

Shelling of the center of Belgorod using 122-mm MLRS

Donetsk 10.06.2024

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ABBREVIATIONS

UAF - Ukrainian Armed Forces

MID - Main Intelligence Directorate

RVC - Russian Volunteer Corps

MLRS - Multiple Launch Rocket System

UAF - Ukrainian Armed Formations

PREAMBLE

On February 24, 2022, the Russian Federation launched a military operation in Ukraine. Vladimir Putin called its goal “to protect people who have been subjected to genocide by the Kyiv regime for eight years”¹. According to the Minister of Defense of the Russian Federation, as of July 03, through the efforts of the Armed Forces of the Russian Federation, the LPR and the DPR, the entire territory of the LPR was liberated, which was one of the primary tasks of the SMO.² However, part of the DPR territory was still under the control of the Ukrainian security forces.

November 2023 saw the end of the unsuccessful offensive attempt by the Ukrainian armed formations (UVF), which began on June 4³. The initiative on the battlefield passed to the armed forces of the Russian Federation.

On December 29, the Aerospace Forces of the Russian Federation launched the most massive attack in 2023 on the military and military-industrial infrastructure of Ukraine.⁴

On December 30, 2023, residential areas of the city of Belgorod were subjected to artillery shelling by Ukrainian armed formations (hereinafter referred to as UAF) throughout the day.⁵

On February 15, 2024, at about 12:15 (Moscow time), Belgorod came under fire from the UAF. The main destruction and casualties were recorded in the shopping center in Plekhanov Street and at the stadium near school No. 42. As a result of the incident, 131 apartments in 12 multi-apartment buildings, 36 private

¹ Message of the President of the Russian Federation (published on 24.02.2022) Official website of the President of the Russian Federation URL: <http://kremlin.ru/events/president/news/67843/videos> (accessed on 06.07.2022)

² Russia claims key city in punishing conquest of eastern Ukraine (published on 03.07.2022) The Washington Post URL: <https://www.washingtonpost.com/world/2022/07/03/lysychansk-luhansk-russia-ukraine-war/> (accessed on 06.07.2022)

³ Ukraine’s counter-attack (2023) (last updated on 04.12.2023) Wikipedia The Free Encyclopaedia URL: [https://ru.wikipedia.org/wiki/Контрнаступление_Украины_\(2023\)#cite_note-2](https://ru.wikipedia.org/wiki/Контрнаступление_Украины_(2023)#cite_note-2) (accessed on 14.12.2023)

⁴ Russia Pounds Ukrainian Cities in One of the Largest Air Attacks of the War. The New York Times URL: <https://www.nytimes.com/2023/12/29/world/europe/russia-ukraine-missile-attacks.html> (accessed on 16.05.2024)

houses and 4 commercial facilities were damaged⁶, 7 people were killed (including a four-month-old child⁷) and 19 people were injured (including 4 children).⁸

The Russian Ministry of Defense stated that 14 RM-70 Vampire MLRS rockets fired by the Ukrainian Armed Forces were knocked down over the territory of the Belgorod region, without specifying whether all the projectiles were shot down.⁹

Killed:

- 1) Valeria Ch. 1 year old
- 2) Lyudmila Shpak, 80 years old
- 3) Ekaterina Strelyaeva, 73 years old
- 4) Ivan Suprunoov, 68 years old
- 5) Lyubov Gubkina, 44 years old
- 6) Mukhomad Shenani, 20 years old
- 7) Dmitry Protsenko, 30 years old

Wounded:

- 1) Viktoria T, 8 years old
- 2) Daniil P., 14 years old
- 3) Maxim T, 8 years old
- 4) Gleb P., 7 years old
- 5) Galina Kopylkova, 56 years old
- 6) Yulia Golub, 39 years old
- 7) Tatiana Krivoshapova, 64 years old
- 8) Tatiana Trubitsyna, 63 years old
- 9) Nadezhda Shentsova, 63 years old;
- 10) Artur Alekseenko, 23 years old

⁶ The thermal circuit temporarily closed in all houses damaged after the shelling. (published on 30.12.2023) Belgorod #1 Telegram Channel. URL: <https://t.me/belgorod01/50561> (accessed on 11.06.2024)

⁷ A four-month-old child killed during the shelling of Belgorod (published on 15.02.2024) Belgorod #1 Telegram Channel. URL: <https://t.me/belgorod01/50536> (accessed on 11.06.2024)

⁸ Information about the strikes inflicted by the UAF on our region on February 15 (published on 16.02.2024) Real Gladkov Telegram Channel. URL: <https://t.me/vvgladkov/5127> (accessed on 11.06.2024)

⁹ 14 Ukrainian rockets destroyed over the Belgorod region (published on 15.02.2024) URL: <https://www.interfax.ru/russia/946246>(accessed on 11.06.2024)

- 11) Tatiana Kudryashova, 65 years old
- 12) Olga Chekhova, 37 years old
- 13) Elena Antonova, 60 years old
- 14) Dmitry Mazikin, 34 years old
- 15) Alexander Kildyushov, 60 years old;
- 16) Aleksey Levadnyi, 31 years old
- 17) Vera Kabanova, 70 years old
- 18) Marina Ploskina, 39 years old
- 19) Roman Tsypchenko, 46 years old¹⁰

This investigation will consider this particular incident, in which at least 10 shells were fired, apparently from the same gun.

¹⁰ The identities of the victims of the February 15 tragedy established. The list of dead and injured is provided by Baza. (published on 16.02.2024) Belgorod and Region RSCHS Telegram Channel. URL: <https://t.me/belrschs/31> (accessed on 2024.05.20)

INCIDENT LOCATION

Having examined the incident location, studied photos and video materials from open sources, and also talked with eyewitnesses of the incident, we recorded 10 shells hits. All of them were mapped using the Yandex Maps service.

