above
Min Range	6,000	Missiles per Vehicle	1
Altitude (m)		Name	9S44, K-1 (Krab)
Max Altitude	24,500	Chassis	Van
Min Altitude	150	VARIANTS	
Dimensions		SA-4A: ORIGINAL 1967 SYSTEM WITH EARLIER LONG-NOSED MISSILE (9M8/-8M/-8M1) AND TERMINAL HOMING. BUT MIN RANGE (9 KM) AND ALTITUDE (3 KM) MEANS A LARGE DEAD SPACE. SA-4B/KRUG-M1: USES 9M38M2 MISSILE, WHICH DECREASED MINIMUM RANGE AND ALTITUDE (SEE LEFT) TO REDUCE DEAD SPACE. THE MISSILE HAS A SHORTER NOSE SECTION THAN EARLIER VERSIONS. THE 2P24M1 IMPROVED TEL ADDED ELECTRO-OPTICAL FIRE CONTROL. 9M8M3: MODIFIED VERSION OF EARLIER SERIES(9M8 - 9M8M1) MISSILE WITH CHARACTERISTIC LONGER NOSE, BUT ADAPTED TO SA-4B LAUNCHER	
Length (m)	8.30		
Diameter (mm)	800		
Weight (kg)	2,450		
Missile Speed (m/s)	800-1000		
Propulsion	Solid fuel		

NOTES

A VARIETY OF MORE MODERN AUTOMATED CONTROL COMPLEXES, SUCH AS POLYANA, CAN BE USED TO UPGRADE THE SYSTEM AND PROCESS DATA MORE RAPIDLY. BATTERIES MAY USE A MIX OF SA-4A AND SA-B MISSILES TO MAXIMIZE RANGE, ALTITUDE, AND GUIDANCE MODES AVAILABLE, WHILE REDUCING DEAD SPACE.

RUSSIAN SAM SYSTEM SA-6/GAINFUL AND SA-6B/GAINFUL MOD 1



SYSTEM	SPECIFICATIONS	Propulsion	2-stage, solid fuel
Alternative Designation	2K12 system, also SA-6a or Kub/Kvadrat (export)	Guidance	Semi-active terminal-homing, 2-3 channels
Date of Introduction	1966, 1976 Kub-M3	Warhead Type	Frag HE
Proliferation	At least 22 countries	Warhead Weight (kg)	50
Target	Low to med altitude FW and heli for SA-6a. FW, heli, CM for SA-6b FW, heli, TBM, CM, UAV, Ground targets for SA-6b/Kvadrat-M4.	Fuze Type	Proximity RF
Description	Battery has 4 triple-launcher TELs, battery control truck, STRAIGHT FLUSH, and two TZM reload vehicles (3 missiles each).	Probability of Hit (Ph%)	70, 80 heli SA-6b 80 FW/heli
Launcher Vehicle		Simultaneous Missiles	2-3/target
Name	SA-6/2P25M2 common upgrade.	FIRE CONTROL	SPECIFICATIONS
Description	Transporter-Erector-Launcher	Sights w/Magnification	
Chassis	Modified PT-76	EO sighting system	TV
Crew	3	Range (km):	30
Combat Weight (mt)	14	Commander and driver	IR
Length (m)	6.09	IFF	Pulse-doppler
Height (m)	4.45	Radar and fire control	
Width (m)	3.04	Name	1S91M2E/STRAIGHT FLUSH
Automotive Performance		Function	Dual (target acquisition and fire control)
Engine Name	V-6R, 6 cyl diesel	Frequency	G/H-med alt acquisition H-illum-med alt tracking I-low alt tracking
Cruising Range (km)	250	Range (km)	60-90 detection 28 tracking
Speed (km/h)		Radar	
Max Road	45	Name	LONG TRACK
Max Swim	N/A	Function	Surveillance, target acq, early warning, on vehicle
Radio	INA	Detection Range (km)	4-167
Protection	NBC Protection System: Collective	Altitude (m)	25-14,000
ARMAMENT	SPECIFICATIONS	Tracking Range (km)	150
Launcher		Frequency	2.6 GHz, Band E
Name	2P25M2 (same as vehicle)	Radar	
Reaction Time (min)	22-24	Name	THIN SKIN
Time Between Launches (sec):	INA	Function	Height Finding
Reload Time (min):	10	Detection Range (km)	240
Fire on Move	No	Tracking Range (km)	INA

Simultaneous targets launcher	1	Frequency Band	H
Simultaneous targets battery	1	Other Radars	Links to EW/TA radars at echelons above division, and radars in SAM units.
Simultaneous missiles battery	1-4		
Emplacement Time (min)	5 or less		
Displacement Time (min)	15 for a battery		
Missile			
Name	Kub-M3/3M9M3		
Range (m)	4,000-25,000		
Altitude (m)	30-14,000		
Dimensions	6.20 m length, 335 mm diameter		
Weight (kg)	630		
Missile Speed (m/s)	700		

VARIANTS

MANY EARLY SA-6/KUB/KVARDRAT SYSTEMS WERE PRODUCED AND EXPORTED. BY THE 1970S, THE SOVIETS FIELDED KUB-M1, M2, AND M3 VERSIONS, AND UPGRADED OLDER SYSTEMS WITH IMPROVED FC (1S91M1), REDUCED SIGNATURE, AND IMPROVED 2P25M2 LAUNCHER WITH AND TV/EO SIGHTS. UPGRADE MISSILE RANGES ROSE FROM 20 KM UP TO 25.

KVADRAT-M: FIELDING FOR THE LATEST SERIES OF UPGRADES BEGAN IN 1996, STARTING WITH SA-6A/ KUB-M3 UNITS. THEY ADDED MODERN SUPPORT SYSTEMS, E.G., AN IMPROVED BATTALION CP VEHICLE, ORION IW SYSTEM (6-21), AND MODERN RADARS. BATTALION STRUCTURE CHANGED TO 6 BATTERIES, EACH WITH 3 TELS AND A 1S91M1/2 FC VEHICLE. AN UPGRADE PACKAGE WAS LATER OFFERED FOR EXPORTS.

SA-6B/ KUB/KVADRAT-M4: THE SA-11/BUK SYSTEM WAS DEVELOPED TO REPLACE SA-6 MRAD UNITS. DUE TO DELAYS, A 1980 INTERIM FIX WAS TO REPLACE ONE SA-6 TEL PER BATTERY WITH A BUK/ 9A38 TELAR, FORMING HYBRID SA-6B BATTERIES AND BATTALIONS. THE 9A38 WAS BATTERY CP/FC VEHICLE (REPLACING/SUPPLEMENTING 1S91M2E) WITH THE FIRE DOME DUAL MODE TA/FC RADAR AND COULD DIGITALLY LINK TO THE IADS. THE 9A38 LAUNCHER COULD BE FIT TO LAUNCH SA-6 MISSILES TO 25 KM, OR SA-11 TO 3.

LATER, SA-6B/KUB-M4 UNITS USED IMPROVED 9A310 SERIES TELARS (E.G., BUK-M1-2 TELARS WITH 42 KM RANGE), AND THEIR UPGRADE SUPPORT ASSETS. A NEW HYBRID SA-6B STRUCTURE WAS DEVELOPED WITH ADDITION OF LAUNCHER-LOADERS (LLS. NOW BATTALIONS HAVE 3 KUB-M3 BATTERIES (ABOVE), AND 3KUB-M4 BATTERIES. KUB-M4 BATTERIES HAVE 1 BUK-M1/M1-A2 TELAR AND 1 LL, FOR 12 MISSILES AND 42 KM RANGE. THE -M4 BATTERIES CAN HANDLE A WIDER RANGE OF TARGETS AND DISTANCES, FOR LESS COST.

2K12 KUB CZ: RECENT CZ CONVERSION OF SA-6 WITH 3 ASPIDE 2000 SAMS. IT DIGITALLY LINKS TO SA-6 FCS, WITH UPDATED DISPLAY. SAM ENGAGEMENT IS TO 23 KM RANGE AND 25-12,000 M ALTITUDE. SPEED AND PH/PK ARE HIGHER. FIELDING IS IMMINENT.

NOTES

THE ASSOCIATED STRAIGHT FLUSH FIRE CONTROL/TARGET ACQUISITION RADAR VEHICLE USES THE SAME CHASSIS AS THE SA-6A TEL.

RUSSIAN SAM SYSTEM SA-11/GADFLY



SYSTEM	SPECIFICATIONS	FIRE CONTROL	SPECIFICATIONS
Alternative Designations	Buk-M1, Gang	Sights	TV optical auto-tracker
Date of Introduction	1979/ 83 for -M1	Acquisition range (km):	20
Proliferation	At least 5 countries	Navigation systems	Available on all
Target	FW, heli, CM, UAV, guided bomb, artillery rocket, ground targets, ships	Onboard Radar	
Description	Brigade assets include bde/btry CPs and radars, TELARs, launcher-loaders, TM-9T229 missile transporter, maintenance and test units. The 6 batteries have 1 TELAR and 1 LL each.	Name	FIRE DOME
Launcher Vehicle		Function	Dual (acquisition and fire control)
Name	9A310M1 or BUK-M1	Detection Range (km)	80 (2 m2), 100 (3m2)
Description	TELAR	Targets Tracked	1 per SPL vehicle
Crew	4	Frequency	6-10 GHz (H/I band)
Combat Weight (mt)	32.34 for TELAR	Guidance Range	42 km
Chassis	GM-569 armored tracked for CP, radar, TELAR, launcher-loader	Other Assets	SA-11 digitally links to the IADS (e.g., aircraft, intel , and other SAM units. SA-10/20/11 FO radars share data with other units in the IADS net. Other assets are FOs and ELINT, e.g., Orion.
Description	TELAR	Radar	
Length (m)	9.3	Name	9S18M1/SNOW DRIFT
Height (m)	3.8 travel/7.72 deployed	Function	Battery target acquisition radar
Width (m)	3.25	Description	Armored tracked chassis w/ phased array radar and dipole antenna
Automotive Performance		Detection Range (km)	100-150
Engine Name, Type	700-hp diesel	Range Precision	400
Cruising Range (km)	500	Detection Altitude (km)	25
Max Road Speed (km/h)	65, 30 TELARs up	Targets Tracked	75
Fording Depth (m)	1	Frequency	Centimetric 3-D phased array
APU	Yes for TELARs, LL, radars, CP	Azimuth Coverage (°):	360 with rotation
Radio	INA	Emplace/Displace (min):	5
Protection		Other Radars	Regiment/Bde will have

			EW/TA radars, such as SPOON REST or Kasta-2E2.
Armor Protection	Small arms (est.)	Launcher-loader (LL)	
NBC Protection System	INA	Name	9A39M1
ARMAMENTS	SPECIFICATIONS	Function	Battery resupply and TEL
Launcher		Fire Control	None, TELARs guide
Missiles per Launcher	4	Missile Load	8
Reaction Time (min)	0.25-0.5 0.1 for low-flyers	Reload Time (min)	15
Time Between Launches (sec)	3	Emplacement Time (min)	5
Reload Time (min)	12	Function	9S470M1
Fire on Move	No	Data Links	Wire and radio AD net, to IADS net, and to SA-10/Osnova
Emplacement Time from March (min)	5	Targets Tracked	15 (with 6 at TELs)
Displacement time (min)	5	VARIANTS	
Emplace Time for Reposition (sec)	20 for a 100-200 m survivability move.	SA-6B/ KUB-M4/KVADRAT-M4: HYBRID UNIT WITH SA-6, AND OR BUK-M1/SA-11 TYPE TELARS. BUK-M: SYSTEM WITH SA-11 MISSILE. IT HAD THE INADEQUATE TUBE ARM, REPLACED BY SNOW DRIFT. FEW BNS WERE FIELDED. MOST SA-11 UNITS USE BUK-M1. BUK-M1-2 AND SA-17/GRIZZLY: UPGRADE SYSTEMS. Use of LLs is transforming SA-11 units. They appear to be updated and modified SA-6 TELs (2P25s), economically converted to expand the unit missile load, yet requiring SA-11 batteries to have only one expensive TELAR. Thus the force can expand with existing stocks of SA-6.	
Simultaneous targets per launcher	1		
Simultaneous Missiles per Launcher	2		
Missile			
Name	9M38M1		
Range (m):			
Max. Range	36,000		
Min. Range	3,000		
Altitude (m):			
Max. Altitude	22,000		
Min. Altitude	15, 0 with degraded Ph		
Dimensions			
Length (m)	5.55		
Diameter (mm)	400		
Weight (kg)	690		
Max target speed (m/s)	830		
Max missile Speed (m/s)	1,200		
Propulsion:	Solid fuel		
Guidance:	RF, inertial correction, semi-active radar homing		
Warhead Type	Frag HE		
Warhead Weight (kg)	70		
Warhead lethal radius (m)	17		
Fuze Type	Proximity RF		
Probability of Hit (Ph%)	80 FW and heli		
Simultaneous missiles	2 per target		
PROTECTION/COUNTERMEASURES			
Jam ECCM:	Noise jam 240-330 w/MHz		
Passive Jam ECCM	3 Packets/100m		
Measures	One launcher operates radar, while others are passive.		
IFF	Pulse-doppler		

NOTES
TELARS CAN OPERATE AUTONOMOUSLY. LAUNCHER-LOADERS CAN LAUNCH WITH TELAR COMMAND. SA-11 CAN LAUNCH SAMS AGAINST GROUND TARGETS.

