

ARCHIVED REPORT

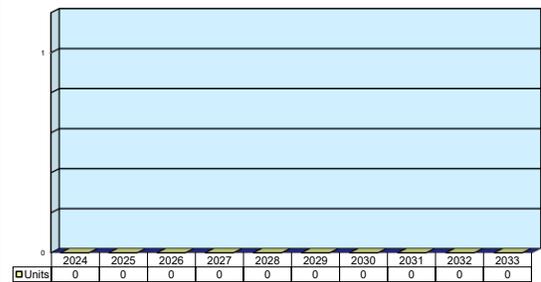
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BM-21 122mm Multiple Launch Rocket System

Outlook

- Russian production lines remain dormant; licensed production in Poland ceased in 2011; production elsewhere unknown
- Focus has shifted to modernization and retrofit as contractors attempt to keep existing systems relevant
- Absent change in program status, this report will be archived in the 2025 supplement

Unit Production Forecast
2024-2033



Orientation

Description. A self-propelled multiple launch rocket system.

Sponsor. The Russian Ministry of Defense sponsors this legacy program of the Soviet Union. The licensee nations sponsor their respective programs.

Status. Development through serial production.

Total Produced. Through 2023, we estimate that the prime contractor and licensees produced 14,362 BM-21 systems.

Application. A mobile, multiple-rocket-based fire support system optimized for the destruction of area targets by means of multiple barrages.

Price Range. In 2024 U.S. dollars, the 12-round BM-21v carries a unit price of \$309,000; the 40-round BM-21-1 carries a unit price of \$392,000.

The license-produced models vary widely in unit price, from \$207,000 for the North Korean M1977 to \$497,400 for the Polish BM-21M and \$511,000 for the RM-70.

Contractors

Prime

Federal State Unitary Enterprise, Rosoboronexport, Rosoboronexport State Corp	http://www.roe.ru , 27/3 Stromynka St, Moscow, Russian Federation, Tel: + 7 495 534 6183, Fax: + 7 495 534 6153, Prime
China North Industries Corp (NORINCO)	http://www.norinco.cn , 12A Guang An Men Nan Jie, PO Box 100053, Beijing, China, Tel: + 86 10 6352 9988, Fax: + 86 10 6354 0398, Email: norinco@norinco.cn , Licensee
DPRK State Arsenals	Pyongyang, Korea, North, Licensee

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Huta Stalowa Wola SA	http://www.hsw.pl, ul Kwiatkowskiego 1, Stalowa Wola, Poland, Tel: + 48 15 813 42 15, Fax: + 48 15 842 19 08, Email: hsw@hsw.pl, Licensee
Iran Defense Industries Organization (DIO)	Pasdaran St, PO Box 19585-777, Tehran, Iran, Tel: + 98 21 22562883, Fax: + 98 21 22551961, Email: marketing@diol.org, Licensee
Motovilikha Plants Corp	http://mz.perm.ru, 1905 Goda St, Perm 35, Russian Federation, Tel: + 7 3422 60 73 01, Fax: + 7 3422 65 62 63, Email: info@artillery-mz.com, Second Prime
Ordnance Factories Organization of India, Ordnance Factory Board - Export Division	http://www.ofb.gov.in, 10 A, S K Bose Rd, Kolkata, India, Tel: + 91 33 2248 5077 80, Fax: + 91 33 2248 9744, Email: ofbtrade@dataone.in, Licensee
Pakistan Ordnance Factories	Wah Cantt, Pakistan, Tel: + 92 51 9055 21019, Fax: + 92 51 9316253, Email: exports@pof.gov.pk, Licensee
ZTS-Special AS	http://www.ztsspecial.sk, Lieskovec 575/25, PO Box 134, Dubnica nad Vahom, Slovakia, Tel: + 421 42 2852 271, Fax: + 421 42 2852 202, Email: gombarova@ztsspecial.sk, Licensee

Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 75 Glen Road, Suite 302, Sandy Hook, CT 06482, USA; rich.pettibone@forecast1.com

Technical Data

Note on Terminology. With the advent of the Lockheed Martin M270 MLRS, *multiple launch rocket system* has become the accepted term for this class of weapon system. However, the Russians call their systems multiple rocket launchers (MRL). For all intents and purposes, the terms *MLRS* and *MRL* are interchangeable.

Crew. Three.