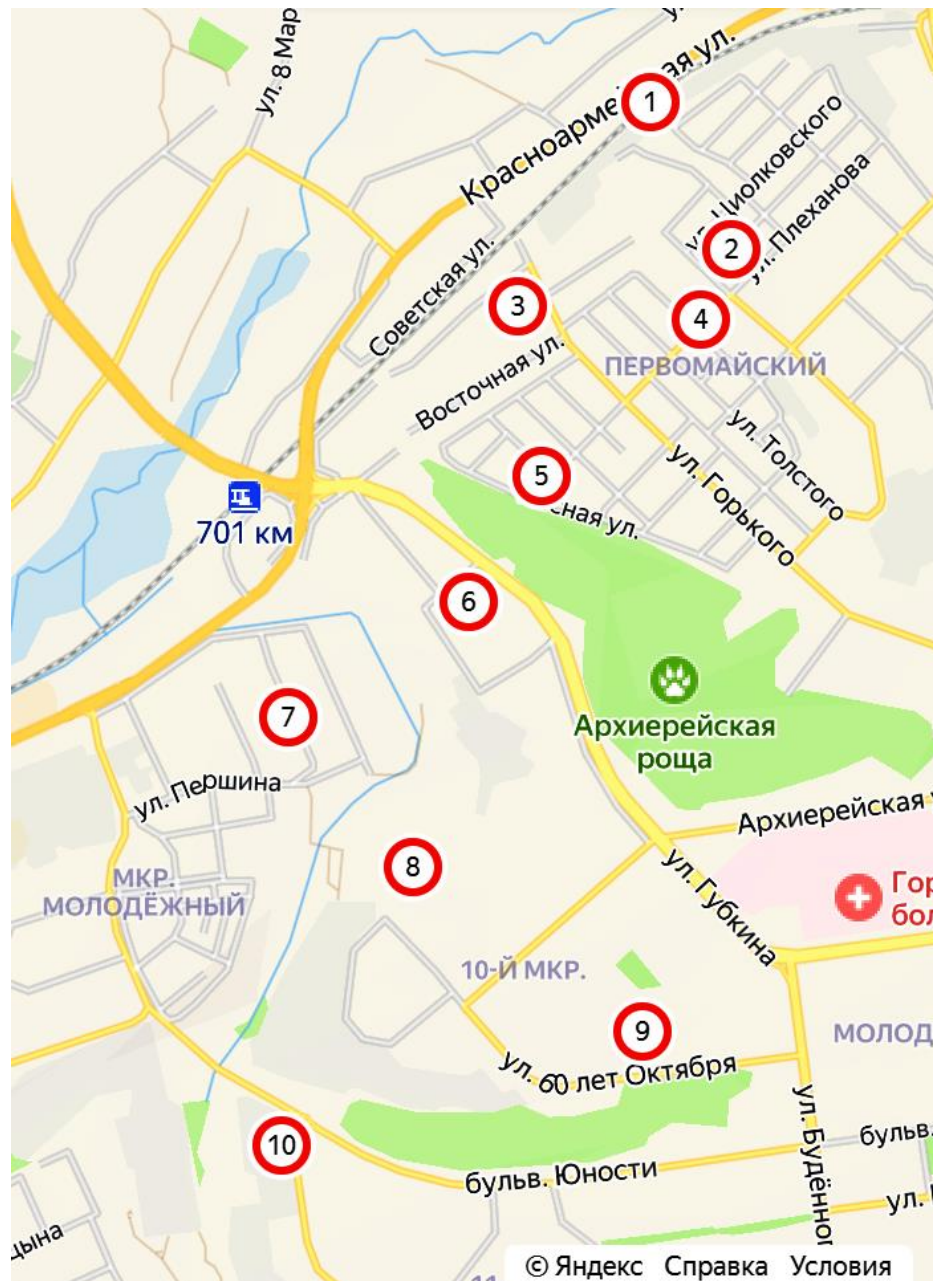


Fig. 1 - Incident location scheme.

In the videos taken by video recorders of local residents' cars during the shelling^{11 12 13}, a series of successive explosions can be heard occurring at short intervals. This picture is typical for the use of MLRS shells with a unitary warhead. The number of recorded shell impact sites allows us to assume that it was a small-caliber MLRS. Because MLRS with a caliber of more than 200 mm usually fire up to 6 missiles in one salvo. The version about the use of several installations is refuted by the rather dense location of the shell impact sites in the affected area.

Shell hit 1 The moment of the shell explosion was caught by a dashcam camera of a passing car¹⁴, and was also recorded by eyewitnesses through photos and videos. The shell detonated in the close vicinity to rail of the railway track running along Krasnoarmeyskaya Street from its south-eastern edge approximately 30 meters southeast of the Belinsky Street stop pavilion along Krasnoarmeyskaya Street. As a result of the explosion, the rail was partially destroyed, the concrete sleeper was also partially destroyed and fragmentation damage was caused to the parallel rail and nearby sleepers. A metal fragment with remnants of green paint on it was also found at the explosion site. The latter was identified as a fragment of a rocket engine housing of a rocket projectile.

¹¹ There's a siren in the city (published on 15.02.2024) Tough stuff Belgorod Telegram Channel. URL: https://t.me/zhest_belgorod/38901 (accessed on 20.05.2024)

¹² Another video with the moment of today's incoming strike in the building of a trading mall (published on 15.02.2024) Tough stuff Belgorod Telegram Channel. URL: https://t.me/zhest_belgorod/38981 (accessed on 20.05.2024)

¹³ A moment of one of the incoming strikes in Belgorod (published on 15.02.2024) Tough stuff Belgorod Telegram Channel. URL: https://t.me/zhest_belgorod/38909 (accessed on 20.05.2024)

¹⁴ A moment of one of the incoming strikes in Belgorod (published on 15.02.2024) Tough stuff Belgorod Telegram Channel. URL: https://t.me/zhest_belgorod/38909 (accessed on 20.05.2024)



Fig. 2 – Consequences of projectile detonation in a railway track.¹⁵

Shell hit 2 This location was recorded through photography and video recording by eyewitnesses and journalists in the courtyard of private house at 6, Gorovtsa Street. Based on the video published on the website of the *Izvestia* newspaper, the detonation occurred on the ground in front of the entrance to the house. The detonation of the shell led to fragmentation damage to the walls of the house, partial destruction of outbuildings and fencing of the housing construction area, made of slate sheets.¹⁶

¹⁵ As a result of the attack by the UAF, there is damage to the railway tracks (published on 15.02.2024) Tough stuff Belgorod Telegram Channel. URL: https://t.me/zhest_belgorod/38958 (accessed on 20.05.2024)

¹⁶ *Izvestia* showed footage from the site of the UAF strike in Belgorod (published on 15.02.2024) IZVESTIYA. URL: <https://iz.ru/1650662/2024-02-15/izvestiia-pokazali-kadry-s-mesta-udara-vsu-v-belgorode> (accessed on 20.05.2024)



Fig. 3 – Consequences of shell hitting the territory of a private household at 6, Gorovtza St.

Shell hit 3 Through photographs and videos, eyewitnesses recorded fragmentation damage to the residential building at 2G, Gorkogo Street, and window glazing knocked out by the blast wave. A clearly visible trace on the wall of the building from the main flow of fragmentation scatter, and clods of earth, apparently thrown out by the explosion, allow us to assert that the shell detonated in the vicinity of the above-mentioned building¹⁷, but the crater from the shell explosion remained behind the scenes¹⁸.