RUSSIAN SAM SYSTEM BUK-M1-2 (SA-11 FO) AND BUK-M2E (SA-17)





SYSTEM	SPECIFICATIONS	Jam ECCM	Noise jam 240-330 w/MHz
Alternative Designations	9K37M1-2	Passive Jam ECCM	3 Packets/100m
Date of Introduction	1997	Measures:	One operates radar while others are passive.
Proliferation	At least 3 countries	IFF:	Pulse-doppler
Launcher Vehicle		FIRE CONTROL	SPECIFICATIONS
Name	9A310M1-2	Laser Range-finder	Ground targets to 15 km, waterborne targets 25 km.
Description	TELAR	Sights:	TV optical auto-tracker
Crew	4	Acquisition range (km):	20, permits passive missile guidance, day and night
Combat Weight (mt)	32.34	Navigation systems	Available on all
Description	TELAR	Onboard Radar:	
Dimensions (m)	9.3 length x 3.25 width 3.8 travel/7.72 deployed	Name	FIRE DOME
Automotive Performance	See SA-11	Radar:	
Radio	INA	Name	9S18M1-1/SNOW DRIFT
Protection		Note	It is similar to 9S1M1
Armor	Small arms (est)	Launcher-loader (LL):	9A39M1-1, see 9A38M1
NBC Protection System	Collective	C2 Vehicle	9S470M1-2, see 9S470M1

ARMAMENT	SPECIFICATIONS	VARIANTS
Launcher		BUK AND BUK-M1: PREDECESSORS, HQ-16: CHINESE BUK-M1-2 UPGRADE IN R&D. SA-N-12: NAVAL VERSION WITH 12 X 9M17M/ SHTIL-1 MISSILES IN A VERTICAL-LAUNCH CANISTER. SHTIL-1: NEW SHIP CANISTERED VERTICAL LAUNCHER VERSION WITH 9M317ME MISSILE TO 32 KM. SA-17/GRIZZLY/BUK-M2E/URAL: RUSSIAN REDESIGN/FOLLOW-ON OF SA-11. IT USES 9M317 MISSILES AND 2 NEW RADARS. THE SYSTEM HAS 2 GIRAFFE VEHICLES (WITH DUAL MODE RADARS ON TELESCOPE ARMS), 4 TELARS, 8 LLS, ORION RF INTEL SYSTEM, AND A SUPPORT COORDINATION VEHICLE. ALL BATTERY RADARS ARE CHAIRBACK PHASED ARRAY WITH 160 KM DETECTION, 120 FOR LOW FLYERS. SYSTEM SIMULTANEOUSLY TRACKS 10 TARGETS AND ENGAGES 4 (OR 24/BN). EFFECTIVE RANGE IS 45 KM WITH PH OF 90% FOR FW/HELI, 80 TBMS. MINIMUM ALTITUDE IS 0 M WITH 80% P-HIT. IT NOW AS LIMITED FIELDING IN 1 COUNTRY. IT IS LIKELY THAT INITIAL RUSSIAN UNITS WILL HAVE BATTERIES WITH A TELAR AND 1-4 LLS, SIMILAR TO BUKS IN KUB-M4 BATTERIES. A WHEELED VERSION OF SA-17 IS BUK-M2EK ON A 6X6 BELORUSSIAN CROSS-COUNTRY CHASSIS.
Missiles per Launcher	4	
Reaction Time (min)	0.25-0.5 0.1 for low-flyers	
Time Between Launches (sec)	2	
Reload Time (min)	12	
Fire on Move	No	
Emplace/Displace Time (min)	5	
Emplace Time, Reposition (sec)	20 for a 100-200 m survivability move.	
Missile		
Name	9M317	
Range (km)	3-42, 15 with TV sights	
Altitude (m)		
Max Altitude	25,000	
Min Altitude	0 with degraded Ph	
Dimensions	5.5 m length, 400 mm diameter	
Weight (kg)	715	
Max Target and Missile Speed (m/s)	1,200	
Propulsion	Solid fuel	

Guidance:	**RF command, inertial correction, Semi-active radar homing (9M317A)**	**BUK-M3: AN UPGRADE IN TESTING FOR USE IN ALL PREVIOUS BUK-M UNITS, WITH A NEW RADAR, AND TBM INTERCEPT CAPABILITY TO MACH 4.**
Warhead Type	**Frag HE**	
Warhead Weight (kg):	**70**	
Warhead lethal radius (m):	**17**	
Fuze Type:	**Proximity RF or contact**	
Probability of Hit (Ph%):	**70 TBM, 80 other**	
Simultaneous missiles	**2 per target**	
Other Missile	**9M317A is an anti-radiation homing missile/attack missile interceptor**	

NOTES

THE BUK-M1-2 IS A MULTI-ROLE SYSTEM FOR SAM AND SURFACE-TO-SURFACE MISSILE (SSM) GROUND/SEA TARGET ATTACK MISSIONS.

RECENT DEVELOPMENTS IN LONG-RANGE AND HIGH-ALTITUDE AIR DEFENSE SYSTEMS

The worldwide trend in modernization of long-range AD (LRAD) and high-altitude AD continues, even in times of shrinking military budgets. The trend is driven by expanding strategic threats of aerodynamic systems (e.g., ballistic and cruise missiles, UAVs, and stealth aircraft), and deadly munitions (e.g., weapons of mass destruction and effects, and precision weapons).

Challenges of rising costs and constricted budgets affect the modernization patterns. Most countries continue to focus most of their air defense modernization programs on upgrading and reconfiguring existing older systems. There are upgrade missiles, C2, and fire control assets for Russian SA-5 and other older SAM systems. A few other countries are developing new systems, including anti-ballistic missile (ABM) systems.

The non-US strategic systems that have received most world attention in recent years are the Russian SA-10, SA-12, and SA-20 series missile systems. S-300P (SA-10/-20) series have seen a lot of changes, and a confusing mix of names and designators. The table below is shown to clarify those nomenclatures. Russian forces systems and their export variants in each series may have essentially the same capabilities; but in some cases, due to the lengthy export contract negotiation process, exported systems may be upgraded by the time they are shipped to recipients. Upgrades succeed only when radars and fire control capabilities match missiles with range and altitude coverage.

In recent years we have heard much about the new Russian 4th generation missile system, **S-400/Triumf**. Due to developmental delays and budget issues, the program was delayed. The delays expedited Russian efforts to modernize SA-10 and SA-12 systems, and to incorporate comparable missile/support capabilities into them. Thus **SA-10d** and **SA-10e** upgrades were further modernized and re-designated **SA-20a** and **SA-20b**. An upgraded SA-12 is fielded and designated as the **SA-23**. The S-400/Triumf is now fielded, and designated **SA-21a**. SA-20b and S-400 systems can launch two different sizes of missiles. The large missiles offer superior performance for ballistic missile defense (BMD), and for long-range defeat of AWACS, RISTA, stealth, and SEAD targets. With the changes in SA-20 and SA-21 programs, many sources have confused details related to those systems.

Changes in strategic systems may impact fielding of medium-range air defense systems (MRADs). As the 9M96-series small missiles improve, they will comprise the majority of missiles on S-300/400 launchers, to service most aerial targets. Some countries may choose not to acquire MRADs (e.g., Buk-M1-2), and instead elect to upgrade strategic systems like SA-10/20a to achieve SA-20b capability. But ground forces also want long-range AD. Most MRADSs range only to 50 km, yet lack the surge capacity of the SA-20b and state-of-the-art long-range systems. SA-12/23 units currently have limited surge capacity. Users can now add canisters of small missiles to existing LRADS TELs for increased surge capacity, without the need to add new expensive MRADs.

Russia intends to upgrade strategic SAM systems and upgrade all S-300 and S-400 systems into an integrated network. Plans call for every battery eventually being capable of countering ballistic missiles, surges, and high-value systems (stealth, AWACS, and SEAD). China is upgrading its SA-10/SA-20 systems to achieve parity with Russian systems. Many forces are adding new long-range EW and TA radars and other sensors, and upgrading older systems to extend their range and digitally integrate them into IADS. These upgrades include improved ELINT capabilities, other passive sensors, and responsive, jam-resistant, secure C3 networks to destroy UCAVs and stealth aircraft.

RUSSIAN LONG RANGE SAM SYSTEM SA-5B/GAMMON



SYSTEM	SPECIFICATIONS	FIRE CONTROL	SPECIFICATIONS
Alternative Designations	S-200V, S-200M, or Vega	Radar	
Date of Introduction	1963	Name	SQUARE PAIR
Proliferation	At least 15 countries	Function	Dual mode - target acquisition and fire control
Target	FW, CM	Effective Range (km)	350
ARMAMENT	**SPECIFICATIONS**	Frequency (GHz)	6.62-6.94
Launcher		Frequency Band	H
Description	Single-rail ground-mounted not mobile but transportable	Located	With firing units
Dimensions	INA	Associated Radars	
Weight (kg)	INA	Name	BAR LOCK B (P-50) follow-on (BACK NET initially)
Reaction Time (sec)	INA	Function	TA/EW
Time Between Launches (sec)	INA	Range (km)	250/ 390
Reload Time (min)	INA	Frequency Band	E/F-band (2-2.5 GHz),
Fire on Move	No	Location	Generally with separate EW or signals recon bns
Emplacement Time (min)	Days	Name	BIG BACK
Displacement Time (min)	Days	Function	Very long-range early warning
Missile		Effective Range (km)	600
Name	5V28M/S-200M	Frequency Band	3-d L-band
Range (km)		Location	Brigade Level
Max Slant Range	300	Name	TALL KING
Effective Range	250	Function	Very long-range early warning
Min Range	17	Effective Range (km)	500-600
Altitude (m)		Frequency Band	A-band (150-180 MHz)
Max Altitude	29,000	Location:	Generally with separate early warning or Signals Recon battalions
Effective Ceiling	30,000	Name	BACK TRAP
Min Altitude	300	Function	Very long-range early earning
Dimensions		Effective Range (km)	410
Length (m)	10.7	Frequency Band	A-band (172 MHz)
Diameter (mm)	750	Location	Brigade Level
Weight (kg)	7,100	Name	ODD PAIR, E-band follow-on (SIDE NET/PRV-11 initially)
Wrap Around Boosters		Function	Height finding radar
Length (m)	4.9	Range (km)	INA
Diameter (mm)	500	Frequency Band	E-band

Missile Speed (m/s)	1,100	Location	Generally with separate early warning or Signals Recon bns
Propulsion	2-stage liquid fuel, four wrap-around solid fuel rockets	Other Radars	The SA-5 can also link to the IADS or to other AD units to get analog AD data. Newer radars, such as the Nebo-SVU mobile radar, are marketed, and can be used with SA-5 series systems.
Guidance	Semi-active homing	VARIANTS	
Warhead Type	Conventional (HE) or nuclear	RUSSIAN ARTICLES HAVE PREDICTED MODERNIZATION PROGRAMS, IN ADDITION TO MISSILE UPGRADES. THERE ARE REPORTS THAT THE SQUARE PAIR CAN BE LINKED WITH AND (PERHAPS) SLAVED TO S-300P SERIES TARGET ACQUISITION RADAR, TO ENGAGE TARGETS TRACKED BY THAT RADAR. THUS AN SA-10 OR SA-20 UNIT COULD INTEGRATE LAUNCHES WITH THE SA-5B TO ENGAGE TARGETS BEYOND THEIR OWN 200 KM RANGE (WITH LIMITED THREAT FROM ATMOSPHERIC SYSTEMS), AND COULD PROTECT THE SA-5 LAUNCHERS WITH THEIR BALLISTIC MISSILE CAPABILITIES. SA-10/20 PHASED ARRAY RADARS GREATLY REDUCE DETECTABLE RF SIGNAL. IRAN CLAIMS TO HAVE UPGRADED ITS SYSTEMS WITH BETTER RADARS AND DIGITAL C2.	
Warhead Weight (kg)	60 HE		
Fuze Type	INA		
Probability of Hit (Ph%):	75 FW/85 large		
Simultaneous missile	INA		
Self-Destruct (sec):	INA		
Booster separation at (km):	2		
Reload Time (min):	5		
Other Missiles			
S-200A	Original missile, 160 km		
S-200 Vega/SA-5b	Improved to 300 km, 40 km ceiling		
S-200VE	Export, range 250 km, 29 ceiling		
S-200M/5V28M	Improved to 300 km, 29 ceiling. It can replace S-200VE as upgrade.		
S-200D/SA-5c	Upgrade 400 km, 40 ceiling		

NOTES

THE SA-5/GAMMON IS A LONG-RANGE, STRATEGIC SEMI-ACTIVE GUIDED MISSILE SYSTEM FOR TARGETING MEDIUM-TO-HIGH ALTITUDE HIGH-SPEED AIRCRAFT.

THE MISSILE HAS A LONG CYLINDRICAL BODY WITH A CONICAL NOSE, FOUR LONG CHORD CRUCIFORM DELTA WINGS, FOUR SMALL CRUCIFORM RECTANGULAR CONTROL SURFACES AT THE EXTREME REAR, AND FOUR JETTISONABLE, WRAPAROUND SOLID-FUEL BOOSTERS WITH CANTED NOZZLES. IT USES A LIQUID PROPELLANT, DUAL THRUST ROCKET ENGINE, AND THE MISSILE TRAVELS ABOUT 2 KM BEFORE BOOSTER SEPARATION. THE SUSTAINER HAS FOUR CROPPED DELTA WINGS AND STEERABLE REAR FINS. CONTROL IS ASSISTED BY AILERONS.

S-300P SERIES STRATEGIC AIR DEFENSE SYSTEMS COMPARISON*

NATO DESIGNATOR	SA-10b GRUMBLE	SA-10c GRUMBLE	SA-20a (SA-10d) GARGOYLE	SA-20b (SA-10e) GARGOYLE
LAUNCHERS	5P85SU cmd TEL** 5P85DU slave TEL** 5P85 trailer lchr w/KrAZ-260V	5P85SU cmd TEL** 5P85DU slave TEL** 5P85T trlr lchr w/KrAZ-260V	5P85SE cmd TEL** 5P85TE trlr lchr w/KrAZ-260V	5P85SE2 cmd TEL** 5P85TE2 Trailer w/KrAZ-260V
MISSILES **Range (km)** **Altitude (km)**	5V55R 7-75 0-25 blast radius Also 5V55V (nuc option) 5V55KD (upgrade variant of 5V55K)	5V55RUD 5-90 0-27 blast radius Also 5V55V nuc 5V55PM anti-radiation (ARM) 48N6E (upgrade option)	48N6/ 48N6E export 5-150 0-27 blast radius Also 5V55V nuc 5V55PM anti-radiation (ARM) 48N6E2 (upgrade option)	48N6M /48N6E2 export 5-200 0-27 blast radius ***"Small missile" (4 per canister) 9M96 /9M96E 9M96M /*9M96E2 5-40 5-40 5-120 5-120 0-35 0-35 0-35 0-35 Near term small missiles will range 200 km (upgrade option).
RADARS	64N6/BIG BIRD Bd* bde TA radar vehicle 30N6/FLAP LID-B Battery FC rdr veh 76N6/CLAM SHELL TA on tower trailer (36D6/TIN SHIELD TA trlr in older units)	64N6/BIG BIRD D* (in 83M6 Bd C2 sys) 30N6/FLAP LID-B 76N6/CLAM SHELL TA on tower trailer (Optional 96L6E Bn TA radar vehicle)	64N6E/ BIG BIRD E** (in 83M6E1 Bd C2 sys) 30N6E1/TOMBSTONE Battery FC rdr veh 96L6E Bn TA rdr veh (76N6/CLAM SHELL Optional supplement) Option: NEBO-SVU	64N6E2/ BIG BIRD E** bde TA radar vehicle 30N6E2/TOMBSTONE Battery FC rdr vehicle 96L6E2 Bn TA radar vehicle 76N6/CLAM SHELL bn option sup NEBO-SVU target track radar (Bn)
OTHER SUPPORT	54K6 CP veh (in the 83M6 Bde C2 system) 1T12 survey trk 22T6 loading trk Baikal-1 Bde Intel Ctr 5157 power station MAZ-537 for rdr twr	54K6/Baikal-1 Bde Intel Ctr (in 83M6 Bde C2 system) 1T12-2M, 22T6 5157 power station MAZ-537 for rdr twr 48III6y M Repair Base	54K6E CP veh (in the 83M6E Bde C2 system) 1T12-2M survey trk 22T6 loading trk Baikal-1 Bde Intel Ctr 5157 power station MAZ-537 tows rdr twr 48III6y M Repair Base	54K6E2 CP veh (battle management center in 83M6E2 Bde C2 system) 1T12-2M survey trk 22T6 loading trk Baikal-1 Bde Intel Ctr 5157 power station trailer MAZ-537 tows the radar tower 48III6y Mobile Repair Base

TA radar = Target Acquisition (surveillance, detection, target tracking, IFF)

FC radar = Fire Control (illumination and guidance, missile tracking, IFF).

Radars

Many modern FC radars are dual-mode (capable of TA and FC functions). The 30N6 series radars are dual-mode.

System radars and most others are phased-array. They offer SEAD rejection, low detection, and high jam resistance.

* Fielded systems may adopt radars or missiles of earlier or later versions. Supporting vehicles carry forward, or are upgraded/replaced with new versions. Thus 30N6 on SA-10b and SA-10c is replaced by 30N6E1 on SA-10d. For SA-10b, a76N6 TA radar replaced the36D6 TA radar. An exception to upgradability is the obsolete SA-10a missile, which used radio command guidance, a feature incompatible with later systems. SA-10a units were converted to SA-10b. Missiles with E designators are for use in exported systems, but could be used in domestic Russian launchers as well.

Mobile AD radars with counter-stealth capability, such as the Nebo-SVU and older EW radars, can be used with SA-10/20 systems.

Substantial numbers of air observers will be used. SHORAD systems (including 2 MANPADS/TEL are co-located).