Launch Vehicle. Varies by launcher configuration. Standard Russian platforms are as follows:

- BM-21: Ural-375D 6x6 truck

- BM-21 Grad-1: ZIL 131 6x6 truck
- BM-21v Grad-V: GAZ 66 4x4 truck

Traverse & Elevation Mechanism. Electrical, with manual backup.

Dimensions. The following data reflect the standard BM-21, BM-21 Grad-1, and BM-21v Grad-V, respectively.

	<u>SI Units</u>	<u>U.S. Units</u>
Launcher Vehicle		
Launch tubes	40/36/12	40/36/12
Length	7.35/6.9/5.65 m	24.11/22.63/18.53 ft
Width	2.69/2.5/2.32 m	8.83/8.20/7.61 ft
Height	2.85/2.48/2.44 m	9.35/8.13/8.01 ft
Combat weight	13.3/10.5/6.0 tonnes	14.66/11.57/6.61 tons

The following data reflect the M-21-OF DB-1B (9M22U) "long" rocket.

	<u>SI Units</u>	<u>U.S. Units</u>
Rocket		
Length	3.23 m	10.6 ft
Diameter	122.4 mm	4.82 in
Weight	77.0 kg	169.4 lb

Performance. The following data reflect the BM-21, BM-21 Grad-1, and BM-21v. The BM-21v differs only in featuring a 360° launcher traverse.

	<u>SI Units</u>	<u>U.S. Units</u>
Launcher elevation	+75°	+75°
Launcher depression	0°	0°
Launcher traverse	120° left/60° right	120° left/60° right
Maximum rocket range	20,380 m	22,287.6 yd
Maximum velocity	690 mps	2,263.7 fps

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SI Units

Propulsion. The 122mm M-21-OF DB-1B (9M22U) rocket features a solid-propellant motor that weighs 20.45 kilograms (44.99 lb).

Warhead. The M-21-OF DB-1B (9M22U) is compatible with the following warhead types:

- High Explosive (HE)
- White Phosphorous (WP)
- Incendiary Smoke
- Chemical (AC or HCN, Sarin, and VX)

Launcher Mode. The standard BM-21 features a 40-round launcher on a Ural-375D (or similar) 6x6 truck. The BM-21 Grad-1 features a 36-tube launcher, which is mounted on a ZIL-131 truck (designated the BM-21-

U.S. Units

1) or MT-LB tracked vehicle. The BM-21v Grad-V features a light, 12-tube launcher on a GAZ-66B truck.

Control & Guidance. Unguided. Four wraparound fins deploy after the rocket exits the launch tube. These fins, with the spin imparted by a rifling groove of the launch tube, provide aerodynamic stabilization. The launcher fires the rocket electrically.

Fire Control. BM-21 fire control is rudimentary, with a central command vehicle providing fire control data (azimuth and elevation) and firing orders. The launch vehicle features only a radio or landline link to the fire control officer.



BM-21 Multiple Rocket Launcher with 122mm Rocket (inset)

Source: Russian Army

Variants/Upgrades

Variants. In addition to the Russian BM-21 variants (see **Technical Data**), the various non-Russian contractors have developed the following licensed and unlicensed BM-21 variants:

Designation	Country	Description
BM-21	Belarus	BM-21 launcher on a MAZ-6317 truck chassis
RM-70	Slovak Republic	BM-21 launcher on a Tatra T813 8x8 truck; includes a 40-round

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Designation	Country	Description
RM-70/85	Czech and Slovak Republics	reload pack forward of the launcher RM-70 on a Tatra T815 VN 8x8 truck; Czech Republic supplies the truck; Slovak Republic supplies the launcher
RM-70 Modular	Czech and Slovak Republics	RM-70 modified by Diehl BGT Defence GmbH to accept both 122mm and 227mm MLRS rockets; deliveries of 26 upgraded systems commenced in May 2005
BM-11	DPRK	Indigenous North Korean derivative of BM-21; mounts two 15-round launchers side by side on a license-produced Ural-375D truck
M1977	DPRK	Follow-on version of BM-11 (U.S. Army identification)
M1985	DPRK	Follow-on version of BM-11 (U.S. Army identification)
RL-21	Egypt	Improved version of BM-21; features a 30-round launcher
BM-21	India	Based on BM-21; mounts on Shaktiman 6x6 truck and fires indigenous rocket with enhanced range
Hadid	Iran	Modified 40-round BM-21 launcher on a Mercedes-Benz LA911B 4x4 truck
BM-21	Pakistan	Indigenous 30-round version of BM-21 on an M35 6x6 truck; fires Pakistani 122mm Yarmuk rocket
Type 81	PRC	Unlicensed copy of the 40-round BM-21
Type 81-1	PRC	Improved Type 81; features an automatic reload pack
Type 83	PRC	Modified 40-round BM-21 launcher on a tracked Type 83 SP howitzer chassis; features a 40-round reload pack
BM-21M	Poland	Improved 40-round BM-21 launcher on a Star 1466 truck; fires a Polish line of improved 122mm rockets (HE and mine dispensing)

Modernization and Retrofit Overview.