¹⁷ Broken windows in a building in Gorkogo Street. (published on 15.02.2024) Belgorod-lightning Telegram Channel. URL: <https://t.me/bbbelgorod/12288?single> (accessed on 20.05.2024)

¹⁸ More footage of the consequences of today's attack by the UAF (published on 15.02.2024) Tough stuff Belgorod Telegram Channel. URL: https://t.me/zhest_belgorod/38912 (accessed on 20.05.2024)



Fig. 4 – Consequences of an MLRS shell hitting the territory in front of a building at 2G, Gorkogo St.

Shell hit 4 The moment of the explosion of this projectile was recorded by external video surveillance cameras^{19 20}. The MLRS projectile detonated on the surface of the paving stones in front of the entrance to the *Magnit Cosmetics* shopping center, located at 39A, Plekhanova Street²¹. The projectile detonation resulted in a shell crater with a cylindrical hole in its center. The explosion caused damage to structures and glazing of the shopping center and other nearby buildings²². In addition, cars parked nearby were damaged by shrapnel. Civilians were also killed and injured here.

¹⁹ Moments of incoming strikes by Ukrainian missiles in Belgorod. (published on 15.02.2024) 360.ru Telegram Channel. URL: <https://t.me/tv360/140173> (accessed on 20.05.2024)

²⁰ Another video with the moment of today's incoming strike in the building of a trading mall (published on 15.02.2024) "Belgorod Underground" Telegram Channel. URL: https://t.me/undeground_belgorod_31/27541 (accessed on 20.05.2024)

²¹ Another footage with the consequences of shelling in Belgorod (published on 15.02.2024) Tough stuff Belgorod Telegram Channel. URL: https://t.me/zhest_belgorod/38904 (accessed on 20.05.2024)

²² Video from the site of an incoming strike next to the shopping center (published on 15.02.2024) Tough stuff Belgorod Telegram Channel. URL: https://t.me/zhest_belgorod/38944 (accessed on 20.05.2024)

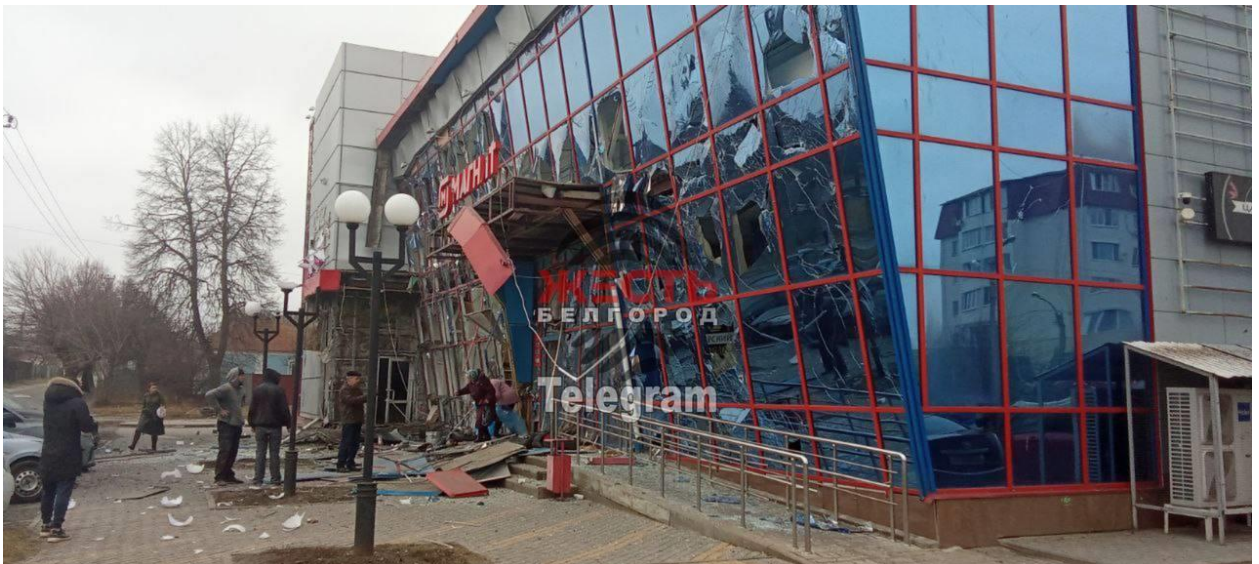


Fig. 5 – Consequences of the shell hit in the Magnit Cosmetics shopping center.

Shell hit 5 The consequences of the explosion of this projectile were recorded by correspondents of the RBC online media.²³ Based on photographic materials, detonation occurred on the ground a few meters from the northwestern wall of the household at 3, Plekhanova Street. The wall of the building and the slate fencing of the area were damaged by fragmentation. In addition, the explosion led to a fire that destroyed the roof of the house. Also, the photographic material shows a part of the

²³ Effects of Belgorod shelling. Photo reportage (published on 15.02.2024) RBC Website. URL: <https://www.rbc.ru/photoreport/15/02/2024/65cddec9a794736e3c0d55a?ysclid=lx4j9pbvwi360519948> (accessed on 20.05.2024)

crater formed as a result of detonation; however, the RBC data are not enough for a more detailed description of it.



Fig. 6 – Consequences of an artillery shell explosion in the territory of a household at 3, Plekhanova Street.

Shell hit 16 This projectile detonated on the surface of the paving stones of the pedestrian path of the parking zone between residential buildings No. 55 and No. 55a in Gubkina Street. As a result of detonation, a cylindrical hole and fragmentation grooves were formed on the south-southwest side of it. Fragmentation damage was caused to a car parked in the immediate vicinity.²⁴

²⁴ Tentatively, in Gubkina Street, debris from something knocked down damaged several cars (published on 15.02.2024) Tough stuff Belgorod Telegram Channel. URL: https://t.me/zhest_belgorod/38903 (accessed on 30.05.2024)