** The TELs are variants of MAZ-543M. Radar and C2 vehicles are on MAZ-543M or MAZ-7910 chassis. Various other trucks and vans are used for support. Radar tower trailers have supporting units for erection and disassembly.

*** Some strategic anti-ballistic missile (ABM) SA-20b units only have 48N6-type “big missiles” and ARMs. In other units, one or more canisters of 4 small missiles will be used. As the smaller (9M96 series) missiles improve in range closer to the big missiles, more launch pods will convert from big missiles to small missiles. Thus the firing units will be able to disperse more widely, with up to four times the target-handling capacity of current firing units.

**** In SA-20a and 20b systems, there are no slave versions of the TELs, only command. Many have the trailer launchers operating out of battalion as primarily transport vehicles for resupplying firing units. They can, however, be used as launchers during air surge activities. Firing units which lose trailer-launchers may then add more TELs.

RUSSIAN SAM SYSTEM SA-10B/GRUMBLE



SYSTEM	SPECIFICATIONS	ARMAMENTS	SPECIFICATIONS
Alternative Designations	S-300PM	Name	64N6
Date of Introduction	1980	NATO Designation	BIG BIRD B
Target	FW, heli, TBM, CM, ASM, UAV	Function	Early warning, target acquisition
Proliferation	At least 8 countries	Unit	Grouping (brigade) level, supports 3-6 90Zh6E complexes (bns), and 12-36 launchers
ARMAMENT	**SPECIFICATIONS**	Mobility	MAZ-7910 van
Transporter-Erector Launcher (TEL):		Detection Range (km)	300 FW/heli, 127 TBM
Name	5P85S or 5P58D	Targets Detected	up to 200
Time Between Launches (sec)	3	Simultaneous Lock and Track	100
Reaction Time (sec)	8-10 (vertical-launch missiles for no slew time)	Frequency Band	F, 3-D phased array
Reload Time (min)	INA	Azimuth Coverage (°)	180, 360 with rotation
Crew	6	Name:	30N6
Fire on Move	No	NATO Designation	FLAP LID-B
Emplace/Displace Time (min)	5/30 TEL 30/30 trailer launcher	Function:	Dual (target acquisition/fire control)
Automotive Performance, 5P85S TEL		Mobility:	MAZ-7910 8x8 van
Chassis	MAZ-7910 (8x8)	Dimensions (m):	14.5 L x 3.2 W x 3.8 H
Engine	D12A-525 525-hp diesel	Unit Associated With	Firing battery
Cruising Range (km)	650	Interception Altitude (m):	25 and higher
Max Road Speed (km/h)	63	Targets Engaged Simultaneously	6
Weight (kg)	42.15 with missiles	Missiles Guided Simultaneously	12
Missile		Frequency Band	I/J phased Array
Name	5V55R	Linked to Integrated Air Defense	Yes
Range (km)	7-75aircraft, 5-35 TBMs	Detection range (km):	200

Altitude (m)		Guidance Range (km):	90+, auto-track
Max Altitude	25,000	Azimuth Coverage (°):	120, 360 with rotation
Min Altitude	25, 0 with blast radius	Many SA-10B units were fielded with 36D6/ TIN SHIELD TA radars. Most were later replaced with 76N6/CLAM SHELL.	
Speed (m/sec)		Other Assets	
Target	50-1,200	VARIANTS	
Max SAM	2,000	SA-10A/S-300P	First system, semi-fixed on trailers, with 5V55K (50 km) missile. Early SA-10b units used the 36D6/TIN SHIELD TA radar, later supplemented or replaced by 76D6/CLAM SHELL
Dimensions		SA-10b	Added TELs, 5V55R (75 km) missiles, and FLAP LID B improved radar
Length (m)	7.25	HQ-2	Chinese copy, indigenous launchers
Diameter (mm)	508	HQ-9	Chinese variant and upgrade
Weight (kg)	2,340 in canister	SA-10c	Russian export upgrade system (aka: S-300PMU) with improved missile
Guidance	Track-Via-Missile (TVM) and missile radar-homing	SA-10f/SA-N-6	Russian naval version. For other variants.
Warhead Type	Frag-HE		
Warhead Weight (kg)	130		
Fuze Type	Radio Command		
Probability of Hit (Ph%):	80 FW and heli		
Simultaneous missiles	2/target (2 x P-hit)		

OTHER ASSETS

THE SA-10B LINKS TO THE IADS TO GET DIGITAL AD DATA FROM EW ASSETS, AD AIRCRAFT, AD INTEL, AND OTHER SAM UNITS. SA- 10 RADARS SHARE DATA WITH OTHER AD UNITS. FORWARD OBSERVERS ARE DISTRIBUTED THROUGHOUT THE COVERAGE AREA. OTHER EW AND TA RADARS CAN USED IN SA-10 GROUPS AND COMPLEXES.

NOTES

ALTHOUGH MANY SA-10B UNITS WERE FIELDED WITH 36D6/TIN SHIELD TA RADARS, MOST WERE LATER REPLACED WITH 76N6/CLAM SHELL. THE PHASED-ARRAY RADARS FEATURE LOW DETECTION, AND HIGH JAM RESISTANCE.

RUSSIAN SAM SYSTEM SA-10C/GRUMBLE (EXPORT)



SYSTEM	SPECIFICATIONS	ASSOCIATED RADARS	SPECIFICATIONS
Alternative Designation	S-300PMU Original fielding was Russian only. This was a commonly exported version of the S-300PM system, including upgrades.	Name	64N6
Date of Introduction	1984	NATO Designator	BIG BIRD D
Proliferation	At least 6 countries	Function	Early warning, target acquisition
Target	FW, heli, TBM, CM, ASM, UAV	Unit	Grouping (brigade) level, supports 3-6 90Zh6E complexes (bns), and 12-36 launchers
Primary Components	SeeSA-10b. TELs are designated 5P85SU and 5P85DU.	Mobility	MAZ-7910 8x8 van
ARMAMENTS	SPECIFICATIONS	Detection Range (km)	300 aircraft, 127 TBMs
TEL and New Semi-trailer Launcher		Number of Targets Detected	up to 200
Name	5P85T (road-mobile only)	Targets for Simultaneous Lock and Track	100
Missiles per Launcher	4	Frequency Band	F, 3-D phased array
Reaction Time (sec)	8-10, vertical-launch missiles for no slew time	Azimuth Coverage (°)	180, 360 with rotation
Time Between Launches (sec)	3	Name:	30N6 (FLAP LID-B) See SA-10b.
Reload Time (min)	INA	Name	76N6
Crew	4-6	NATO Designation	CLAM SHELL
Fire on Move	No	Function	Low altitude target acquisition
Emplace/ Displace Time (min)	5/30	Unit Associated With	Battalion and bde
Automotive Performance	For TEL see SA-10b, except	Mobility	Mounted atop 40V6 trailer tower. Antenna station is on a 5T58 truck
Cruising Range (km)	800	Operation	Station can operate 500m from radar

Road/ Dirt Road Speed (km/h)	60/30 The 5P85TE trailer-launcher is normally towed by a KRAZ-260B 6x6 truck.	Emplacement Time (hrs)	1-2
		Detection Range (km)	
Missile		@ 500 m altitude	93
Name	5V55RUD	@ 1,000 m altitude	120
Range (km)	5-90	Targets Tracked Simultaneously	Up to 180
Max Altitude (m)	27,000	Target Generation Time/Target (sec)	3
Min Altitude (m)	25, 0 with blast radius	Resolution of Target RCS	.02 m2 @ 1400 kts
Speed (m/sec)		Frequency Band	I, 3-D radar
Max Target	1,200	Azimuth Coverage (°):	120, 360 with rotation
Max SAM	2,100	Recent upgrade 96L6E all-altitude target acquisition radar vehicle can replace the CLAM SHELL towed (stationary) site radar.	
Length (m)	7	VARIANTS	
Diameter (mm)	513	RADARS, MISSILES, AND C2 ARE COMPATIBLE AMONG SYSTEM VARIANTS. FORCES MAY USE A MIX OF EARLIER AND LATER ASSETS. LATER C2, MISSILES, AND RADARS ARE COMPATIBLE, AND OTHER UPGRADE ASSETS ARE ALSO COMPATIBLE. FOR OTHER SA-10/20 VARIANTS. HQ-9: CHINESE UPGRADE SA-10B SYSTEM TO NEAR SA-10C, WITH INDIGENOUS TELS AND MISSILES (100-KM) AND HQ-2 75-KM ARM. FT-2000: ADDS A 100-KM PASSIVE ARM.	
Weight (kg)	2,300 in canister		
Guidance	Track-Via-Missile, missile radar homing, home on jam		
Warhead Type	Frag-HE		
Warhead Weight	133		
Fuze Type	Radio Command		
Probability of Hit (Ph%):	80 FW and heli		
Simultaneous missiles	2 per target, doubles the probability of hit		
Other Missiles:	5V55R, in early units 5V55PM anti-radiation missile (radar homing missile), 6Zh48 nuclear warhead missile. An optional upgrade is 48N6. HQ-2 Chinese ARM for FT-2000.		

COMMAND AND CONTROL

THE 83M6 BDE AUTOMATED C^2 SYSTEM INCLUDES THE 54K6/BAIKAL CP VAN AND THE 64N6 RADAR. THE BAIKAL CONTAINS THE BDE BATTLE MANAGEMENT CENTER AND DIGITAL DATA TRANSMISSION SYSTEM.

WITH THIS C^2 AND OTHER COMPATIBLE NETS, THE SA-10 COMPLEX CAN BE USED AS THE BASE FOR AN AREA INTEGRATED AIR DEFENSE SYSTEM. THE SA-10C DIGITALLY LINKS TO EW ASSETS, AD AIRCRAFT, AD INTEL. SA-10 RADARS SHARE DATA WITH OTHER UNITS IN THE IADS NET. THE SYSTEM CAN BE LINKED DIRECTLY OR THRU IADS WITH OTHER AD MISSILE SYSTEM COMPLEXES, SUCH AS SA-5, EARLIER SA-10, AND SA-11. THE 83M6E CAN PASS DETECTIONS (OF UP TO 60 TARGETS) DIRECTLY TO THE RUBEZH-2M AIR INTERCEPT CONTROL NET.

THE OSNOVA-1E INTEGRATED AIR DEFENSE SYSTEM C2VEHICLE CAN PROCESS 120 TARGETS AT A TIME. IT CAN SIMULTANEOUSLY SORT OUT AIRCRAFT ECM (WITH THE AKUP-22 SYSTEM) AND PASS UP TO 80 TARGETS TO BAIKAL-1E OR OTHER AD MISSILE SYSTEMS, AS WELL AS TO RUBEZH-2M.

EVEN IF IADS AND BRIGADE NETS ARE TAKEN OUT OF OPERATION, DUAL-MODE RADARS ON 30N6 PERMIT A FIRE UNIT (BATTERY) TO OPERATE AUTONOMOUSLY.

OTHER ASSETS

FORWARD OBSERVERS ARE DISTRIBUTED THROUGHOUT THE COVERAGE AREA. SA-10C GROUP INCLUDES 85V6E/ORION ELINT. THE NEBO-SV MOBILE COUNTER-STEALTH RADAR SYSTEM OR NEWER NEBO-SVU CAN LINK TO SA-10C, WITH COUNTER-STEALTH DETECTION TO 350 KM.

NOTES

MOST UNITS USE TELS ONLY, NOT SEMI-TRAILER MELS (MOBILE ERECTOR LAUNCHERS). CHINESE UPGRADES SIMILAR TO SA-10C ARE CALLED HQ-10 AND HQ-15.

THE PHASED-ARRAY RADARS FEATURE LOW DETECTION, AND HIGH JAM RESISTANCE.

RUSSIAN SAM SYSTEM SA-12A AND SA-12B, SA-23, AND S-300V4



SYSTEM	SPECIFICATIONS	command and control	SPECIFICATIONS
System Designation	Antey S-300V	Name	9S457-1
Date of Introduction	1982	Function	Command Post tracked vehicle
Proliferation	At least 6 countries	Unit	Brigade, links to up to 4 9S15
Targets	FW, heli*, TBM, CM, ASM, UAV	Targets Detected	200
Launcher Vehicle	9A83, GLADIATOR, SA-12a 9A82, GIANT, SA-12b	ASSOCIATED RADARS	SPECIFICATIONS
Name	TELAR	Name	9S15MTS
Description	4	NATO Designator	BILL BOARD-A
Crew	MT-T heavy tracked chassis	Function	Early warning, target acquisition
Chassis		Unit Associated With	Brigade
Weight (mt)	48	Mobility	Tracked vehicle-mounted
Dimensions (m)		Detection Range (km)	10-250
Length	12.3 LLVs & 9A85, 14.5 9A82	Range Accuracy (m)	250
Width and Height	3.38 and 3.78	Azimuth Coverage/Sweep:	360°, 6-12 sec
Automotive Performance		Number of Targets tracked	up to70
Engine		Frequency Band	F (3-4GHz), phased array
Cruising Range (km)		ECCM:	Operates in jam 1-2kW/MHz
Max Road Speed (km/h)		Emplace/Displace (min):	5
ARMAMENT	SPECIFICATIONS	Name	
Transporter-Erector-Launcher		NATO Designator	HIGH SCREEN
Reaction Time (sec):	40 alert, 15 launch	Function	Sector TA for TBMs
Time Between Launches (sec):	1.5	Unit Associated With	Brigade
Brigade missile load	96-192 (4-8/TELAR)	Mobility	Tracked vehicle-mounted
Fire on Move	No	Detection Range (km)	200
Emplacement/displacement time (min):	5	Range Accuracy (m)	
Navigation equipment	FCS embedded	Number of Targets tracked	16-20 based on jamming
Onboard fire control	Illum/guidance radar	Frequency Band	INA 3-D phased array

	180, 360 per rotation	Azimuth Coverage (°):	90, 360 with rotation
Missiles		Name	9S32-1
Name	9M83 aka GLAD/GLADIATOR	NATO Designation	GRILL PAN
Type	Two-Stage, solid-fuel	Function	In FC tracks missile and remote controls TELAR guidance radars
Primary Targets	Dual - aircraft/missiles	Unit	Battery, receives mission from CP
Launch Mode	Vertical launch	Mobility	Tracked vehicle-mounted
Range (km)	6-80, 30 TBMs	Detection Range (km)	150, 140 automatic
Altitude (km)	0.025 - 25	Targets Tracked Simultaneously	up to 12
Max Speed (km/sec)	3.0 target, 1.7 SAM	Missiles Guided Simultaneously	up to 6
Dimensions	7.9 m x 915 mm diameter	Frequency Band	INA 3-D phased array
Weight (kg)	2,400	Azimuth Coverage (°):	42, 360 with rotation
Guidance	inertial/radar SAH Home on jam	LAUNCHER-LOADERS	SPECIFICATIONS
Warhead Type	Focused Frag-HE	Name	9A84 - GIANT, 9A85 - GLADIATOR
Warhead Weight (kg)	150	Function	Can launch with TELARs nearby; Use same chassis.
Fuze Type	radio cmd or proximity	VARIANTS	
Probability of Hit (Ph%):	90 FW, 70 heli	SA-23/S-300VM: INTERIM UPGRADE OF 5 UNITS AROUND MOSCOW, WITH 9M82M /3M MISSILES. 9M82M RANGES 200 KM, IS IMMUNE TO ECM, AND CAN INTERCEPT BALLISTIC MISSILES AT 4,500 M/S (MRBMS FROM 2,500 KM). THE 9M83M RANGES TO 110 KM. EXPORT NAME IS ANTEY-2500. S-300V4: A DEEPER MODERNIZATION BEYOND THE ABOVE INTERIM UPGRADE. NEW MISSILES ON THE 12A AND 12B LAUNCHERS RANGE 120+ AND 300+ KM, RESPECTIVELY. THE SYSTEM MAY LINK TO OTHER S-300 SYSTEMS FOR RANGE OF 300 ± KM AND BETTER INTEGRATION. FIELDING IS UNDERWAY. SAMODERZHETS: SOME SOURCES SAY THIS IS THE PROGRAM FOR INTEGRATING/UPGRADING ALL S-300 SYSTEMS. IT MAY INCLUDE A MISSILE TO BRING OLDER TELS UP TO MODERN STANDARDS. RECENT UPGRADES MAY HAVE OVERTAKEN IT.	
Simultaneous missiles	2 per target		
Name	9M82 aka GIANT, Zur-1, SA-12b		
Type	Two-Stage, solid-fuel		
Primary Target	TBMs-IRBMs		
Launch Mode	Vertical launch		
Range (km)	13-100 aircraft, 40 TBMs		
Altitude (km)			
Max Altitude	25 TBMs, 30 aircraft		
Min Altitude	2 TBMs, 1.0 aircraft		
Max Speed (km/s)	3.0 target, 2.4 SAM		
Dimensions	9.9 m x 1215 mm diameter		
Weight (kg)	4,600		
Guidance	Inertial, radar semi-active homing (SAH), home on jam		
Warhead Type	Focused Frag-HE		
Warhead Weight (kg)	150		
Fuze Type	radio command or proximity		
Probability of Hit (Ph%)	80 FW, 70 TBM		
Simultaneous missiles	2 per target		

OTHER ASSETS

THE SA-12 SYSTEM DIGITALLY LINKS TO THE IADS (E.G., EW ASSETS, AIRCRAFT, INTEL, AND OTHER SAM UNITS. RADARS SHARE DATA WITH OTHER UNITS IN THE IADS NET. OTHER ASSETS ARE FOS AND ELINT (ORION). THE NEBO-SV/BOX SPRING OR NEBO-SVU COUNTER-STEALTH RADAR CAN BE USED.