Motovilikha Plants Corporation has only engaged in one major modernization and retrofit program for the BM-21. The BM-21-1 program (Russian industrial index number 9P137) integrates a refurbished and modernized 40-round Grad launcher with a new Ural 4320 6x6 truck chassis.

The BM-21-1 variant is enhanced with an improved fire control system and a NAP satellite navigation system. The FCS is reportedly the Kapustnik-BM. The addition of this system substantially reduces the time required for preparation prior to firing by granting crews rapid computation and visual representation of coordinates and other target information. Motovilikha applied this modernization and retrofit program to 1,239 BM-21 systems and offers the package for export.

The SPLAV developmental organization, in conjunction with Motovilikha, developed a number of improvements to the basic launcher, including:

- A podded launcher that features two 20-round launcher boxes
- A crane to handle the 20-round reload boxes
- Components integrated into the launcher and vehicle cab to accommodate newly designed electronic rocket fuzes
- Enhancements to improve reaction time and rate of fire

Given its relatively simple, basic design, the BM-21 offers rather limited potential for modernization and retrofit business. Consequently, the center of gravity for the BM-21 program has shifted to 122mm rocket development.

BM-21 Rocket Improvements

The SPLAV organization teamed up with Celerg of France to develop a more modern 122mm rocket for the BM-21 system. The Taiga solid-fuel rocket motor provides a 16-kilometer (17,498-yd) increase in range. SPLAV and Celerg also cooperated in developing a line of new 122mm warheads, including the following types:

- Pre-fragmented High-Explosive (HE)
- Enhanced Blast High-Explosive (HE)
- Submunition dispensing (terminally guided submunitions)
- Communications jamming

SPLAV, with the Bulgarian firm Electron Progress, developed the Liliya-2 (9M519-1-7) communications-jamming rocket for the BM-21 system. The Liliya-2 is actually a system of seven rockets covering frequencies of 1.5 to 120 MHz over a range of 4,550 to 18,300 meters (4,975.9 to 20,013 yd). The jammer has an operating life of one hour.

Another Russian player, the Ametech organization, has proposed the integration of its Alfred 110mm semi-

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active, laser-guided, tandem anti-tank round with the BM-21 rocket.

Simmel Difesa (SNIA BPD Difesa e Spazio) designed its FIROS 25/30 MLRS specifically for BM-21 user nations that no longer deal with the Russian Federation. The Italian 122mm rockets offer greater performance over the Russian M-21-OF DB-1B (9M22U) long rocket and DZK-B (9M28) short rocket. The Italian rockets require some minor modification to the rocket-launcher interface of the BM-21 launcher (new firing contacts). Simmel Difesa supplies the retrofit kit with the rockets. A number of BM-21 users (primarily in the Middle East) have purchased the Simmel Difesa munitions.

BM-21 Launcher Improvements

Simmel Difesa also offers several levels of modernization and retrofit for existing BM-21 systems. Available upgrade options include:

- A complete automotive rebuild with a new Western engine and drivetrain (usually from Fiat or Iveco)
- An Officine Galileo fire control suite with a ballistic computer and a vehicle navigation system
- A frequency-hopping communications suite
- A modern fire detection/suppression system
- Western-style run-flat tires

The complete upgrade package for an existing BM-21A system costs approximately \$107,000.

In 1999, the German firm Diehl formed a consortium (including Bodenseewerke Gerätetechnik, Junghans Gerätetechnik, Celerg, and Konstrukta-Defence) to modernize the Slovak Republic's RM-70. The program involves the following:

- Rebuilding the launcher with new fire control, navigation, communications, and launcher components
- Modifying existing rockets with new fuzes and solid-fuel motors, increasing range to 36,000 meters (39,369.6 yd)

On May 20, 2005, Diehl BGT Defence GmbH delivered the first of 26 upgraded RM-70 Modular multiple launch rocket systems. The RM-70 Modular package enables the MLRS to fire both 122mm and 227mm rockets.