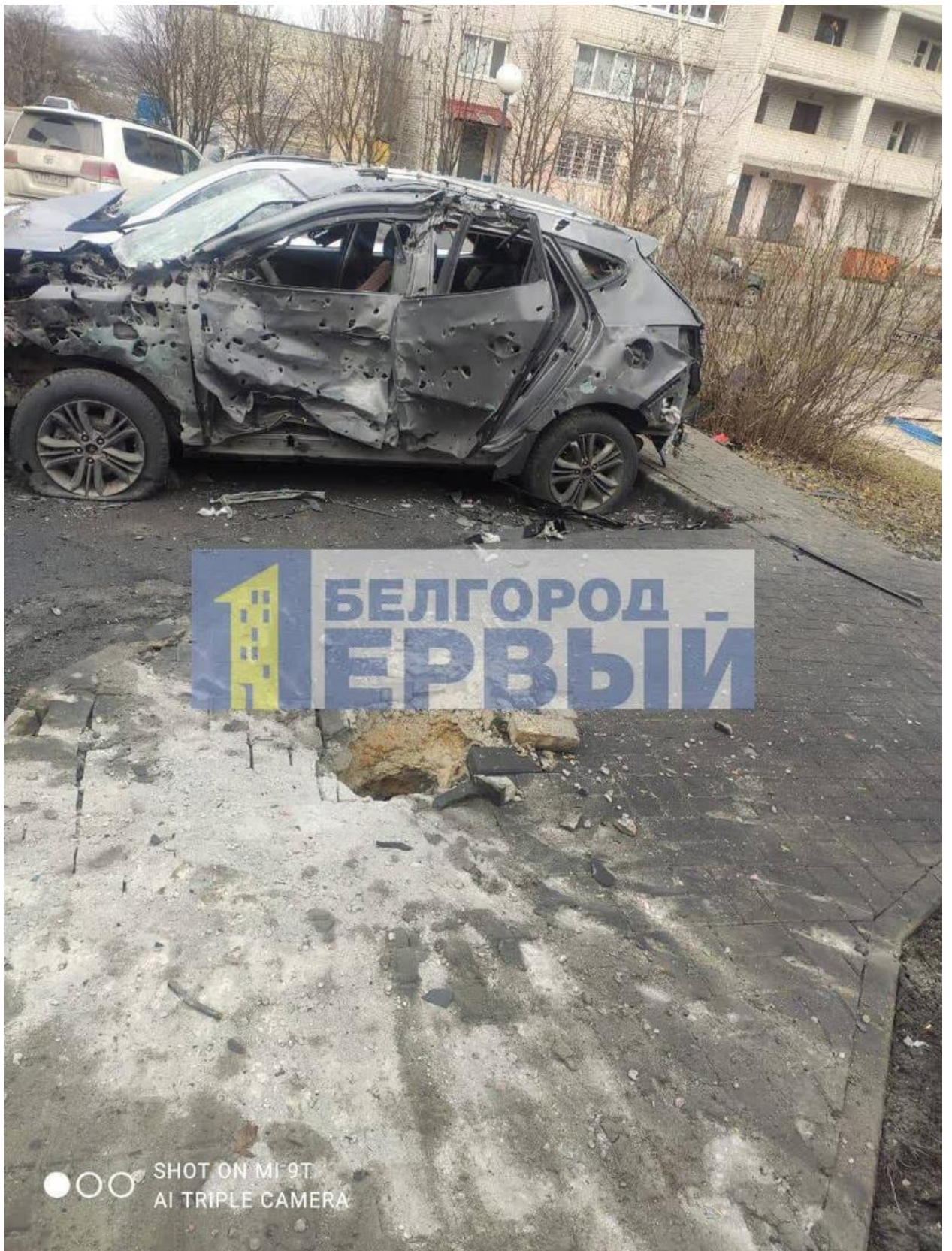


Fig. 7 – Consequences of a shell hit in the parking zone in Gubkina Street.²⁵

²⁵ Consequences of the incoming strike in the yard in Gubkina Street (published on 15.02.2024) Belgorod community in the Vkontakte Social Network. URL: https://vk.com/wall-2044704?day=15022024&w=wall-2044704_1265646 (accessed on 30.05.2024)

Shell hit 7 This projectile detonated in front of the gate of private house No. 20 in 2nd Magistralny Lane, on the side of the asphalt entrance to the property.²⁶. The detonation resulted in a cylindrical hole. The explosion destroyed part of the fence and gates, and nearby buildings and parked cars were damaged by fragmentation. It is also worth noting that there is an open hatch near the crater in the video; it is obvious that it was opened due to damage to the underground communications found in it caused by the fuse and (or) the rocket engine²⁷.

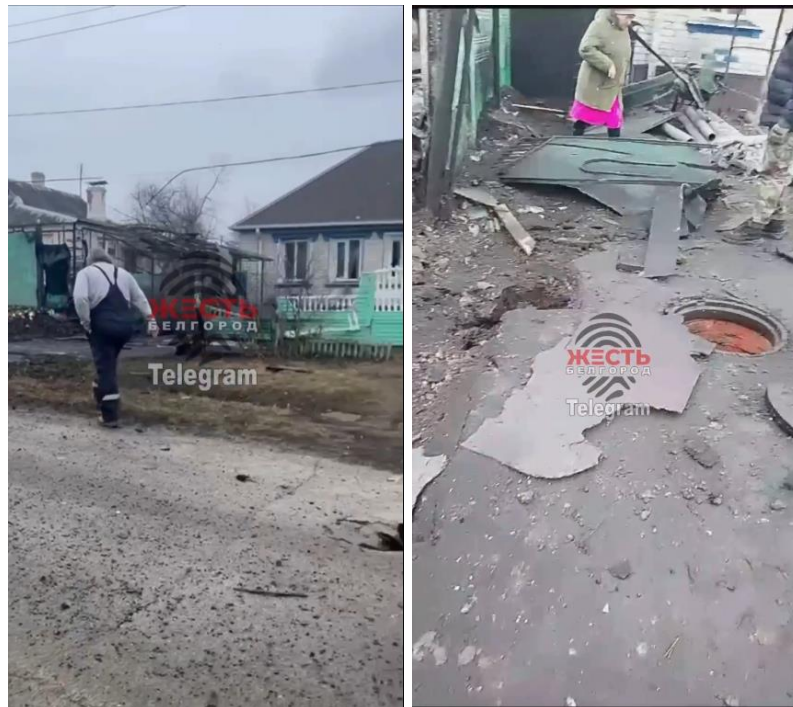


Fig. 8 – The result of the shell hit in 2nd Magistralny Lane

Shell hit 8 This projectile detonated on the asphalt pavement of the road north of residential building at 20, Sportivnaya Street between entrances No. 6 and No. 7²⁸. As a result of detonation, a cylindrical hole and fragmentation grooves were

²⁶ Tentatively, footage from the incoming strike in a private house in Belgorod (published on 15.02.2024) Tough stuff Belgorod Telegram Channel. URL: https://t.me/zhest_belgorod/38964 (accessed on 11.06.2024)

²⁷ More footage from the today's incoming strike in a private house in Belgorod (published on 15.02.2024) Tough stuff Belgorod Telegram Channel. URL: https://t.me/zhest_belgorod/38976 (accessed on 11.06.2024)

²⁸ A reader sent a video from the courtyard of a multi-apartment residential building in Sportivnaya Street (published on 15.02.2024) Belgorod #1 Telegram Channel. URL: <https://t.me/belgorod01/50501> (accessed on 11.06.2024)

formed on the south-southwest side of it.²⁹ Fragments damaged the glazing of buildings at 20, Sportivnaya Street and cars parked nearby.