NOTES

THE SYSTEM GENERALLY DOES NOT TARGET HELICOPTERS, BUT WILL FOR SELF-DEFENSE. THE PHASED-ARRAY RADARS FEATURE LOW DETECTION, AND HIGH JAM RESISTANCE

RUSSIAN SAM SYSTEM SA-20A/GARGOYLE



SYSTEM	SPECIFICATIONS	ASSOCIATED RADARS	SPECIFICATIONS
Alternative Designation	S-300PMU1, Previously SA-10d.	Name	64N6E
Date of Introduction	1990-93	NATO Designator	BIG BIRD E
Proliferation	At least 6 countries	Function	Early warning, target acquisition
Target	FW, heli, TBM, CM, ASM, UAV	Unit	BDE supports 3-8 90Zh6E complexes (BNs - 12-36)
Primary Components	See SA-10c, above.	Mobility	MAZ-7910 8x8 van
ARMAMENT	**SPECIFICATIONS**	Detection Range (km)	300
TEL and Trailer Launcher		Number of Targets Detected	up to 200
Name	5P85SE TEL only, ground units 5P85TE trailer launcher for site defense See SA-10c, above. Note other updated equipment in the Comparison Table.	Targets Simultaneous Lock and Track	100
Automotive Performance	For 5P85SE TEL on MAZ-5910, see SA-10b, except the following.	Frequency Band	F, 3-D phased array
Cruising Range (km)		Azimuth Coverage (°):	360 with rotation
Road/Dirt road Speed (kmh):		Emplace/Displace Time (m)	5
The 5P85TE trailer-launcher is normally towed by a KRAZ-260B 6x6 truck.		Name	30N6E1
Missile		NATO Designator	TOMBSTONE
Name	48N6/ 48N6E export	Function	Dual (TA/FC) and battery CP
Type	Single-Stage, solid-fuel	Unit	Battery (SAM system), for 3 launchers
Launch Mode	Vertical launch	Mobility	MAZ-7930 8x8 van
Launch Range (km)	5-150	Detection Range (km)	300
Max Range	40	Guidance Range (km)	200 auto-track

Targets .5-1 km altitude	28-38	Targets Engaged Simultaneously	up to 6
Altitude (m)	6-27,000 0 with blast radius	Missiles Guided Simultaneously	up to 12
Speed (m/sec)		Frequency Band	I/J, 3-D phased array
Max Target	2,800	Name	96L6E
Max SAM	2,100, 25g turn	Function	All-altitude target acquisition and processing center - replaces CLAM SHELL
Dimensions	7.5 m length 519 mm diameter	Unit Associated With	Battalion (2-6 btry)
Weight in Canister (kg)	2,580	Mobility	MAZ-7930 8x8 van
Guidance	Track-Via-Missile, missile radar homing, home on jam	Operation	Up to 5 remote workstations
Warhead Type	Frag-HE	Emplacement/ Displacement Time (min)	5 for truck, 30 towed, 120 for mast mounted
Warhead Weight (kg)	145, twice the previous KE from warhead fragments	Range (km)	300, more with 40V6M tower
Fuze Type	Radio command	Targets Tracked Simultaneously	up to 100
Probability of Hit (Ph%):	90 FW/heli, 70 others.	Frequency Band	Centimeter L-band, 3-D phased-array
Simultaneous missiles	up to 2 per target	Azimuth Coverage (°):	120, 360 with rotation
Other Missiles	5V55R, original missile. First export missile was 5V55RUD. Optional export upgrade (see above) is 48N6E. 5V55PM anti-radiation missile, 6Zh48 nuclear warhead missile. HQ-2 Chinese ARM for FT-2000.	The antenna can be mounted on a 40V6M tower with same height as CLAM SHELL	

VARIANTS

SA-10C: THIS IS A COMMONLY EXPORTED VERSION OF S-300. OPTIONAL UPGRADES OF C^2, MISSILES AND RADARS ARE AVAILABLE.

SA-20A/SA-10D/S-300PMU1: THIS SYSTEM UPGRADE WAS DESIGNED FOR 48N6/48N6E MISSILES. MOST EQUIPMENT IS COMPATIBLE WITH

SA-10C. CHINA HAS ACQUIRED SA-20A, AND IS UPGRADING EARLIER LAUNCHERS TO THIS CAPABILITY. IT IS ALSO TRYING TO UPGRADE TO SA-20B.

SA-20B/FAVORIT: RUSSIAN IMPROVED SYSTEM WITH UPGRADE TO 200-KM 48N6E2 MISSILE AS WELL AS 9M96 SERIES "SMALL MISSILE."

OTHER ASSETS

THE SA-20A DIGITALLY LINKS TO THE IADS, INCLUDING AD AIRCRAFT, AND OTHER SAM UNITS IN THE IADS NET. FORWARD OBSERVERS ARE DEPLOYED THROUGHOUT THE COVERAGE AREA. EACH BRIGADE ALSO HAS AN 85V6E/ORION ELINT. FOR OSNOVA-1E IADS C2 VEHICLE AND 83M6E AUTOMATED C2 SYSTEM.

NOTES

THE "BIG MISSILE" COULD BE REPLACED WITH 4 N6M/4 N6E2 (NEXT PAGE). THE 30N6E1 MAY NOT BE ABLE TO USE THE FULL 200 KM MISSILE RANGE AGAINST SOME SMALLER AERIAL TARGETS; BUT IT CAN AGAINST LARGER TARGETS. THE PHASED-ARRAY RADARS FEATURE LOW DETECTION, AND HIGH JAM RESISTANCE.

RUSSIAN UNIVERSAL SAM SYSTEM SA-20B/FAVORIT



SYSTEM	SPECIFICATIONS	Name	9M96E2/9M96M "small missile"
Alternative Designation	S-300PMU2/ GARGOYLE or GARGOYLE B. Favorit is Russian forces and export	Type	Single-Stage, solid-fuel "Hittile" – (agile "hyper-maneuver" with small HE)
Date of Introduction	1996	Launch Mode	Vertical launch
Proliferation	Fielded in 6 countries	Launch Range	1-120
Target	FW, MRBM, heli, CM, ASM, UAV, and artillery rockets	Altitude	30,800 5, 0 with blast radius
ARMAMENT	SPECIFICATIONS	Max Target	4,800
TEL and Trailer Launcher		Max SAM	1,800 and 20+ g turns with thrust vectoring
Name	5P85SE2 TEL and 5P85TE2 TL	Length (m)	5.65
Chassis	MAZ-5910 chassis for TEL KRAZ-260 tractor for TL (MEL)	Diameter (mm)	240
Missiles per Launcher	4 for 48N6E2 16 for 9M96E/E2, in 4 pods	Weight (kg)	420, 2,700 for container of 4
Automotive Performance	5P85SE2 TEL on MAZ-5910	Guidance	Track-via-missile, active radar homing, also ARM and home on jam
Missile		Warhead Type	Controlled frag-HE
Name	N6M/4 N6E2 "big missile"	Warhead Weight (kg)	24
Type	Single-Stage, solid-fuel	Fuze Type	"Smart" prox, frag shaping
Launch Mode	Vertical launch	Probability of Hit (Ph) %:	90 FW, and heli 80 others
Launch Range (km)	5-200	Simultaneous missiles	up to 2 per target
Max Range TBMs	40	Other Missiles	Previous 48NE missile (150 km) can be used. 9M96E ranges 40 km. Domestic 9M96M ranges 120 km.
Targets .5-1 km high	28-38	ASSOCIATED RADARS	SPECIFICATIONS

Max. Altitude	27,000	NATO Designator	BIG BIRD E See 64N6E at SA-20a
Min. Altitude	6, 0 with blast radius	Detection Range (km)	400
Speed (m/sec):		Name	30N6E2
Max Target	2,800	NATO Designation	TOMBSTONE See 30N6E1 at SA-20a
Max SAM:	2,100, 25g turn	Guidance Range (km)	200
Dimensions:		Name	96L6E Target acquisition radar and battle mgmt center at battalion.
Length (m)	7.5	Nebo-SVU	VHF (counter-stealth) TA radar is located at brigade level.
Diameter (mm)	519	Other Assets	The SA-20b digitally links to the IADS. Each brigade also has an 85V6E/Orion ELINT system.
Weight in Canister	2580		
Guidance:	Track-Via-Missile, missile radar homing, home on jam		
Warhead Type	Frag-HE		
Warhead Weight (kg):	180		
Fuze Type	radio command		
Probability of Hit (Ph%):	90 FW, 70 for high-speed missiles and TBMs, 80 others		
Simultaneous missiles	up to 2 per target		

VARIANTS

THIS SYSTEM (ORIGINALLY CALLED SA-10E) WAS DESIGNED AGAINST BALLISTIC MISSILES AND LOW MANEUVERABLE SYSTEMS SUCH AS UAVS, ARTILLERY ROCKETS (LIKE MLRS), AND AIR-LAUNCH MISSILES. IMPROVED FROM SA-10D, IT IS COMPATIBLE WITH MOST OF THE EQUIPMENT FOR SA-10B, C, AND D (SA-10A). STRATEGIC ABM UNITS HAVE ONLY BIG MISSILES.

CHINA IS ORDERING SA-20B AND UPGRADING OTHER LAUNCHERS TO SA-20B CAPABILITY.

S-400/SA-21A: THE SYSTEM WAS FIELDED IN 2007 WITH RUSSIAN VEHICLES. IT SHARES 9M96-SERIES MISSILES WITH SA-20B. THE SYSTEM WILL USE NEW, MORE POWERFUL RADARS, INCLUDING PROTIVNIK-GE AND NEBO-M, AND WILL INTERLINK WITH SA-20 LAUNCHERS.

SA-21B/SAMODERZHETS: NEAR-TERM UPGRADE FOR ALL S-300/S-400 SYSTEMS. THE PROGRAM HAS IMPROVED INTEGRATION AND MISSILE.

NOTES

ABOVE PHOTO SHOWS FAVORIT WITH 1 CANISTER OF 9M96E2 MISSILES. BY SHIFTING FROM 1 SMALL-MISSILE POD PER LAUNCHER TO 2-4, THE NUMBER OF MISSILES PER LAUNCHER CAN INCREASE FROM 7 TO 10, 13, OR 16. THE PHASED-ARRAY RADARS FEATURE LOW DETECTION, AND HIGH JAM RESISTANCE.

RUSSIAN SAM SYSTEM SA-21A/GROWLER/S-400



SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designations	Triumf, Triumph as a translation	Name	91N6E2 BIG BIRD E It is an improved SA-20B EW/TA radar, with an AD intel processing center on a MAZ-7930 towed van trailer, co-located with the brigade CP/battle management center. See 64N6E at SA-20a.
Date of Introduction	2007	Detection Range (km)	At least 400
Proliferation	Fielded in 1 country	Azimuth Coverage (°):	360
Target	FW, IRBMs to 3,500 km, heli, CM, ASM, UAV, and artillery rocket	Name	Nebo-SVU/1L119 This VHF target acquisition radar is at Brigade level. The first search priority is stealth aerial systems. Because of limited sector coverage, it is likely that up to 4 will be used.
Primary Components	Group/brigade 2-8 bns and 91N6 E2. Each bn has 6-12 trailer launchers (TLs, aka mobile erector-launchers or MELs) , 55K6E 8x8 van, 5T58-2 SAM transporter, 22T6-2 loading crane, and radars. Battery (firing unit) has 3 TLs.	Name	96L6E TA radar/battle mgt center is initially at bn until 59N6 replaces it.
ARMAMENT	SPECIFICATIONS	Name	59N6/Protivnik-GE
Trailer Launcher (TL) or MEL		Function	All-altitude target acquisition and Unit Associated With: Battalion (2-6 btry)
Name	5P85TE2	Unit Associated With	Trailer with KrAZ-260 tractor
Tractor	BAZ-64022 6x6 tractor	Mobility	Trailer with KrAZ-260 tractor
Missiles per Launcher	3 x 40N6 4 x 9M96E2 (current likely mix)	Operation	Digital links to battery, battalion, and brigade/IADS processing center

Automotive Performance	For 5P85TE2 TL	Emplacement/Displacement time (min):	15
Cruising Range (km)	800 (est)	Range (km):	400
Road/ Dirt Road Speed (km/h)	60/30 (est)	Targets Tracked Simultaneously	up to 150
Missile		Frequency Band	AESA Decimetric L-band, 3-D phased-array
Name	40N6 “big missile”	Azimuth Coverage (°):	120, 360 with rotation
Type	Solid-fuel	Name	92N2E
Launch Mode	Vertical launch	NATO Designation	GRAVESTONE
Launch Range (km)	5-400	Function	Dual (TA/FC) radar vehicle and CP
Max Range TBMs	40	Unit	Battery (SAM system), for 3 launchers
Targets	28-48	Mobility	MAZ-7930 8x8 van
Altitude (m)		Detection and Guidance (km)	400 auto-track
Max Altitude	0,000+	Targets Engaged Simultaneously	up to 6 (est)
Min Altitude	5, 0 with blast radius	Missiles Guided Simultaneously	up to 12 (est)
Speed (m/sec)		Frequency Band	I/J, 3-D phased array
Max Target	5,000	Azimuth Coverage (°):	120, 360 with rotation
Max SAM	4,800		
Dimensions			
Length (m)	7.5		
Diameter (mm)	519		
Weight (kg)	2,000, 2,800 in canister		
Guidance	Track-Via-Missile, missile active radar homing, home on jam		
Warhead Type	Frag-HE		
Warhead Weight (kg)	180+		
Fuze Type	Radio command		
Probability of Hit (Ph)%:	90 FW. 80 heli		
Simultaneous missiles	up to 2 per target (doubles probability of hit)		
Name	9M96E2/9M96M “small missile. ”A canister of 4 can fit on the SA-21 launcher in place of a big missile. It is possible that most launchers in most batteries (by the Near Term) will have 2 canisters of small missiles (8 total).		
Other Missiles	The system can also launch older missiles for SA-10 and SA-20 systems. There are reports of a 48N6DM missile, which offers longer range than the 48N6. This may		

	have been an interim missile for use until 40N6 was fielded.		