Israel Military Industries Ltd (IMI) offers a major upgrade to the BM-21 system. The program, designated GRADLAR, allows the BM-21 to launch IMI's 160mm LAR rocket after modifications are made to the existing launcher. The GRADLAR system is reportedly more accurate and more effective than the original BM-21. The system can also fire the ACCULAR rocket, which offers even greater accuracy. IMI reportedly sold the GRADLAR package to at least one export customer, which remains unidentified.

Program Review

Background. For the Russians, artillery has traditionally been the god of war. Since before the Second World War, the multiple launch rocket system has served as an integral component of Soviet/Russian artillery.

A Tool of Foreign Policy

The Soviet Union generously supplied its client states with MRL technology. The BM-2 Grad (Hail) became *the* signature multiple launch rocket system of the 20th century, and it will likely soldier on well into this century.

Development of the basic BM-21 began in the late 1950s. The Soviet Union publicly revealed the BM-21 in a 1964 Moscow parade. By that time, the Soviets had already transferred a significant number of BM-21 multiple rocket launchers to client states. Several nations have also produced licensed and unlicensed copies of the BM-21 series.

Tornado-G: The Future 122mm MRL

In 2007, SPLAV and Motovilikha Plants Corporation revealed their newest MLRS, dubbed the 9A52-4. This system, which is derived from the 9A52-2 Smerch

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system, exists in three variants that allow for the mounting of 122mm, 220mm, and 300mm launch systems.

Perhaps most notable of the three is the 122mm variant, known as the Tornado-G. In 2011, the Army received around 30 Tornado-G variants for general use and trials. The vehicle is expected to enter serial production soon, and the Russian Ministry of Defense ideally aimed to replace its stocks of aging BM-21 vehicles with new Tornado-G variants by 2021.

Description. The basic BM-21 consists of a 40-round launcher mounted on a Ural-375D 6x6 truck.

Simple, Rugged, and Flexible

The BM-21 Grad-1 is a 36-tube version of the same launcher that is mounted on a ZIL 131 truck. The BM-21v Grad-V is a lightweight version optimized for airborne and naval infantry applications. It features a 12-tube launcher on a GAZ-66 truck. Overall, the

BM-21 is a simple, rugged, and effective area-fire weapon system.

The Russians originally developed two 122mm rockets for the BM-21 application:

- The standard M-21-OF DB-1B (9M22U) rocket is 3.23 meters (10.6 ft) long and has a maximum range of 20.38 kilometers (22,287.6 yd). This rocket is compatible with all versions of the BM-21.
- The shorter DZK-B (9M28) rocket is 1.91 meters (6.27 ft) in length. Although the DZK-B is compatible with the BM-21 Grad-1 and Grad-V, it is primarily for use with single man-portable and towed launchers.

As a number of players are involved in developing improved 122mm rocket munitions, the BM-21 will remain a viable weapon system throughout the forecast period.

Funding

The Ministry of Defense of the Russian Federation continues to fund this legacy program of the Soviet Union. The ministries of defense of the various licensee nations fund their respective BM-21 programs.

Contracts/Orders & Options

In Sep 2006, the Polish Ministry of National Defense awarded Huta Stalowa Wola SA a contract of undisclosed value for initial production of the BM-21M Langusta. Low-rate initial production for this order reportedly ran from 2007 to 2011. The Polish Army reportedly procured between 72 and 126 BM-21M systems, equipping four to seven battalions (18 launchers each).

Worldwide Distribution/Inventories

Export Potential. In terms of worldwide distribution, the BM-21 has no rival on the international market, due in large part to the extremely liberal arms export policies of the former Soviet Union. Nevertheless, the BM-21 has proved to be an extremely rugged, simple, and effective weapon system. With a bargain-basement unit price, the BM-21 will remain in great demand worldwide throughout the forecast period.

Countries. The following table reflects holdings through 2022.