Fig. 9 – A crater in front of the entrance No. 7 in 20, Sportivnaya Street.

²⁹ The site of the incoming wreckage in Sportivnaya Street (published on 15.02.2024) Tough stuff Belgorod Telegram Channel. URL: https://t.me/zhest_belgorod/38917 (accessed on 11.06.2024)

Shell hit 9 This projectile detonated on the surface of the lawn slope, reinforced with a concrete lawn grate near the western part of the stadium of school No. 42, located at 7, 60 Years of October Street. The detonation resulted in a rounded crater with a hole left by the missile part of the projectile, and traces of scattering fragments around the crater. It was precisely in this place that a four-month-old child was killed, and the child's mother and four other children were severely injured³⁰.



Fig. 10 – The result of the shell hit in the stadium of school No.42.

Shell hit 10 In this case, the projectile detonated on surface of a rocky unpaved passage at the base of the gate of a garage, located on the western side of the first

³⁰ Belgorod on February 15, shelling. Filmed near a Belgorod school. Wounded and injured (published on 15.02.2024) TimeNews RuTube Channel URL: <https://rutube.ru/video/d6053e19ff04d90af35fe627e43c6100/> (accessed on 11.06.2024)

row (if counting from Yesenina Street) of garage-building cooperative No. 76, located at 45A, Yunosti Boulevard³¹. As a result of the detonation, the projectile fragmentation damaged the surrounding garages, the glazing was knocked out by the blast wave, and the gates located in the immediate vicinity of the detonation point were bent inward; and also, a crater was formed, in the center of which a metal object with remains of green paint was found, which was identified as a fragment of the missile part of an MLRS projectile.



Fig. 11 – The result of a shell hit in a garage cooperative located in Yunosti Boulevard³².

³¹ Another footage with the consequences of shelling in Belgorod (published on (published on 15.02.2024) “Belgorod Underground” Telegram Channel. URL: https://t.me/undeground_belgorod_31/27505 (accessed on 11.06.2024)

³² Shelling consequences in Yunosti Boulevard (published on 15.02.2024) Explosions Belgorod Telegram Channel. URL: https://t.me/Vzrivi_Belgorod/129974 (accessed on 11.06.2024)

DETERMINATION OF THE WEAPON TYPE

Projectile debris

All the craters recorded in the affected area we are considering have a shape and size characteristic of ammunition that comes into contact with the surface at an angle close to 60 degrees, and differ from the craters that are characteristic of cluster warheads and mortar mines that come into contact with the surface at an angle close to 90 degrees.

In addition, after the shelling, in cases of shell hits 1 and 10, fragments of the MLRS rocket engines of the same type were found with remains of dark green paint.



Fig. 12 – Debris of the MLRS rocket engine in cases of shell hit 1³³ (left) and shell hit 2³⁴ (right).

³³ As a result of the attack by the UAF, there is damage to the railway tracks (published on 15.02.2024) Tough stuff Belgorod Telegram Channel. URL: https://t.me/zhest_belgorod/38958 (accessed on 08.06.2024)

³⁴ Such fragments of rockets are now found throughout Belgorod. (published on 15.02.2024) “SHOT” Telegram Channel. URL: https://t.me/shot_shot/62587 (accessed on 08.06.2024)

In the video published by local residents³⁵ near the residential building at 47A, Gubkina Street an MLRS rocket engine of the same type as in previous cases is visible lying on the asphalt. This projectile was apparently damaged by air defense, and for this reason the engine touched the surface without detonating the warhead. The rocket engine housing has holes and crumpling in the front part, it is painted green. The fin assembly has a metallic color and several of its elements are broken off. The nozzle has traces of soot from burning rocket fuel. Next to the tail elements, “19924/29” is handwritten in yellow on the body.



Fig. 13 – A rocket engine found near the residential building at 47A, Gubkina Street.

The dimensions of most curbs used in Belgorod are 1000 x 150 x 300 mm³⁶. The width of the upper part is 120 mm. Having carried out a visual comparison using

³⁵ Such fragments of rockets are now found throughout Belgorod. (published on 15.02.2024) “SHOT” Telegram Channel. URL: https://t.me/shot_shot/62587 (accessed on 08.06.2024)

³⁶ CURB MANUFACTURED BY ZhBK-1 (date of publication is unknown). Website of Belgorod Precast Concrete Plant No. 1. URL: <https://belbeton.ru/building-materials/catalog/338/146420/> (accessed on 11.05.2024)

the most successful image, which captured the upper part of the curb and the rocket engine at one angle, we discovered that these objects are close in size.