OTHER ASSETS

THE SA-21A DIGITALLY LINKS TO THE IADS, AND SHARES DATA WITH OTHER UNITS IN THE NET. FOR DISCUSSION OF OSNOVA-1E IADS C2 VEHICLE, BAIKAL-1E, RUBEZH-2M, 83M6E2 AUTOMATED C2 SYSTEM , AND OTHER ASSETS. FORWARD OBSERVERS ARE DEPLOYED THROUGHOUT THE COVERAGE AREA. EACH BRIGADE ALSO HAS AN 85V6E/ORION ELINT.

AN IADS DIGITALLY INTERFACES THE NEBO-SVU COUNTER-STEALTH RADAR SYSTEM, PROTIVNIK, AND 96L6E, TO OVERLAY DETECTIONS.

A RECENT COUNTER-STEALTH RADAR SYSTEM IS THE NEBO-M MOBILE MULTI-BAND SYSTEM, WITH THREE VEHICLES. RLM-D HAS L-BAND RADAR. RLM-S HAS X-BAND. RLM-M HAS A VHF RADAR, SIMILAR TO NEBO-SVU. THE SYSTEM IS SPECIFICALLY DESIGNED AGAINST STEALTH AIRCRAFT AND F-35. A RECENT RUSSIAN CONTRACT CALLS FOR 100 SYSTEMS TO REPLACE NEBO-SVU IN SA-20B/S-400 UNITS, AND WILL BE INCLUDED IN SA-23/S-300V4 UNITS.

VARIANTS

THE S-400 SERIES USES A NEW ARRAY OF TRUCKS, TRACTORS, AND TRAILERS. DUE TO S-400 PRODUCTION DELAYS, THE SA-20 SERIES WAS CONFUSED WITH IT. MANY S-400 UPGRADES CAN BE APPLIED TO SA-10, SA-12, AND SA-23. CHINA IS ORDERING SA-20B AND UPGRADING OTHER LAUNCHERS TO SA-20B CAPABILITY.

S-400/SA-21A: THE SYSTEM WAS FIELDED IN 2007 WITH RUSSIAN VEHICLES. EARLY UNITS ARE STRATEGIC AND USE ONLY 40N6 400-KM BIG MISSILES. MOST LAUNCHERS CAN ALSO MOUNT CANISTERS OF 9M96 SERIES SMALL MISSILES.

SA-21B/S-400M/SAMODERZHETS: UNLIKE THE OTHER. SAMS, SA-21A'S 40N6 WILL RANGE 400 KM.

NOTES

THERE ARE ALSO REPORTS OF A SYSTEM IN DEVELOPMENT CALLED S-500, WITH LONGER RANGE AND A DESIGN VELOCITY OF 10,000 M/S. NO DETAILS ARE AVAILABLE. THE PHASED-ARRAY RADARS FEATURE LOW DETECTION, AND HIGH JAM RESISTANCE.

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Worldwide Equipment Guide

Chapter 1: Littoral Systems



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Chapter 1: Littoral

This chapter focuses on vessels for use in littoral ("near the shore") operations. Littoral activities include the following:

- "brown water" naval operations in coastal waters (out to as far as 200+ km from shore),
- amphibious landing operations or port entry (opposed and unopposed),
- coastal defense actions (including patrols, engaging enemy, and denying entry)
- operations in inland waterways (rivers, lakes, etc), and
- actions in large marshy or swampy areas.

There is no set distance for “brown water.” Littoral range is highly dependent on specific geography at any point along a coast. Littoral operations can be highly risky. Forces moving in water are often challenged by nature and must move at a slow pace while exposed to enemy observation and fires. Thus littoral forces will employ equipment best suited for well-planned operations with speed, coordination, and combined arms support. Littoral forces will employ a mix of conventional forces, specialized (naval, air, and ground) forces and equipment, and civilian equipment which can be acquired or recruited for the effort. Each type of action may require a different mix of equipment to deal with challenges of terrain, vulnerability, and enemy capabilities.

Coastal water operations can utilize naval vessels that can operate in blue water. Naval battle groups for deep water also operate in littoral waters. Submarines and anti-submarine warfare (ASW) systems conduct missions in littoral waters. But challenges of shallow waters and shoreline threats also require use of smaller fast-attack boats, patrol craft, cutters, etc. Other craft include tug and maintenance boats, amphibious aircraft, and submarines. Many of the surface vessels in Chapter 1 are designed for littoral operations. Newer technologies are contributing to vessel designs for littoral waters. Along coastal areas, naval craft support ground forces by transporting troops and supplies as needed. For patrols in search of enemy and smuggler activities, stealthy high-speed craft are valuable assets. Paramilitary, police, security force, and other authorized agency craft will also operate in these waters. Most vessels in these waters are civilian commercial watercraft (for shoreline maintenance, fishing, and transport) and private pleasure craft. Insurgent forces and smugglers use these craft and may even “hide in plain sight.”

Amphibious landing operations need additional vessels, including landing craft, and shallow water close-in Amphibious landing operations need additional vessels, including landing craft, and shallow water close-in fire support craft to suppress ground targets and provide air defense. Air cushion landing craft (aka landing craft air cushion – LCAC) offer speed and agility to insert assets early in an operation. Other equipment includes unmanned underwater vessels (UUVs) for vessel inspection, reconnaissance, etc. Assets include special purpose forces (SPF), with specialized equipment, such as coastal infiltration submarines (see Sang-O at pg 2-7), midget submarines, scuba gear, semi-submersible infiltration landing craft (pg 3-10 below), and mother ships for surreptitious launch. Aircraft support missions include anti-ship and anti-landing fires, surveillance, and transport. Inflatable boats (modular, rigid, and rigid-hulled) are widely used.

Most vehicles classified as amphibious are not really designed to operate in sea state 3 or greater. Thus they must be used in fairly calm waters or launched close to shore from landing craft.

Many countries, however, have a fairly wide variety of vehicles for use in coastal amphibious operations. Some of the largest amphibious forces are in conventional army units that must operate in littoral zones. Thus they must have many vessels, special vehicles, and support assets. Combat vehicles for amphibious operations include selected IFVs and APCs (Vol 1 pg 3-41), light tanks and other heavy armored combat vehicles (HACVs, Vol 1 pgs 6-42 through 58). Chinese forces have added several fighting vehicles with buoyant front compartments for use in high sea states. These include the Type 90 APC, ZBD2000 IFV, and Type 63AM (aka Type 99) light amphibious tank. Highly amphibious combat support vehicles (CSVs) include the U.S. DUKW and the Russian PTS-M. Support equipment includes bladders to attach to vehicles and equipment, and amphibious trailers, such as the Russian PKP (for use on land and water).

Coastal defense forces include conventional units and weapons. Many ATGMs can destroy naval vessels (including NLOS systems, Vol 1 pg 6-75). Specialized weapons include anti-ship missile systems, e.g., Harpy, HY-2/SILKWORM, and supersonic missile BrahMos (Vol 2, pg 5-14). Other specialized systems include aircraft and anti-ship artillery systems (like the Russian Bereg SP cannon system). Torpedoes (such as the high-speed Shkval-E) can be launched from ships or underwater launchers to destroy vessels. Air defense missile systems, e.g., Russian SA-11 and Buk-M1-2 (Vol 2, pg 6-78), can be used as anti-ship missiles. Naval aircraft (e.g., the Russian Ka-27/HELIX) and UAVs can be used for coastal defense forces. Engineers and other support units will emplace obstacle systems underwater and ashore at likely landing areas. Surface and subsurface minefields will target surface vessels and submarines, and slow and channelize movement. Anti-landing mines are laid close to shore and at landing sites. Remote mine and rocket launchers deliver fires and strikes at landing craft and vehicles attempting to breach gaps in obstacle systems. Missile, gun, and rocket weapons will deliver precision strikes. Unmanned surface vessels with remote operated weapons can patrol and attack enemy targets.

Most large military forces conducting large military offensive operations will use ports to bring in forces or support the forces. The OPFOR will focus great effort to deny waterborne early entry and prevent sustained embarkation operations. They will use all available air, land, and naval forces. They will attack the force at critical nodes such as restricted waterways, including straits, channels, canals, harbors, and in port areas, to destroy the force and deny facilities. Mines, torpedoes, submarines, fast-attack craft, SPF, insurgents, and other means will be used.

Crossings in inland waterways are described in Army Field Manual 7-100.2 (Chapter 12). Factors such as gap width, depth, water speed, and threat (whether the crossing is opposed, etc.) affect the choice of equipment used. Coastal patrol, fast-attack, and landing craft can be used in inland waterways. Shallow-draft military riverine craft and commercial boats are widely used.

Airboats can move quickly, even in the shallowest waters. Barges can mount weapons and supplement carrying capacity of vessels. Amphibious vehicles are widely used. Improvised swim assists such as bladders and barrels enable equipment and vehicles to cross water gaps. Hydro-propulsion water-craft and craft with snag protection are widely used. Jet skis (aka wave runners) can be adapted for military use, even mounting weapons and operating rapidly in shallow waters. Seaplanes and aircraft fitted with pontoons can access areas difficult to reach by land.

Engineer assets are used in gap crossings. Reconnaissance assets, e.g., Russian IRM armored reconnaissance vehicles, frogmen with Scuba gear, re-breathers, mini-subs, and underwater propulsion units, shoreline recon units, and underwater maps help prepare a crossing.

Atmospheric diving suits (ADS) are used in all waters for longer-duration underwater work (deep sea diving, ship and harbor repair, surveillance, and engineer work). Civilian divers will also be used. Bridge vehicles can be used for narrow crossings. Pontoons, amphibious transporters and ferries can be used for wider gaps. Boats and amphibious trailers are used.

Pioneer units and others use improvised assets to aid in crossings. Inflatable rafts and improvised aids, such as wooden rafts constructed from nearby timber and structures, will be used to supplement military assets. Boats can be lashed together to substitute for pontoons as improvised bridges. They may even be planked with boards to support vehicles and equipment.

Mechanized amphibious units will include companies and battalions organized and equipped for use in opposed crossings. These units are carefully coordinated with supporting units to use deception, surprise, supporting fires (direct and indirect), and rapid maneuver to cross and to seize the other shore. Assets will include armored amphibious vehicles, fire support vehicles, and other support systems with amphibious capabilities. Aircraft and airborne/air assault assets will be used if available. Water-borne assets will attempt to expand the crossing area and bridge the gap (if needed for support assets to cross). Engineer ferries and transporters can be used once the site is secured. Non-swimming vehicles with high-ford designs and snorkels can be used in many crossings. Some tanks with snorkels can ford in waters to 5 m in depth. Winches on fording vehicles aid in navigating narrow water crossings.

Defense of inland waterways is primarily executed with conventional units. Additional equipment can include crossing assets (above, such as commercial watercraft, and anti-landing mines). The Russian KPDM-4 cassette anti-landing mine system offers 50-m ground launch range, for concealed or defilade launch. The VSM-1 helicopter minelayer can also be used.

Marshy and swampy areas require a mix of boats and vehicles that can move in very shallow waters. Airboats and tracked vehicles designed for very low ground pressures can be useful for rapid movement in these areas. The Ukrainian/Russian MT-LB armored transporter, and the Swedish Bv-206 are far-better suited for these terrains. Wheeled vehicles are poorly suited for this terrain. Even many amphibious tracked vehicles cannot be used in these areas, due to excessive ground pressure. In areas with 1 to 3 feet of water with muddy bottoms and banks, and some obstruction (stumps, brush, etc.), vehicles may find the going very slow. Winches, hoists, and saws are critical assets for pulling out vehicles and clearing obstructions. Engineer road clearing and reconnaissance vehicles (Vol 1, pgs 8-37 thru 41) can help. A wide array of other support and combat support assets can be used in littoral missions, including water crossings and actions in nearby land areas (including ports, coasts, and marshy or sandy areas).

Improvised assets are used by civilians in marshy areas, and will be exploited by military forces. Large numbers of flat-bottom boats, amphibious ATVs (such as Supacat, Vol 1, pg 3-73), and dismounted infantry are needed. So-called “swamp buggies” can be fashioned from trucks and tractors with large wide wheels for low ground pressure and high ground clearance. They can transport assets, free mired vehicles, and be fashioned into “technicals” for fire support.

Modern Technologies in Littoral Craft Design

There are several modern technologies for vessel design which offer more rapid movement for executing military operations. Some of these are quite costly, or are more suitable for calmer littoral waters, higher mission rates over shorter operating range, or for use in specialized missions.

Hydrofoils are increasingly used in commercial ferries, which can be exploited for military use. Some military patrol craft forces, including U.S. and Russian examples, feature hydrofoils. Discussion of this technology can be found below.

Another modern technology for modern craft is the ***air cavity*** hull design. With a scalloped cross-section, catamaran and trimaran designs mean that much of the hull is above the waterline, for reduced drag and shallower draft. These designs are increasingly being used in the commercial sector for sail craft and for racing boats. They also offer wider hulls for better stability over the waves, and more space to carry wide loads. They are popular for ferries and other roles carrying wide loads, such as vehicles. Capabilities for higher speed, dependable operation (with no need for mechanisms which can fail, e.g., hydrofoils), a stable platform, and shallow draft mean that coastal patrol and attack craft can use this design. A further development of the air cavity design technology is the addition of wave-piercing sponsons with hydra-jet propulsion. Despite higher cost, air cavity vessels are likely for use in littoral and some blue water roles.

Air cushion vessels can operate in coastal areas with irregular shore line and shallows. They are noted below for amphibious landing use, but can also be used as patrol craft, and to provide high speed transport in coastal zones.

Another littoral military technology is ***wing-in-ground effect (WIG)*** *craft*, which use lifting thrust for flight 1-2 meters above the waves, and propelling thrust for missions at speeds of up to 700 km/hr. A few Russian WIG craft were equipped with missiles to attack ships, and with large compartments to deliver troops and equipment. Due to military fielding and operational cost issues, most of the large Russian military "Ekranoplans" are no longer in use. However, successful peacetime conversions include the Orlyonok (with 140 ton displacement, speed 220 knots, range 830 nm). It is now used for passenger and cargo transportation, but could be employed for military roles. Commercial developers in various countries offer smaller WIG craft for passenger and cargo transport, and for personal use.

Inland waterways permit use of new technologies designed for commercial and recreational uses. Military requirements for riverine craft include high speed, rapid maneuver, shallow water capability, space for weapon mounts, and more. Airboats can operate in rivers and creeks and in marshy areas with a few inches of water. Ski boats, "cigar boats," and other high-speed designs offer potential for military applications.

Hydrofoil Craft for Littoral Operations



This technology is increasingly being used for boats and ships in both commercial and military sectors. It is an expensive propulsion upgrade because of the mechanisms required, but the benefits are in open water speed. For ferries and medium range transport, shorter passage time can mean more passages and missions completed. For military applications, speed also decreases exposure time and permits quicker response time to engage targets. When in harbor areas or shallow water, foils are folded for conventional hull down

propulsion. Wave action in high sea state open water will affect craft designed for coastal waters, as is true with any conventional designs.