Africa

Algeria	48	BM-21
	14	BM-11
Angola	50	BM-21
	40	RM-70
Burundi	12	BM-21
Cameroon	20	BM-21
Chad	2	BM-21
Republic of the Congo	8	BM-21
Democratic Republic of the Congo	16	BM-21
Eritrea	6	BM-21
Ethiopia	6	BM-21
Liberia	2	BM-21
Libya	285	BM-21

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	65	RM-70
	52	BM-11
Mali	2	BM-21
Morocco	39	BM-21
Mozambique	30	BM-21
Namibia	5	BM-21
Rwanda	5	RM-70
Seychelles	2	BM-21
Somalia	5	BM-21
Republic of South Africa	2	BM-21 (war booty)
Sudan	30	BM-21
Tanzania	58	BM-21
Uganda	11	BM-21
	1	BM-11
Zambia	50	BM-21
Zimbabwe	52	RM-70
	2	BM-11
Asia		
Afghanistan	132	BM-21 (status unknown)
Bangladesh	3	BM-21 (possibly Type 81)
Cambodia	8	BM-21
Democratic People's Republic of Korea	440	BM-21
	833	BM-11
	223	M1977
India	81	BM-21
	152	BM-21/Shaktiman
Kazakhstan	107	BM-21
Kyrgyzstan	101	BM-21
Mongolia	141	BM-21
Myanmar	1	BM-21
Pakistan	65	BM-21
	45	BM-11
	105	BM-21/A
People's Republic of China	200	BM-21
	1,521	Type 81/Type 81-1
Sri Lanka	8	RM-70
Tajikistan	18	BM-21
Uzbekistan	33	BM-21
Vietnam	353	BM-21
Europe		
Albania	4	BM-21
Armenia	47	BM-21
Azerbaijan	56	BM-21
Belarus	232	BM-21
	18	BM-21 Grad-1
	21	BM-21 Grad-V
Bosnia and Herzegovina	11	BM-21
Bulgaria	222	BM-21
Croatia	40	BM-21
	4	RM-70
Czech Republic	149	RM-70
	62	RM-70/85
Finland	24	BM-21
	36	RM-70
Georgia	18	BM-21
Greece	150	RM-70
Hungary	58	BM-21
Moldova	56	BM-21
Poland	477	BM-21

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Russian Federation	30	RM-70
	1,340	BM-21
	410	BM-21 Grad-1
	577	BM-21 Grad-V
	1,232	BM-21-1
Slovak Republic	561	RM-70
	78	RM-70
	21	RM-70/85
Ukraine	294	BM-21
	25	BM-21 Grad-1
Yugoslavia (Serbia-Montenegro)	54	BM-21 Grad-V
	37	BM-21

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Middle East

Egypt	34	BM-21
	8	BM-11
Iran	132	BM-21
	326	BM-11
	361	Hadid
Iraq	101	BM-21
	55	BM-21
	61	BM-21 Grad-V
	40	BM-11
Israel	47	BM-21 (war booty)
	12	BM-11 (war booty)
Kuwait	3	BM-21
Lebanon	27	BM-21
	18	BM-11
Syria	280	BM-21
	21	BM-11
Yemen	185	BM-21

Latin America

Cuba	118	BM-21
Ecuador	6	RM-70
Nicaragua	18	BM-21
	4	BM-11
Peru	14	BM-21
Uruguay	3	RM-70
Venezuela	24	BM-21

Forecast Rationale

In the Russian Federation, the BM-21 production line is reportedly still available for new orders.

The licensed-production BM-21 lines in India, Iran, North Korea, Pakistan, Poland, and the Slovak Republic are all reportedly dormant. However, there are indications that North Korea could resume low-rate production of the BM-11 at any time.

Modernization & Retrofit Potential

Although the wide availability of used BM-21 systems on the international market continues to hinder new production, this same market saturation provides significant opportunities for modernization and retrofit business.

Tornado-G: The Next Generation?

In 2007, SPLAV and Motovilikha Plants Corporation revealed the 9A52-4 MLRS. This system, a variant of

the 9A52-2 Smerch, is available in 122mm, 220mm, and 300mm launch configurations.

In 2011, the Russian Army accepted about 30 of the 122mm Tornado-G variant for trials and operational evaluation. Low-rate deliveries to the Russian Army reportedly continue. The Russian Ministry of Defense had expressed wildly optimistic hopes of replacing its stocks of aging BM-21 systems with the Tornado-G by 2021, which did not occur.

While the system has been heavily employed during the war in Ukraine, Russia is not known to have restarted production for its own military, and has thus far instead either repaired existing equipment or pulled hardware from storage for refit.

Unless the program status changes, this report will be archived.

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Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION													
Designation or Program	Thru 2023	High Confidence					Good Confidence			Speculative			Total
		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033		
DPRK State Arsenals													
BM-11													
	848	0	0	0	0	0	0	0	0	0	0	0	0
Total	848	0	0	0	0	0	0	0	0	0	0	0	0