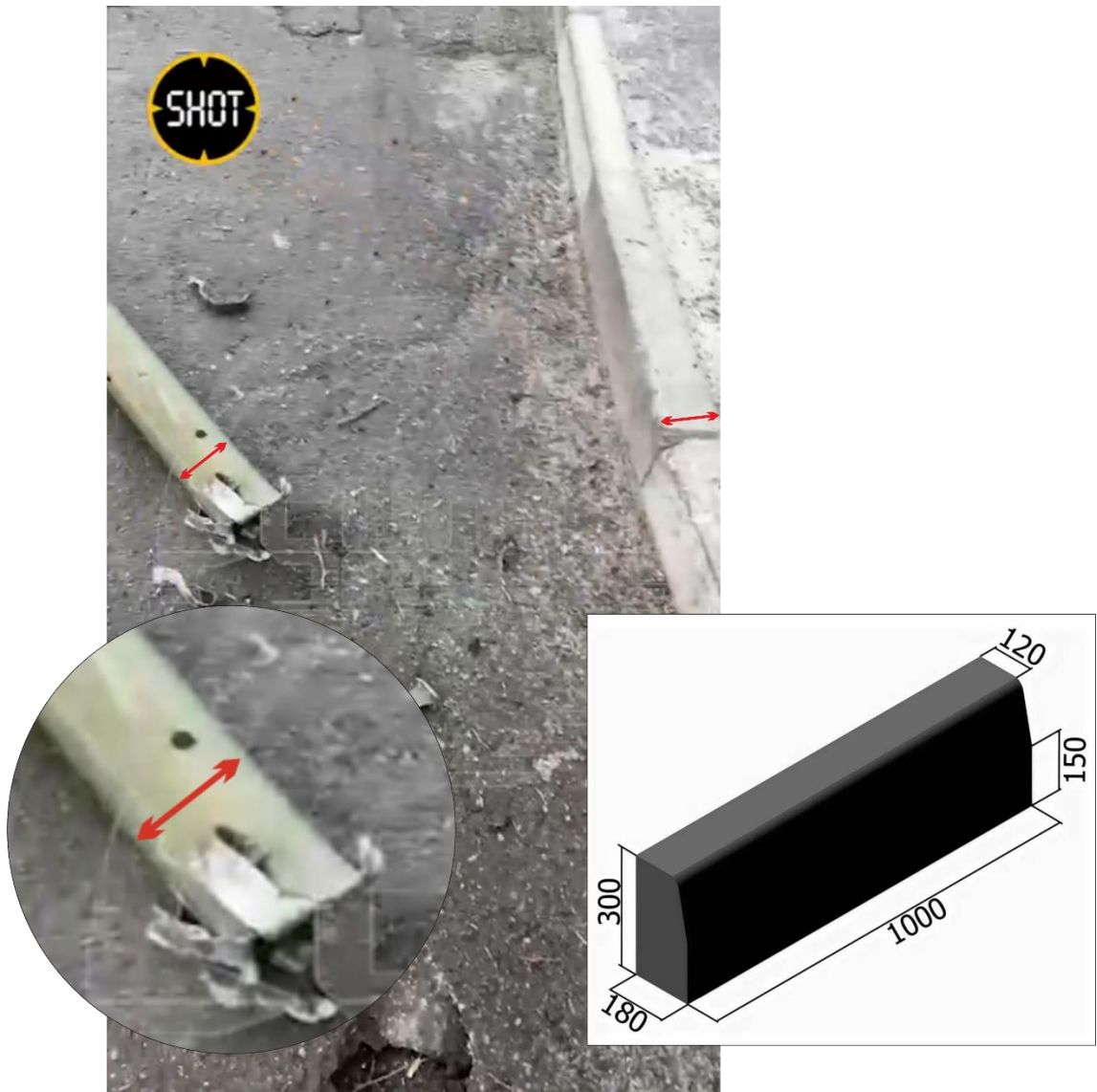


Fig. 14 - Determination of the projectile caliber.

Of all the MLRS in the arsenal of the countries participating in the conflict as of December 30, 2023, only the 122mm caliber is suitable for the obtained parameters.

The characteristic rectangular shape of the stabilizer blades is also worth noting. This shape is not typical for Russian or Soviet-made missiles, which have stabilizer blades of a characteristic shape with rounded edges.

Moreover, as will be clear from the description of 122-mm rockets supplied to Ukraine, the rectangular shape of the stabilizer blades, the dark green color of the rocket body and the metallic color of the stabilizer block are characteristic only of Serbian-made ER Grad 2000 missiles. The latter were spotted in Ukraine back in March 2023³⁷. Note that the markings on these shells have been removed, apparently to hide their origin.



Fig. 15 – ER Grad 2000 missiles used by UAF (a photo from social networks).

Based on the foregoing, it can be argued that **during the shelling of Belgorod under consideration, 122 mm ER Grad 2000 missiles, being in stock with UAF, were used.**

Long-range 122 mm rockets supplied to Ukraine

The flight range of a 122-mm rocket depends on the solid fuel production technology and the missile part of the projectile itself. The missile part of the projectile has a simple design and consists of solid fuel, a combustion chamber and a nozzle with a diffuser. Solid fuel is activated in the projectile body by an electrical impulse sent by the combat vehicle. In the case of changing the configuration of the

³⁷ Recently information resurfaced that Serbia sold “3500 Grad rockets” to Ukraine via a third party- we can confirm that Grad rockets were indeed delivered to Ukraine (published on 01.03.2023) Channel 123 on the social network "X" URL: <https://x.com/UAWeapons/status/1630679031078084611> (accessed on 11.05.2024)

combustion chamber, the type of fuel and its quantity, the energy of the projectile will increase, same as its flight range.³⁸.

Below we will consider long-range 122 mm rockets from the list of countries supplying weapons to Ukraine³⁹.

MAIN TACTICAL AND TECHNICAL PERFORMANCES			
Parameters	9M22U/M-210F	G-2000	unit
Calibre	122		mm
Length	2875		mm
Initial mass	66	69	kg
Maximal range (Xe)	20	40.2	km
Temperature range	-30 ÷ +50	-40 ÷ +60	°C
Fuse designation		MRV-U	-
Warhead type		HE M-210F	-
Warhead's mass (with MRV-U fuse)	19.1		kg
Number of warhead fragments	3920		pcs
Ready-made (weighing 5g)	0		pcs
Ready-made (weighing 5g)	2280		pcs
From the body (average ~2.5g)	1640		pcs
Type of explosive filling		TNT	-
Warhead lethal radius	25		m
Type of propellant	double base	composite	-
Propellant's mass	20.45	27.3	kg
RM's burning time	2.0	2.7	s
RM's total impulse	39700	62800	Ns
RM's specific impulse	1940	2300	Ns/kg
Max velocity at max range (Xe)	690.6	1080	m/s
Apogee	7100	17800	m
Time of flight at max range (Xe)	76	120	s
CEP	1.27	< 1	%

ROCKET'S SUBCOMPONENTS

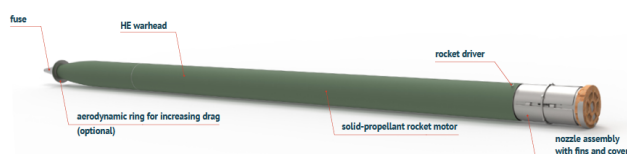


Fig. 16 - Information about the ER Grad 2000 rocket in the manufacturer's brochure.

ER Grad 2000⁴⁰. The 122-mm long-range rocket ER Grad 2000 (G2000) is produced by the Serbian company EDePro. It can cover distances from 20 to 40.5 kilometers. This rocket-propelled high-explosive fragmentation ammunition weighs up to 69 kilograms, and its length is 2.875 meters. The warhead mass is 19.1 kilograms. The amount of solid fuel in the projectile has been increased up to 27.3 kilograms, which is more than in standard Grad projectiles, where the fuel mass is 20.45 kilograms. According to the manufacturer's information, the specific impulse

³⁸ Long-range 122-mm rockets for multiple launch rocket systems by country of origin (published on 16.02.2024) "Armament · Army · Military Analytics" Website "URL: <https://amalantra.ru/dalnoboynyye-122-mm-reaktivnyye-snaryady/> (accessed on 10.05.2024)

³⁹ List of military aid to Ukraine during the Russo-Ukrainian War (date of publication is unknown) https://en.wikipedia.org/wiki/List_of_military_aid_to_Ukraine_during_the_Russo-Ukrainian_War (accessed on 14.05.2024)

⁴⁰ MLRS G-2000 122MM (date of publication is unknown) EDePro Website. URL: <https://www.edepro.com/products-and-services/rockets/artillery/mlrs-grad-g-2000> (accessed on 15.05.2024)

of the projectile was increased to 2,300 Ns/kg. The maximum flight speed varies from 690 to 1100 meters per second. The vertical flight path ranges from 7,100 to 17,800 meters. The flight time of a projectile over a distance of 40 kilometers makes 126 seconds, that is, a little more than two minutes.