Military craft using foils are currently limited to craft for littoral operations. However, new hydrofoil designs are being considered for larger blue-water vessels. Military craft have been used by the U.S., Russia, Italy, Philippines, Israel, and others. A Canadian test of the Italian FHE-400 Bras'Dor 200-ton hydrofoil boat for anti-submarine warfare found it to be impressive in coastal waters, but unsuitable for long-term deep-water use under severe weather conditions.



One of the early commercial hydrofoil craft was the Italian Supramar design licensed to the Rodriquez shipyard as the PT-20. This craft is highly successful and used around the world. The 72-passenger ferry displaces 32 tons, for a speed of 35 knots. Military conversions such as the Philippine patrol craft noted at right continue to operate.



The Italian SPARVIERO Class delivered in 1974. With 62.5 knots foil-borne, 8 foils folded. mm OTO-Melara cannon and launchers. includes seven fast-attack craft, first tons of displacement, speed is 50 Range is 2,225 km. The boat has a 76 two Otomat anti-ship missile



Russian ANTARES-Class patrol boats from the 1970s and 80s are among several designs currently in operation. They displace 220 tons, with a max speed of 65 knots, and can operate in 3-meter waves. Hull-borne, it can operate in sea state 7. Range is 410 nm. Weapons include a 76-mm gun, a 30-mm 6-barrel Gatling-type gun, and two torpedo tubes. Other Russian hydrofoil vessels include SOKOL-Class ships of 465 tons.

Very Lightweight Craft for Use in Littoral Operations

Inflatable craft can fit in small spaces, with reduced weight for crew carry and transport. They fit stealthy operations with low profile (less visual signature), little metal for minimal radar and thermal signature, and low acoustic signature (low weight for smaller engines, and minimal sound of waves against a hull). They are also very cost effective. Inflation/re-inflation/ preparation times are reduced with compressed gas, pneumatic pumps, and cans of quick sealer.

These craft are popular in the sport industry, and are widely used in commercial roles. Thus there are many new technologies and hundreds of producers, most for non-military markets. Although rubber is still used; its use is far outnumbered by the variety of polyethylene watercraft available. Any of these products could have uses for military forces; however, military applications have some requirements that affect choices. Commercial boats often use bright colors for easy detection, versus military craft that are patterned to be concealable. Military craft are usually more rugged, to withstand wear and handle all

men and gear needed on a mission. Military craft may need to support weapons mounts and more powerful engines.

Improved boat technologies have led to confusion in the terms used for the boats. The acronym RIB can mean ***rubber inflatable boat***, ***rigid inflatable boat***, and ***rigid-hulled inflatable boat***. Zodiac and other commercial firms offer boats which can be deflated, easily shipped, then quickly re-inflated and placed into service. Non-rigid boats are well-suited for small teams and for portage off-road between uses. Improvised means for added rigidity include inserted rods, boards, plywood to add decking, and loose seats or packs. Oars are often used for clandestine and short crossings.

Rigid inflatable boats, often favored by military forces, can have rigid seats and decking, for less chance of puncture, better stability in heavier waves, and more carrying capacity. There are dozens of designs for sporting, commercial, and military use. Facilities on or near the water will more likely use these craft than the earlier types. Styrofoam fills add rigidity and prevent sinking.



Rigid-hulled inflatable boat

Many military units now use rigid-hulled inflatable boats (RHIB), which can be stacked and quickly placed into service, and can handle bigger engines, more troops and supplies, and heavier seas. Inflatable sections extend freeboard, reduce spray and wave effects, and assure flotation in case of capsizing. A fiberglass hull also permits weapon mounts. Some of the boats use armor plate to protect against 7.62-mm rounds. To avoid confusion of terms, the Zodiac Company now refers to its basic rubber inflatable boats as modular inflatable boats (MIB); but it also offers rigid designs.

Rafts and boats can be towed or rowed, and improvised from random wood, cut from trees, or rigged with drums or bladders. Inflatable rafts assist missions and can be life rafts in emergencies. Craft like canoes, kayaks, johnboats and bateaus can be expropriated for military use. Another option is folding commercial or assault boats with polypropylene or plywood panels, also used as pontoons.



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FRENCH MISTRAL CLASS LHD



SYSTEM	SPECIFICATIONS	WEAPONS	SPECIFICATIONS
Alternative designations:	BPC; NTCD; ex-VLADIVOSTOK; GAMAL ABDEL NASSER	Name:	Mistral SAM
Date of introduction:	2006	Quantity:	12
Proliferation:	Egypt	Range (km):	6
Length overall (m):	199		
Beam (m):	32	Name:	Breda-Mauser 30-mm CIWS
Draft (m):	6.2–6.3	Quantity:	2
Displacement, full load (mt):	21,500	Range (km):	INA
Crew (total):	160		
Troop capacity:	450 long; 900 short	Name:	12.7-mm MG
Max speed (knots):	19	Quantity:	4
Endurance (days):	45	Range (km):	INA
Range (nm/knots):	11,000/15; 6,000/18		
Generator/motor:	3 Wärtsilä 16v32 diesel sets, 1 18V200 Wärtsilä diesel	AIRCRAFT	SPECIFICATIONS
Propulsion:	2 Mermaid podded azimuthal thruster props; 1–2 bow thrusters	Name:	NH-90 / AS-532 Cougar / AS-665 Tigre / SA-330 Puma
Ship horsepower, total:	19,040	Quantity:	16
Radar:	Thales MRR NG 3D; BridgeMaster 250E; navigation		
Sonar:	INA	Name:	Light helos (in lieu of above)
Electronic warfare:	Thales ARBR-21; jammers; decoy launchers	Quantity:	35
Combat:	SENIT 9; Thales SIC 21; satcom		

VEHICLES	SPECIFICATIONS	LANDING CRAFT	SPECIFICATIONS
Name:	Leclerc MBT	Name:	EDA-R
Quantity:	40	Quantity:	1
Name:	Armored vehicles (in lieu of MBT)	Name:	LCAC (in lieu of EDA-R)
Quantity:	60	Quantity:	2
VARIANTS	SPECIFICATIONS	Name:	LCM (in lieu of EDA-R)
GAMAL ABDEL NASSER; Ex-VLADIVOSTOK	Export version; higher helicopter hanger; some Russian electronics	Quantity:	4

NOTES
CAN HANDLE CH-53E SUPER STALLION AND MV-22B OSPREY. CONTAINS AN ONBOARD HOSPITAL. RUSSIAN PURCHASE OF TWO VLADIVOSTOK-CLASS VESSELS CANCELLED BY FRANCE DUE TO EVENTS IN THE UKRAINE; VESSELS SOLD TO EGYPT INSTEAD (GAMAL ABDEL NASSER CLASS). EGYPTIAN VERSION CARRIES SOME RUSSIAN ELECTRONICS SYSTEMS AND RUSSIAN KA-52K HELICOPTERS.

RUSSIAN IVAN GREN CLASS LST



SYSTEM	SPECIFICATIONS	WEAPONS	SPECIFICATIONS
Alternative designations:	Project 11711 / 1171.1 / 1171.1E	Name:	122-mm or WM-18 140-mm MRLS
Date of introduction:	2016 expected	Quantity:	2
Proliferation:		Range (km):	INA
Length overall (m):	120		
Beam (m):	16.5	Name:	AK-176M 76-mm gun
Draft (m):	3.6–3.8	Quantity:	1
Displacement, full load (mt):	6,000	Range (km):	15.7
Crew (total):	100		
Troop capacity:	300–380	Name:	AK-630 30-mm CIWS
Max speed (knots):	18	Quantity:	2
Endurance (days):	30	Range (km):	5
Range (nm/knots):	3,500/16		
Generator/motor:	2 diesel sets	VEHICLES	SPECIFICATIONS
Propulsion:	2 propellers	Name:	MBT
Ship horsepower, total:	10,000	Quantity:	13
Radar:	Cross Dome; Bass Tilt; Laska; navigation		
Sonar:	INA	Name:	APC (in lieu of MBTs)
Electronic warfare:	decoy launchers	Quantity:	60
Combat:	INA		
		AIRCRAFT	SPECIFICATIONS
VARIANTS	SPECIFICATIONS	Name:	Ka-29 Helix
		Quantity:	1–2

NOTES

CAN MAKE LANDING VIA A PONTOON BRIDGE. HAS AN EXPANDABLE HANGAR TO ACCOMMODATE A SECOND HELICOPTER. CAN HOLD 20' ISO SHIPPING CONTAINERS AND 1500 TONS OF CARGO IN LIEU OF TROOPS.

RUSSIAN OKEAN CLASS PS



SYSTEM	SPECIFICATIONS	WEAPONS	SPECIFICATIONS
Alternative designations:	Project 22100	Name:	AK-176MA 76-mm gun
Date of introduction:	launched 2014	Quantity:	1
Proliferation:		Range (km):	INA
Length overall (m):	91.8		
Beam (m):	14.8	Name:	14.5-mm gun
Draft (m):	INA	Quantity:	2
Displacement, full load (mt):	2,700	Range (km):	INA
Crew (total):	41–44		
Troop capacity:	INA		
Max speed (knots):	20		
Endurance (days):	60		
Range (nm/knots):	12,000		
Generator/motor:	German diesels	AIRCRAFT	SPECIFICATIONS
Propulsion:	2 propellers	Name:	Ka-27PS
Ship horsepower, total:	INA	Quantity:	1
Radar:	surface search; navigation		
Sonar:	INA	VARIANTS	SPECIFICATIONS
Electronic warfare:	INA		
Combat:	Buran-6M communications		

NOTES
NEW CLASS OF OFFSHORE BORDER GUARD SHIP. HAS ICE-BREAKING CAPABILITY.

PAKISTANI AZMAT CLASS PTG



SYSTEM	SPECIFICATIONS	WEAPONS	SPECIFICATIONS
Alternative designations:		Name:	CSS-N-8 Saccade ASCM
Date of introduction:	2012	Quantity:	8
Proliferation:		Range (km):	120
Length overall (m):	63		
Beam (m):	8.8	Name:	AK-630 30-mm CIWS
Draft (m):	2.4	Quantity:	1
Displacement, full load (mt):	560	Range (km):	5
Crew (total):	14–38		
Troop capacity:	INA	Name:	14.5-mm MG
Max speed (knots):	30	Quantity:	2 7
Endurance (days):	INA	Range (km):	INA
Range (nm/knots):	1,000/18		
Generator/motor:	4 diesel sets	LANDING CRAFT	SPECIFICATIONS
Propulsion:	4 propellers	Name:	RIB
Ship horsepower, total:	INA	Quantity:	1+
Radar:	Type 360; fire control; navigation		
Sonar:	hull-mounted	VARIANTS	SPECIFICATIONS
Electronic warfare:	intercept; jammer; decoy launcher		
Combat:	INA		

NOTES

BASED ON CHINESE HOUJIAN CLASS. FIRST UNIT WAS CONSTRUCTED IN CHINA AND SECOND IN PAKISTAN.

IRANIAN KAMAN CLASS PTG



SYSTEM	SPECIFICATIONS	WEAPONS	SPECIFICATIONS
Alternative designations:	COMBATTANTE IIB	Name:	CSS-N-8 Saccade / Ghader / Noor ASCM
Date of introduction:	1977	Quantity:	4 (2 twin)
Proliferation:		Range (km):	120–200
Length overall (m):	47		
Beam (m):	7.1	Name:	76-mm Oto Melara gun
Draft (m):	1.9	Quantity:	1
Displacement, full load (mt):	275	Range (km):	19
Crew (total):	31		
Troop capacity:		Name:	Bofors 40-mm gun
Max speed (knots):	36	Quantity:	1
Endurance (days):	INA	Range (km):	12
Range (nm/knots):	2,000/15; 700/33.7		
Generator/motor:	4 MTU 16V538 TB 91 diesels	Name:	Oerlikon GAM-B01 20-mm gun (in lieu of 40-mm gun)
Propulsion:	4 propellers	Quantity:	1
Ship horsepower, total:	14,400	Range (km):	2
Radar:	WM-28 fire control; Decca 1226 navigation		
Sonar:	INA	Name:	12.7-mm MG
Electronic warfare:	TMV-433 suite with DR-2000 receiver, Dalia analyzer, and Alligator jammer	Quantity:	2
Combat:	INA	Range (km):	INA
VARIANTS	SPECIFICATIONS		
SINA	Locally-produced variant; greater displacement; slightly slower; modified radome; introduced in 2009		

NOTES
KAMAN CLASS WAS IMPORTED FROM FRANCE, WHILE SINA CLASS IS LOCALLY PRODUCED. ADDITIONAL SINA UNITS CURRENTLY UNDER PRODUCTION

Chinese/Iranian C-14 Class Catamaran Missile Boat



SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designation:	China Cat	Missile:	C-701/YJ-7/TL-10A and B, Kosar in Iran
Date of Introduction:	2002	Type:	Multi-role cruise missile
Proliferation:	2 countries. Iran, China	Launchers:	4
Description:		Weight (kg):	100
Crew:	10	Length (m):	2.5
Displacement (tons):	20	Diameter (m):	.18
Length Overall (m):	23	Warhead:	29 kg semi-armor-piercing
Height of hull (m):	3.6	Speed:	Mach 0.8
Beam (m):	4	Range (km):	20
Draft (m):	1	Guidance:	TV guided initial version, as C-701T, TL-10A in Iran
PERFORMANCE	SPECIFICATIONS	Prob-hit (%):	90
Speed (knots):	50	Missile:	C-704/JJ/FL-9/TL-6B in China, Nasr in Iran
Range (nautical miles):	300	Type:	Anti-ship cruise
Propulsion:	2 x props (diesel engines)	Launchers:	2
FIRE CONTROL	SPECIFICATIONS	Weight (kg):	350-360
Electro-Optics:	Photoelectric camera in mast	Length (m):	3.5
Sonar:	INA	Diameter (m):	.28
Radar:	1 x POT HEAD surface search	Warhead:	30 kg SAP
		Speed:	Mach 0.8-.9
		Range (km):	35
		Guidance:	Radar-homing
		Prob-hit (%):	
		AMMUNITION	SPECIFICATIONS
		C-701 Cruise missile	4-8 combat load
		TL-10 Anti-ship missile	4-8 combat load
		C-704 Anti-ship missile	2-4 combat load
		12.7x108 mm linked MG	INA

NOTES
WEAPONS, SENSORS, AND COUNTERMEASURES VARY AMONG VESSELS IN THE CLASS.

Russian/Ukrainian ZUBR-Class Air Cushion Landing Craft



SYSTEM	SPECIFICATIONS	ARMAMENT (ROCKET)	SPECIFICATIONS
Alternative Designation:	Project 1232.2, POMORNIK-Class; DONETS'K Class	Name:	A-22/Ogon
Date of Introduction:	1988	Launcher:	MS-227
Proliferation:	3 countries	Type:	22 x 140 mm launch tubes
Description:		Fire Control:	DVU-3-BS rangefinder
Crew:	31	Rate of fire: (rd/min)	
Displacement (tons):	550		
Length Overall (m):	56.2	Name:	SA-N-8
Height of hull (m):	21.9	Launcher:	4-missiles
Beam (m):	25.6	Warhead:	1.0 kg Frag-HE
Draft (m):	1.5	Speed:	Mach 0.56
PERFORMANCE	SPECIFICATIONS	Range (km):	6
Speed (knots):	55	Guidance:	IR-homing
Range (nautical miles):	400	Prob-hit (%):	50
Propulsion:	3x variable-pitch air prop, 50,000 bhp from gas turbine		
Lift Engines:	4 x NO-10 engines		
Ship Power	2x 100kW gas turbine		
ARMAMENT (GUNS)	SPECIFICATIONS		
Name:	AK-630M AD gun mount		
Gun:	GSSh-6-30K (AO-18)		
Type:	6-barrel 30 mm Gatling gun		
Fire Control:	EO camera, MR-123 radar		
Rate of fire: (rd/min)	5,000		
Range (m):	5,000		

NOTES
WEAPONS, SENSORS, AND COUNTERMEASURES VARY AMONG VESSELS IN THE CLASS.
LIFT CAPACITY: 3 X TANKS, 8 X BMP-2 IFVS, OR 10 X BTR-80 APCS OR UP TO 140 TROOPS AND 130 TONS OF CARGO
BOW AND STERN RAMPS ASSIST LOADING.