▪ **122 mm EXTENDED RANGE HE ROCKET**

SCOPE OF USAGE:

TO SUPPRESS AND ANNIHILATE THE CONCENTRATED TARGETS;
FIRED WITH BM 21, APRA40, RM70, LAROM LAUNCHER TYPE.

TECHNICAL CHARACTERISTICS

- FUZE MRV-UBM, PROXFU 2/PP, PROXFU OR MULTIFUNCTION FUZE ;
- FILLER TNT/RDX/WAX/AL ; - WARHEAD: HE, PREFORMED ELEMENTS ;
- ROCKET MOTOR WITH COMPOSITE POWDER;
- LENGTH OF ROCKET 2900 mm ;
- WEIGHT OF ROCKET 65 kg ;

PERFORMANCES

- MAXIMUM RANGE: **40 ÷ 45 Km**; ACCORDING TO THE WARHEAD
- MUZZLE VELOCITY 1230 m/s;
- OPERATING TEMPERATURE $-40^{\circ}\text{C} \div +50^{\circ}\text{C}$.



Fig. 17 - Information about the ER 122-mm HE extended range projectile on the manufacturer's website.

ER 122 mm HE (Extended Range Rocket)⁴¹. This rocket is produced by the **Romanian** company S.TOHAN SA Zarnesti. According to the manufacturer's technical specifications, this projectile is compatible with MLRS systems such as BM-21 Grad, APRA40 (Romania), RM-70 Vampire (Czech Republic) and LAROM (Romania-Israel). The effective target engagement range is up to 42 km. The total mass of this projectile is 64 kg. Of these, 18.4 kg is the mass of the warhead, and the projectile is 2.9 meters long. The maximum initial speed of the projectile is 1,430 m/s, and the mass of solid fuel in the rocket is 24.8 kg.

⁴¹ Military Products (date of publication is unknown) Tohan Website. URL: <http://www.tohan.ro/122%20mm%20ROCKETS%20FAMILY.html> (accessed on 14.05.2024)

122 MM HE ROCKETS “GRAD” FOR 122 MM MLRS

The 122 mm HE rocket and 122 mm HE extended-range rocket were developed for the 122 mm MLRS (multiple rocket launcher systems) BM-21 GRAD and RM-71, but can be used with any equivalent rocket launcher of similar design and characteristics. HE missiles are intended for use against the enemy in open and field shelters, to create passageways in minefields, and to destroy armor.

MSM GROUP offers its customers a standard 122 mm HE missile with a range of 20 km and a 122 mm HE missile with an extended range of 40 km. All our missiles are supplied with the MRV-U fuse, which is a standard “GRAD” compatible fuse. The igniter is a mechanical, point detonation igniter with optional SQ or delayed action. The barrel has an internal section with prefabricated iron fragments for higher fragmentation efficiency. Our 122 mm rockets have been delivered to over 8 countries worldwide. We are one of the few companies producing such ammunition in NATO and EU territory.



Fig. 18 - Information about the 122-mm HE extended range projectile on the manufacturer's website.

122-mm HE extended range⁴². This 122-mm extended-range rocket is produced by the **Slovak** defense-industrial company MSM Group. The company manufactures this ammunition for the Slovak-German version of the RM-70 modified MLRS, which is produced in Slovakia under the Czech license RM-70. This missile has a destruction range of up to 40 kilometers, a total mass of 69 kilograms, of which 19.1 kilograms is attributed to the warhead. The initial speed of the ammunition is 1,100 meters per second.

⁴² 122 MM HE ROCKETS “GRAD” FOR 122 MM MLRS (date of publication is unknown) MSM Groupe Website. URL: <https://www.msm.sk/en/produkt/122-mm-he-rockets-grad-for-122-mm-mlrs/> (accessed on 16.05.2024)

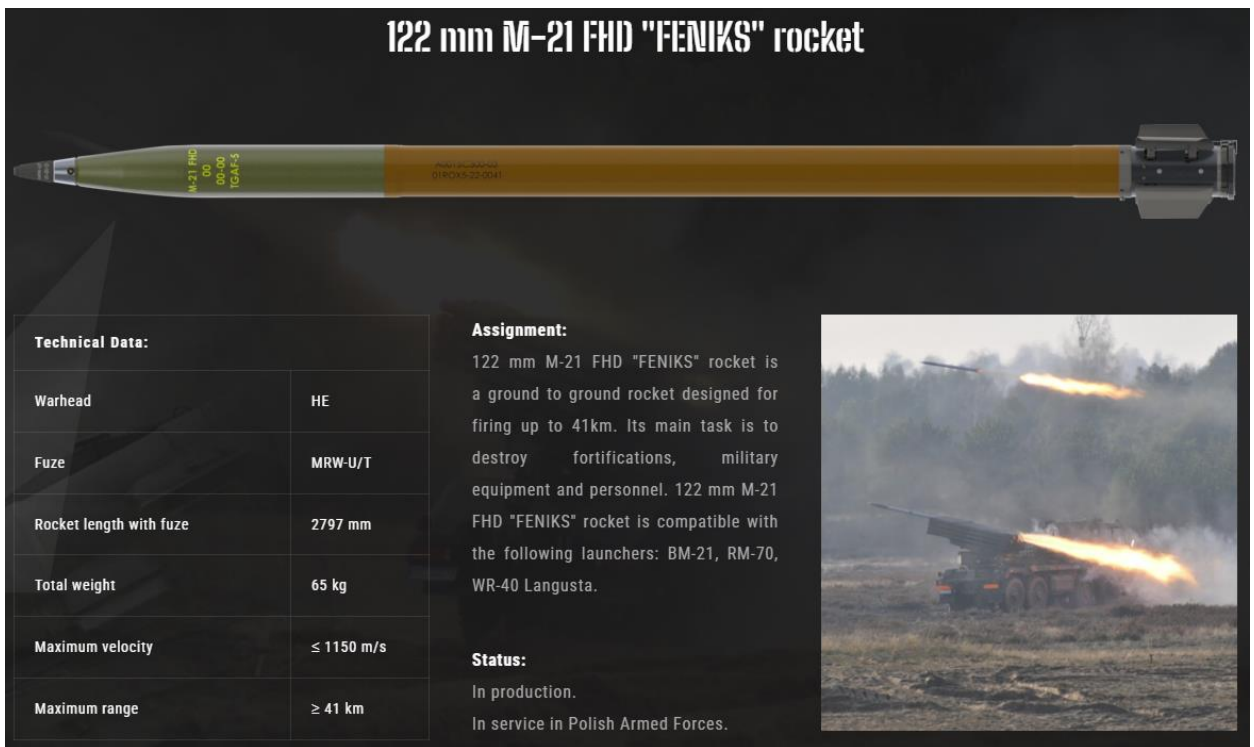


Fig. 19 - Information about the M-21 FHD "Feniks" projectile on the manufacturer's website.