Swedish CB90H Fast Assault Craft



SYSTEM	SPECIFICATIONS	ARMAMENT	SPECIFICATIONS
Alternative Designation:	Combat Boat 90 H (Stridsbat 90, aka Strb 90	Caliber, Type, Name:	Twin .50 cal (12.7x99 mm) MG , M2HB
Date of Introduction:	1991	Mount:	Fixed forward
Proliferation:	At least 8 countries	Rate of Fire (rd/min):	900-1100 cyclic
Description:		Loader Type:	Belt feed
Crew:	4	Ready/Stowed Rounds:	750
Displacement (tons):	20 full load	Elevation:	-20/+60
Length Overall (m):	14.9	Fire on Move:	Yes
Height of hull (m):	4.5		
Beam (m):	3.8		
Draft (m):	0.9		
PERFORMANCE	SPECIFICATIONS		
Speed (knots):	50		
Range (nautical miles):	440		
Propulsion:	2x water jets, 2x Scania DS114 diesel		
FIRE CONTROL	SPECIFICATIONS		
Electro-Optics:	EO sight for remote FCS on main gun		
Radar:	Naval patrol version		

NOTES

WEAPONS, SENSORS, AND COUNTERMEASURES VARY AMONG VESSELS IN THE CLASS. AN OPTION FOR FUTURE DEVELOPMENT IS AMOS 120 MM MORTAR WITH TWIN AUTO-LOAD DIRECT FIRE. ANOTHER CONSIDERATION IS THE RBS 17 MANPADS LAUNCHER.

VARIANTS

VARIANTS INCLUDE NAVAL VERSIONS, RIVERINE PATROL CRAFT, AN AMBULANCE VERSION, AND OTHERS.

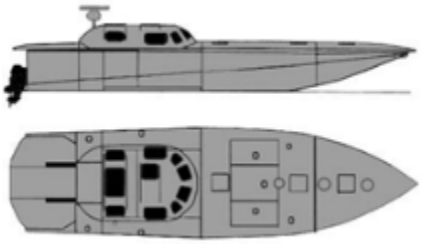
CB90HS: ARMORED VERSION WITH NBC PROTECTION, MORE ENGINE HP, AND PROTECTED AGAINST 7.62 MM ROUNDS.

CB90HCG: GREEK COAST GUARD VERSION WITH A RAISED STRUCTURE, DIFFERENT ENGINES, ADDITIONAL NAVIGATION, RADARS, AND SONAR.

CB90N: NAVAL PATROL CRAFT WITH SUPERSTRUCTURES AND OTHER CREW ACCOMMODATIONS.

NORTH KOREAN SEMISUBMERSIBLE INFILTRATION LANDING CLASS (SILC)





SYSTEM	SPECIFICATIONS	WEAPONS	SPECIFICATIONS
Alternative designations:	Cluster-Osprey; Type B; Raccoon; Type C; SP-10	Name:	Small arms
Date of introduction:		Quantity:	INA
Proliferation:	Iran	Range (km):	INA
Length overall (m):	9.3		
Beam (m):	2.5		
Mean draft (m):	1		
Displacement (mt):	5		
Crew (total):	2		
Troop capacity:	3–4	VARIANTS	SPECIFICATIONS
Max speed, surfaced (knots):	30–50	Improved SILC (I-SILC)	Larger; faster (surfaced); fully submersible to 3m; some may have torpedo tubes
Max speed, semisub (knots):	12		
Endurance (days):	INA	Taedong B; Kajami	Export version to Iran
Range (nm/knots):	250–300		
Generator/motor:	3 inboard-outboard		
Propulsion:	3 propellers		
Ship horsepower, total:	INA		

PRIMARY USE FOR THE CRAFT IS TO INSERT SPF TEAMS FOR INFILTRATION MISSIONS. THE CRAFT RACES AT HIGH SPEED ACROSS OPEN AREAS WITH ONLY THE CAB SHOWING, AND REDUCES SPEED TO APPROACH SHORE, AND THE NEW I-SILC CAN SUBMERGE TO A DEPTH OF APPROXIMATELY 7 METERS AS IT APPROACHES THE SHORE. SIMILAR CRAFT ARE MARKETED BY A FIRM LOCATED IN SINGAPORE, AND ACCORDING TO NEWS REPORTS, CRAFT SIMILAR TO THE NK SILC WERE DELIVERED TO IRAN. SOUTH AMERICAN DRUG TRAFFICKERS HAVE ATTEMPTED TO OBTAIN SILCS FOR USE IN TRANSPORTING DRUGS INTO THE U.S.. USUALLY LAUNCHED FROM "MOTHER SHIPS" THAT ARE DISGUISED AS FISHING VESSELS OR FREIGHTERS. SEVERAL VERSIONS EXIST, INCLUDING AT LEAST ONE THAT IS FULLY SUBMERSIBLE.

ALTHOUGH THE CRAFT CAN OPERATE FROM FAR BASES IN SHALLOW COASTAL WATERS, MOST ARE CARRIED ON "MOTHER SHIPS". THESE 50-100 TON SHIPS ARE OPERATED BY NAVAL SPF FORCES AND ARE DISGUISED AS LARGE, COMMERCIAL FISHING VESSELS, NOT UNLIKE LARGE FISHING VESSEL “MOTHER SHIPS” OR FREIGHTERS WHICH HAVE ONE OR TWO UNDERWATER DOORS CONCEALED ON THE STERN, TO LAUNCH SEMISUBMERSIBLE CRAFT.

SOME MOTHER SHIPS ARE ACTUALLY INTELLIGENCE SHIPS, AGAIN DISGUISED AS LARGE FISHING VESSELS OR FREIGHTERS, WITH AN ARRAY OF INTERCEPT, RECONNAISSANCE, AND RADIO SYSTEMS, AS WELL AS

SEMISUBMERSIBLE CRAFT. A 100-TON TRAWLER WAS FOUND WITH SA-16/IGLA-1 MANPADS, AND RPG-7V ATGLS.

HOVERCRAFT CAN ALSO BE USED TO LAUNCH SILCS AND I-SILCS.

Dec
2016

Worldwide Equipment Guide

Chapter 2: Surface Systems



TRADOC G-2 ACE Threats Integration
Ft. Leavenworth, KS

Distribution Statement: Approved for public release; distribution is unlimited.

Chapter 2: Surface

Naval surface vessels vary widely, from aircraft carriers displacing tens of thousands of metric tons to meters-long rubber inflatable boats for littoral use. This chapter covers aircraft carriers and surface combatants. These vessels are designed to conduct overt attacks against naval, air, and/or ground targets or to perform patrol functions. The different types are listed below in order of decreasing tonnage. Of note, distinctions between the types have become blurred in recent years.

- Aircraft carrier: Displacing 18,00-102,000 metric tons, aircraft carriers serve as waterborne military air bases. Lightly-armed, their importance comes from the ability to move large numbers of fighter/attack aircraft around the globe and serve as self-contained bases for the same.
- Battleship: Once the greatest weapon on the seas, battleships could displace as much as 63,000 metric tons – more than some modern-day aircraft carriers. They were armed with heavy guns and used for ship-to-ship and ship-to-shore battles. The last active battleships were decommissioned in 1991.
- Cruiser: Usually displacing 5,000-11,000 metric tons, cruisers were originally fleet scout ships. They have since evolved into anti-air and anti-ship vessels, though some classes can also do shore bombardment. Larger platforms can displace as much as 27,000 metric tons and may be referred to as battle cruisers. These vessels are usually armed with heavy guns and a combination of missiles and/or torpedoes.
- Destroyer: Commonly displacing 4,000-10,000 metric tons, these ships were originally designed for anti-submarine (undersea) warfare. The role of modern destroyers has expanded to include anti-ship and anti-air functions. These vessels are usually armed with missiles, torpedoes, and heavy guns.
- Frigate: Originally used for scout and escort duties, modern frigates commonly displace around 3,000 metric tons and mainly perform anti-air and anti-submarine duties. These vessels are usually armed with a combination of missiles, torpedoes, depth charges, and guns.
- Corvette: Smaller than frigates, corvettes nonetheless perform similar duties. They displace approximately 1,000-1,500 metric tons and are usually armed with a combination of missiles, torpedoes, depth charges, and guns.

This chapter focuses on surface vessels that are capable of blue-water operations. Large patrol craft and smaller littoral vessels are covered in Chapter 1. Questions and comments on data listed in this chapter should be addressed to:

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Chinese LIAONING Class CV



SYSTEM	SPECIFICATIONS	AIRCRAFT	SPECIFICATIONS
Alternative designations:	Project 11435/1143.5/1143.6; ex-KUZNETSOV Class; ex-VARYAG	Name:	J-15 or Su-33 Flanker
Date of introduction:	2012	Quantity:	24–26
Proliferation:			
Length overall (m):	304–306	Name:	Ka-31 Helix / Ka-27 / Z-8 / Z-9 / Z-18
Beam (m):	70–73	Quantity:	12–24
Draft (m):	10–11		
Displacement, full load (mt):	59,400	WEAPONS	SPECIFICATIONS
Crew (total):	1,960–2,000	Name:	18-cell FL-3000N SAM launcher
Air wing (total):	626	Quantity:	3–4
Troop capacity:	INA	Range (km):	9
Max speed (knots):	30		
Endurance (days):	45	Name:	30-mm CIWS
Range (nm/knots):	3,850/29; 8,500/18	Quantity:	2–3
Generator/motor:	8 boilers; 4 steam turbines	Range (km):	3
Propulsion:	4 propellers		
Ship horsepower, total:	200,000	Name:	12-round RBU-6000 anti-sub RL
Radar:	Top Plate; Dragon Eye; Sea Eagle; Band Stand; navigation	Quantity:	2
Sonar:	INA	Range (km):	6
Electronic warfare:	4 decoy/chaff launchers		

VARIANTS	SPECIFICATIONS		
INA	Domestically produced		

NOTES
FORMER RUSSIAN KUZNETSOV-CLASS SHIP VARYAG MODIFIED BY THE CHINESE. WAS REPORTEDLY BOUGHT FOR A FLOATING CASINO/AMUSEMENT PARK, WITH PURCHASE CONTRACT PROHIBITING SHIP'S USE FOR MILITARY PURPOSES. RADARS INCLUDE CHINESE AEGIS-LIKE PHASED ARRAY RADAR (DRAGON EYE) . DISPLACEMENT ESTIMATES VARY WIDELY.

Chinese LUYANG III Class DDG



SYSTEM	SPECIFICATIONS	WEAPONS	SPECIFICATIONS
Alternative designations:	Type 052D; KUNMING	Name:	YJ-62 or YJ-18 ASCM
Date of introduction:	2014	Quantity:	8
Proliferation:		Range (km):	280 or 220
Length overall (m):	154–160		
Beam (m):	17–18	Name:	DH-10 LACM (possible)
Draft (m):	6–6.5	Quantity:	INA
Displacement, full load (mt):	7,500	Range (km):	2000
Crew (total):	280		
Troop capacity:	INA	Name:	HQ-9 / 9A / 9B SAM
Max speed (knots):	30	Quantity:	64
Endurance (days):	INA	Range (km):	200
Range (nm/knots):	4,500/15		
Generator/motor:	CODOG with 2 QC-280 gas turbines and 2 diesel engines	Name:	FL-3000N SAM
Propulsion:	2 propellers	Quantity:	24
Ship horsepower, total:	INA	Range (km):	9
Radar:	Knife Rest; Dragon Eye; Band Stand; Seagull-C; Type 344 fire control; Type 760 navigation		
Sonar:	bow-mounted; towed array	Name:	324-mm Yu-7 torpedoes
Electronic warfare:	2 jammers; 4 decoy launchers	Quantity:	6
Combat:	SITN240 satcom; JSIDLS	Range (km):	14
AIRCRAFT	SPECIFICATIONS	Name:	PJ-38 130-mm gun
Name:	Z-9 / Ka-27 / Ka-28 Helix	Quantity:	1
Quantity:	1–2	Range (km):	29
VARIANTS	SPECIFICATIONS	Name:	Type 730 30-mm CIWS
LUYANG II	Immediate predecessor	Quantity:	1–2
		Range (km):	3

NOTES
VESSEL BOASTS TWO 32-CELL MULTI-PURPOSE VLS THAT MAY BE CAPABLE OF LAUNCHING ASCM, LACM, SAM, AND ASROC. RADARS INCLUDE CHINESE AEGIS-LIKE PHASED ARRAY RADAR (DRAGON EYE).

Russian ADMIRAL SERGEI GORSHKOV Class FFG



SYSTEM	SPECIFICATIONS	WEAPONS	SPECIFICATIONS
Alternative designations:	Project 22350	Name:	SS-N-26 Oniks and/or SS-N-27 Club and/or SS-N-30A Kalibr ASCM
Date of introduction:	2016	Quantity:	2x8
Proliferation:		Range (km):	220–1500
Length overall (m):	135		
Beam (m):	16.4	Name:	SA-N-7 Gadfly or Redut VLS w/ 9M96-series SAM
Draft (m):	4.5	Quantity:	24 / 32
Displacement, full load (mt):	4,550	Range (km):	40 or 120
Crew (total):	210		
Troop capacity:	INA	Name:	Kashtan or Palash CIWS SAM
Max speed (knots):	30	Quantity:	8 or 16
Endurance (days):	30	Range (km):	10 / INA
Range (nm/knots):	4,000/14		
Generator/motor:	4 diesel-gas turbines/engines (see notes)	Name:	Kashtan or Palash CIWS - 30-mm gun
Propulsion:	2 propellers	Quantity:	2
Ship horsepower, total:	65,000	Range (km):	4 / INA
Radar:	Furke-series; Puma; Monolit 34K1; Poliment; navigation/ surface search		
Sonar:	Zarye bow-mounted; Vinyetka towed array	Name:	A-192/192M 130-mm gun
Electronic warfare:	TK-25 ECM system; decoy launchers	Quantity:	1
		Range (km):	29.5
AIRCRAFT	SPECIFICATIONS	Name:	Medvedka-2 or PAKET ASW system torpedoes
Name:	Ka-26 / 27 / 28 / 31 / 32	Quantity:	2x4
Quantity:	1	Range (km):	INA

VARIANTS	**SPECIFICATIONS**		
Project 22356	**Export version**		

NOTES

TWO GAS TURBINES WITH EITHER AN ADDITIONAL 2 GAS OR 2 DIESELS IN A CODOG, CODAG, OR COGAG CONFIGURATION. BASED ON INDIAN TALWAR CLASS, THIS VESSEL IS LARGE ENOUGH TO BE CONSIDERED A DESTROYER. RUSSIA EXPERIENCING PRODUCTION DELAYS FROM UKRAINIAN REFUSAL TO SUPPLY TURBINES FOR VESSELS IN PRODUCTION DUE TO 2014 INVASION OF CRIMEA.

Russian ADMIRAL GRIGOROVICH Class FFG



SYSTEM	SPECIFICATIONS	WEAPONS	SPECIFICATIONS
Alternative designations:	Project 1135.6/11356/11356M; KRIVAK IV; modified TALWAR	Name:	SS-N-27 Club-N and/or SS-N-30A Kalibr ASCM
Date of introduction:	2016	Quantity:	8
Proliferation:		Range (km):	220–1500
Length overall (m):	124.8		
Beam (m):	15.2	Name:	Shtil-1 system w/SA-N-7C SAM
Draft (m):	4.2–4.6	Quantity:	3x12
Displacement, full load (mt):	4,035	Range (km):	32
Crew (total):	180–200		
Troop capacity:	INA	Name:	Kashtan CIWS - SA-N-11 Grison SAM
Max speed (knots):	30	Quantity:	64
Endurance (days):	30	Range (km):	10
Range (nm/knots):	4,850/14		
Generator/motor:	COGAG with 4 M90FR Zorye gas turbines and 4 diesel sets	Name:	Kashtan CIWS - 30-mm AK-630 gun
Propulsion:	2 propellers	Quantity:	2
Ship horsepower, total:	56,000–60,900	Range (km):	4
Radar:	Top Plate; Cross Dome; Front Dome; Plank Shave; Puma; navigation		
Sonar:	MGK-335EM-03 Platina; active towed array	Name:	A-190 100-mm gun
Electronic warfare:	ECM; PK-10 decoy launchers	Quantity:	1
		Range (km):	21.5
		Name:	12-round RBU-6000 ASW RL w/90R and/or RGB-60 rockets
		Quantity:	1
		Range (km):	6

AIRCRAFT	**SPECIFICATIONS**	**Name:**	**533-mm torpedoes**
Name:	**Ka-27 / 28 / 31**	**Quantity:**	**4**
Quantity:	**1**	**Range (km):**	**INA**
VARIANTS	**SPECIFICATIONS**	**Name:**	**Igla MANPADS w/8 SAMs**
TALWAR	**Older export version**	**Quantity:**	**1**
		Range (km):	**6**

NOTES

IMPROVED INDIAN TALWAR-CLASS VESSEL. DATA BASED ON TALWAR SPECIFICATIONS. RUSSIA EXPERIENCING PRODUCTION DELAYS FROM UKRAINIAN REFUSAL TO SUPPLY TURBINES FOR VESSELS IN PRODUCTION DUE TO 2014 INVASION OF CRIMEA. INDIA REPORTEDLY TO BUY THREE VESSELS CURRENTLY UNDER CONSTRUCTION DUE TO TURBINE ISSUE.

Russian BUYAN-M Class FFLG



SYSTEM	SPECIFICATIONS	AIRCRAFT	SPECIFICATIONS
Alternative designations:	Project 21631; GRAD SVIYAZHSK	Name:	SS-N-27 Club and/or SS-N-30A Kalibr ASCM
Date of introduction:	2014	Quantity:	8
Proliferation:		Range (km):	220–1,500
Length overall (m):	74.1		
Beam (m):	11	Name:	Igla-1M SAM
Draft (m):	2.6	Quantity:	8
Displacement, full load (mt):	949	Range (km):	5
Crew (total):	52		
Troop capacity:	INA	Name:	A-190 100-mm gun
Max speed (knots):	25	Quantity:	1
Endurance (days):	10	Range (km):	21.5
Range (nm/knots):	1,500		
Generator/motor:	4 diesel sets	Name:	AK-630 30-mm gun
Propulsion:	2 pump jets	Quantity:	2
Ship horsepower, total:	INA	Range (km):	5
Radar:	Cross Dome; Bass Tilt; Laska; MR-321		
Sonar:	INA	Name:	14.5-mm mg
Electronic warfare:	PK-10 decoy launchers	Quantity:	2
		Range (km):	7
VARIANTS	SPECIFICATIONS	Name:	7.62-mm mg
Project 21630 BUYAN	Smaller predecessor	Quantity:	3
Project 21632 TORNADO	Export version; based on Project 21630	Range (km):	2

NOTES

ENLARGED BUYAN CLASS FOR COASTAL OPERATIONS. USED TO FIRE SS-N-30A MISSILES AT SYRIA FROM CASPIAN SEA IN FALL 2015. KAZAKHSTAN PLANNING TO BUY SIX OF SMALLER EXPORT VERSION. CREW ESTIMATES VARY WIDELY.


TRADOC
G-2

Dec
2016

Worldwide Equipment Guide

Chapter 3: Undersea Systems



TRADOC G-2 ACE Threats Integration
Ft. Leavenworth, KS

Distribution Statement: Approved for public release; distribution is unlimited.

Chapter 3: Undersea

Naval undersea vessels vary widely, from ballistic missile submarines displacing several thousand tons to meters-long semi-submersible craft for littoral use. There are several broad categories of undersea vessels, the most commonly known being the traditional submarine. Additional categories include midget submarines, submersibles, semi-submersibles, and unmanned underwater vessels (UUVs).

Most undersea vessels are designed to conduct overt attacks against naval and/or ground targets. Other roles played include coastal infiltration; intelligence, surveillance, and reconnaissance (ISR); mine warfare; research; salvage; search and rescue (SAR); and special purpose forces support functions such as swimmer delivery.

The primary types of "blue-water" submarines are attack submarines and strategic submarines. Attack submarines are designed to target naval vessels – surface, undersea, or both – and are armed with torpedoes and/or anti-ship missiles. These boats are increasingly being armed with ship-to-shore missiles as well. Strategic submarines fall into two main categories based on armament. Ballistic missile submarines, commonly known as "boomers," are armed with intercontinental ballistic missiles, while guided missile submarines carry cruise missiles.

This chapter focuses primarily on undersea vessels capable of blue-water operations, and is currently limited to submarines. Littoral vessels, such as North Korea's Semisubmersible Infiltration Landing Craft (SILC), are covered in Chapter 1 of this volume. Questions and comments on data listed in this chapter should be addressed to:

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Russian BOREY Class SSBN



SYSTEM	SPECIFICATIONS	WEAPONS	SPECIFICATIONS
Alternative designations:	BOREI; Project 955; YURI DOLGORUKY	Name:	SS-NX-32 Bulava SLBM
Date of introduction:	2013	Quantity:	16
Proliferation:		Range (km):	8,300
Length overall (m):	170		
Beam (m):	13.5	Name:	SS-N-16 Stallion ASW
Mean draft (m):	9–10	Quantity:	12
Displacement, surfaced (mt):	14,956	Range (km):	100
Displacement submerged (mt):	19,711		
Crew (total):	107	Name:	SA-N-10 Grouse SAM
Troop capacity:	INA	Quantity:	8
Max diving depth (m):	450	Range (km):	-6+
Max speed, surfaced (knots):	15		
Max speed, submerged (knots):	29	Name:	533-mm torpedoes
Endurance (days):	100	Quantity:	Up to 12
Range (nm/knots):	unlimited	Range (km):	INA
Reactor:	2 nuclear PWR		
Power generation (MW):	380		
Propulsion:	1 pump jet		
Ship horsepower, total:	60,000	VARIANTS	SPECIFICATIONS
Radar:	Navigation; surface search	BOREY-A/Project 955A	Expanded hull; Improved electronics systems
Sonar:	MGK-540 Skat-3M		
Countermeasures:	Rim Hat		

NOTES

FOURTH-GENERATION NUCLEAR BALLISTIC MISSILE SUBMARINE. BOREY-A VARIANT ORIGINALLY REPORTED TO HAVE 20 MISSILES INSTEAD OF 16. REPORTED DISPLACEMENT VARIES; FIGURES GIVEN HERE ARE FROM IHS JANE'S.

Russian YASEN Class SSN/SSGN



SYSTEM	SPECIFICATIONS	WEAPONS	SPECIFICATIONS
Alternative designations:	Project 885; SEVERODVINSK; GRANEY	Name:	SS-N-26 Sapless SLCM
Date of introduction:	2014	Quantity:	Up to 24
Proliferation:		Range (km):	120-300
Length overall (m):	120		
Beam (m):	12–13.5	Name:	SS-N-27/30 (3M54/3M14) SLCM
Mean draft (m):	8.4-9.4	Quantity:	up to 24
Displacement, surfaced (mt):	9,500	Range (km):	220
Displacement submerged (mt):	11,800		
Crew (total):	80–90	Name:	SS-N-21 Sampson SLCM
Troop capacity:	INA	Quantity:	up to 24
Max diving depth (m):	600	Range (km):	2,500
Max speed, surfaced (knots):	17		
Max speed, submerged (knots):	31–35	Name:	SS-N-16 Stallion ASW
Endurance (days):	100	Quantity:	up to 24
Range (nm/knots):	unlimited	Range (km):	100
Reactor:	1 KPM OK-650V nuclear PWR		
Power generation (MW):	200	Name:	SS-N-15 Starfish ASW
Propulsion:	1 pump jet	Quantity:	up to 24
Ship horsepower, total:	43,000	Range (km):	40
Radar:	Snoop Pair		
Sonar:	Irtysh Amfora	Name:	650-mm and 533-mm torpedoes
Countermeasures:	Rim Hat ESM	Quantity:	up to 24
		Range (km):	INA
VARIANTS	**SPECIFICATIONS**	Name:	mines (in lieu of torpedoes)
YASEN-M	Improved electronics systems; improved sound dampening	Quantity:	INA
		Range (km):	INA

NOTES
FOURTH-GENERATION NUCLEAR ATTACK SUBMARINE. SOME REPORTS STATE IT IS THE QUIETEST RUSSIAN NUCLEAR SUBMARINE TO DATE. EXPECTED CORE LIFE OF 25–30 YEARS. INDIA CURRENTLY IN NEGOTIATIONS TO LEASE ONE YASEN SUBMARINE FROM RUSSIA.

Russian LADA Class SSK



SYSTEM	SPECIFICATIONS	WEAPONS	SPECIFICATIONS
Alternative designations:	Project 677; SANKT PETERSBURG	Name:	SS-N-26 Sapless SLCM
Date of introduction:	2010	Quantity:	up to 10
Proliferation:		Range (km):	120-300
Length overall (m):	67		
Beam (m):	7.1–7.2	Name:	SS-N-27/30 (3M54/3M14) SLCM
Mean draft (m):	4.4	Quantity:	up to 10
Displacement, surfaced (mt):	1,793	Range (km):	220
Displacement submerged (mt):	2,693		
Crew (total):	34–38	Name:	SS-N-16 Stallion ASW
Troop capacity:	INA	Quantity:	up to 18
Max diving depth (m):	250	Range (km):	100
Max speed, surfaced (knots):	10		
Max speed, submerged (knots):	21	Name:	SS-N-15 Starfish ASW
Endurance (days):	45	Quantity:	up to 18
Range (nm/knots):	6,000/7 snorkeling; 650/3 submerged	Range (km):	40
Generator:	2 diesel		
Motor:	1 PG-102M electric	Name:	533-mm torpedoes
Propulsion:	1 7-bladed propeller	Quantity:	up to 18
Ship horsepower, total:	2,700	Range (km):	INA
Radar:	I-band		
Sonar:	Lira suite	Name:	DM-1 mines
Countermeasures:	Intercept ESM	Quantity:	up to 18
		Range (km):	INA
VARIANTS	SPECIFICATIONS		
AMUR 1650	Export variant		

NOTES
FOURTH-GENERATION DIESEL-ELECTRIC ATTACK SUBMARINE. EXPORT VERSION AVAILABLE IN SIX DIFFERENT SIZES. REPORTED DISPLACEMENT VARIES; FIGURES GIVEN HERE ARE FROM IHS JANE'S.

North Korean SANG-O Class SSC



SYSTEM	SPECIFICATIONS	WEAPONS	SPECIFICATIONS
Alternative designations:	SHARK	Name:	533-mm torpedo; likely 53-56
Date of introduction:	1990s	Quantity:	2–4
Proliferation:	Vietnam	Range (km):	8
Length overall (m):	35.5		
Beam (m):	3.8	Name:	mines
Mean draft (m):	3.2–3.7	Quantity:	16
Displacement, surfaced (mt):	260	Range (km):	INA
Displacement submerged (mt):	281		
Crew (total):	11 or 19		
Troop capacity:	15		
Max diving depth (m):	180		
Max speed, surfaced (knots):	7.6		
Max speed, submerged (knots):	8.9		
Endurance (days):			
Range (nm/knots):	2,700/7 snorkeling		
Generator:	1 diesel		
Motor:	1		
Propulsion:	1 shrouded propeller		
Ship horsepower, total:	200		
Radar:	Furuno		
Sonar:	Active/passive array	VARIANTS	SPECIFICATIONS
Countermeasures:	INA	SANG-O II (K-300)	39m long; 13 knots submerged

NOTES

THIS BOAT HAS TWO VERSIONS: ONE WITH TORPEDO TUBES AND MINIMAL TROOP CAPACITY, THE OTHER WITH EXTERNAL MINES, TROOP CAPACITY, AND NO TORPEDOES. REPORTED DISPLACEMENT VARIES; FIGURES GIVEN HERE ARE FROM IHS JANE'S.

Iranian GHADIR Class SSM



SYSTEM	SPECIFICATIONS	WEAPONS	SPECIFICATIONS
Alternative designations:	IS 120	Name:	533-mm torpedoes
Date of introduction:	2007	Quantity:	2 tubes
Proliferation:		Range (km):	INA
Length overall (m):	29		
Beam (m):	2.75		
Mean draft (m):	2.5		
Displacement, surfaced (mt):	117		
Displacement submerged (mt):	125		
Crew (total):	7		
Troop capacity:	INA		
Max diving depth (m):	INA		
Max speed, surfaced (knots):	7–11		
Max speed, submerged (knots):	7–9		
Endurance (days):	INA		
Range (nm/knots):	INA		
Generator:	Diesel		
Motor:	Electric		
Propulsion:	INA		
Ship horsepower, total:	INA		
Radar:	INA		
Sonar:	INA	VARIANTS	SPECIFICATIONS
Countermeasures:	INA		

NOTES

LIKELY BASED ON NORTH KOREAN YONO SSM. BOAT HAS A RETRACTABLE SECONDARY PROPELLER. IN JANUARY 2016 IRAN CLAIMED TO HAVE FILMED A US AIRCRAFT CARRIER IN THE STRAIT OF HORMUZ FROM THIS PLATFORM. REPORTED DISPLACEMENT VARIES; FIGURES GIVEN HERE ARE FROM IHS JANE'S.


TRADOC
G-2

AIP	air-independent propulsion
APC	armored personnel carrier
ASCM	anti-ship cruise missile
ASROC	anti-submarine rocket
ASW	anti-submarine warfare
CIWS	close-in weapon system
CODAG	combined diesel and gas
CODOG	combined diesel or gas
COGAG	combined gas and gas
COGOG	combined gas or gas
CV	aircraft carrier
DDG	guided-missile destroyer
ECM	electronic countermeasures
ESM	electronic support measures
FFG	guided-missile frigate
FFLG	guided-missile corvette
INA	information not available
JSIDLS	Joint service integrated data link system
LACM	land-attack cruise missile
LCAC	air-cushion landing craft
LCM	medium landing craft
LHD	multi-purpose amphibious assault ship
LST	tank landing ship
MANPADS	man-portable air-defense system
MBT	main battle tank
MG	machine gun
MRLS	multiple rocket launcher system
MW	mega-watt
PS	patrol ship
PTG	guided-missile patrol boat
PWR	pressurized-water [nuclear] reactor
RIB	rigid inflatable boat
RL	rocket launcher
SAM	surface-to-air missile
satcom	satellite communications
SDV	swimmer delivery vehicle
SLBM	sub-launched ballistic missile
SLCM	sub-launched cruise missile
SSBN	ballistic missile submarine, nuclear
SSC	coastal submarine
SSGN	guided missile submarine, nuclear
SSK	attack submarine, diesel-electric
SSM	miniature submarine

SSN	attack submarine, nuclear
VLS	vertical launch system