M-21 FHD "Feniks"⁴³. This rocket was developed by the **Polish** company Mesko SA for use in the WR-40 Langusta multiple launch rocket systems and the Czech RM-70 systems, including the Vampire modification. The projectile belongs to the Feniks-Z line of ammunition, the name of which comes from the testing region at the Zagan proving ground, where they were carried out in August 2001. The M-21 Feniks FHE projectile has a high-explosive fragmentation warhead weighing 18.4 kilograms and contains up to 6,000 fragments. It is 1.983 meters long. The line also includes the M-21FK Feniks projectile weighing 23.5 kilograms, equipped with 42 cumulative fragmentation combat elements. The destruction range of this projectile is 32 kilometers.

⁴³ 122 mm M-21 FHD "FENIKS" rocket (date of publication is unknown) Mesko Website. URL: <https://www.mesko.com.pl/en/product/122-mm-m-21-fhd-feniks-rocket> (accessed on 14.05.2024)

The 122 mm TRG-122 Guided Rocket provides accurate and effective fire power on high priority targets within the ranges of 13-30 km.



Fig. 20 - Information about the TRG-122 projectile on the manufacturer's website.

TRG-122⁴⁴. This 122mm rocket is produced by the **Turkish** company Roketsan. It has a destruction range of up to 40 kilometers. The projectile weighs 72 kilograms, of which 18.4 kilograms are attributed to the combat high-explosive fragmentation part. The TRG-122 projectile is highly precise and equipped with a GPS system. In addition, the Turks produce the TRB-122 rocket for their T-122 Sakarya multiple launch rocket system. It also has an increased range of 40 kilometers, is 2930 meters long and weighs 65.9 kilograms.

⁴⁴ TRG-122 (publication date is unknown) Roketsan Website. URL: <https://www.roketsan.com.tr/en/products/trg-122-guided-rocket> (accessed on 16.05.2024)

SHELLING DIRECTION

At the sites of shell hits 6 and 10, fragmentation grooves are located south of the point of contact of the projectile with the surface. Considering that these craters can be defined as craters of the second type,⁴⁵ allows us to assert that the shelling was carried out from the direction indicated by the location of the fragmentation grooves relative to the point of contact of the projectile with the surface.

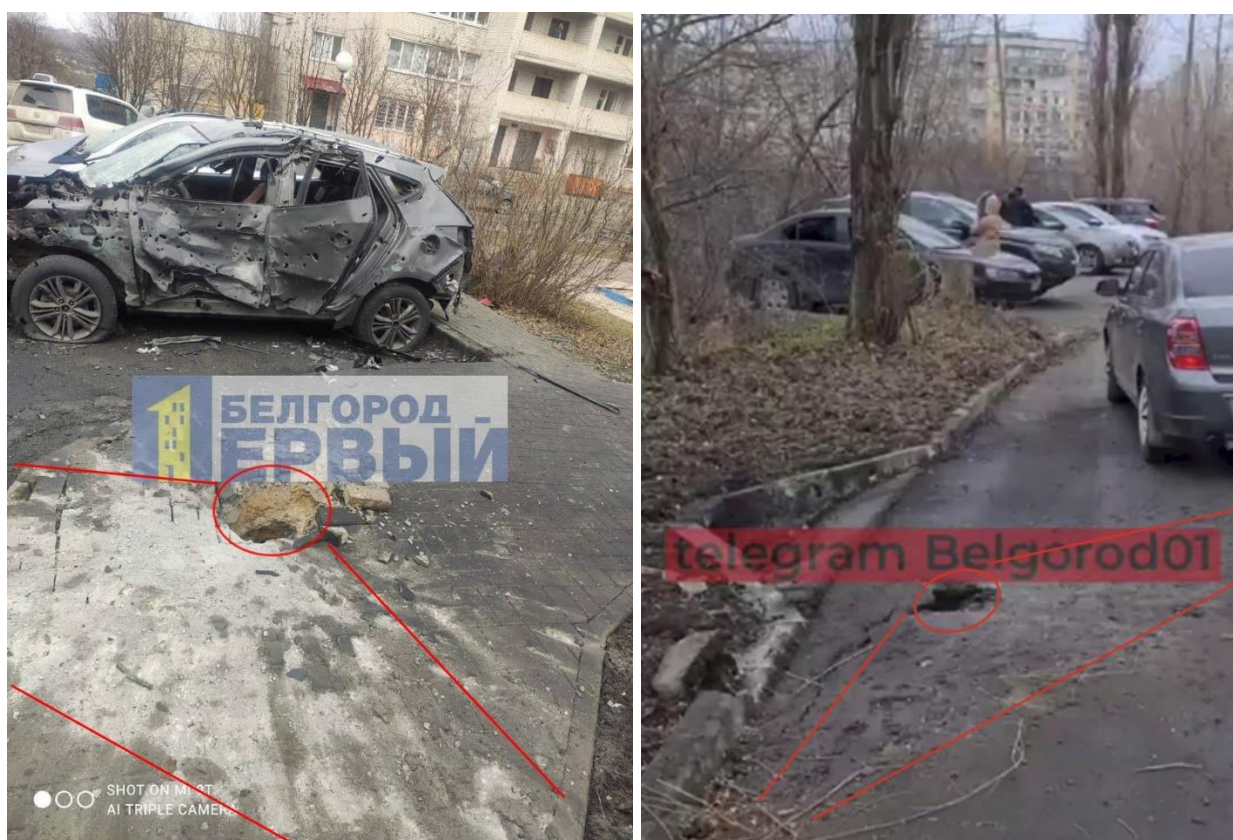


Fig. 21 – Signs of craters of the second type in cases of shell hits 6 and 10.

⁴⁵ ANALYSIS OF CRATERS FROM HIGH EXPLOSIVE SHELLS (published on 2015) VKontakte Social Network. URL: https://vk.com/wall-95389776_278 (accessed on 15.05.2024)

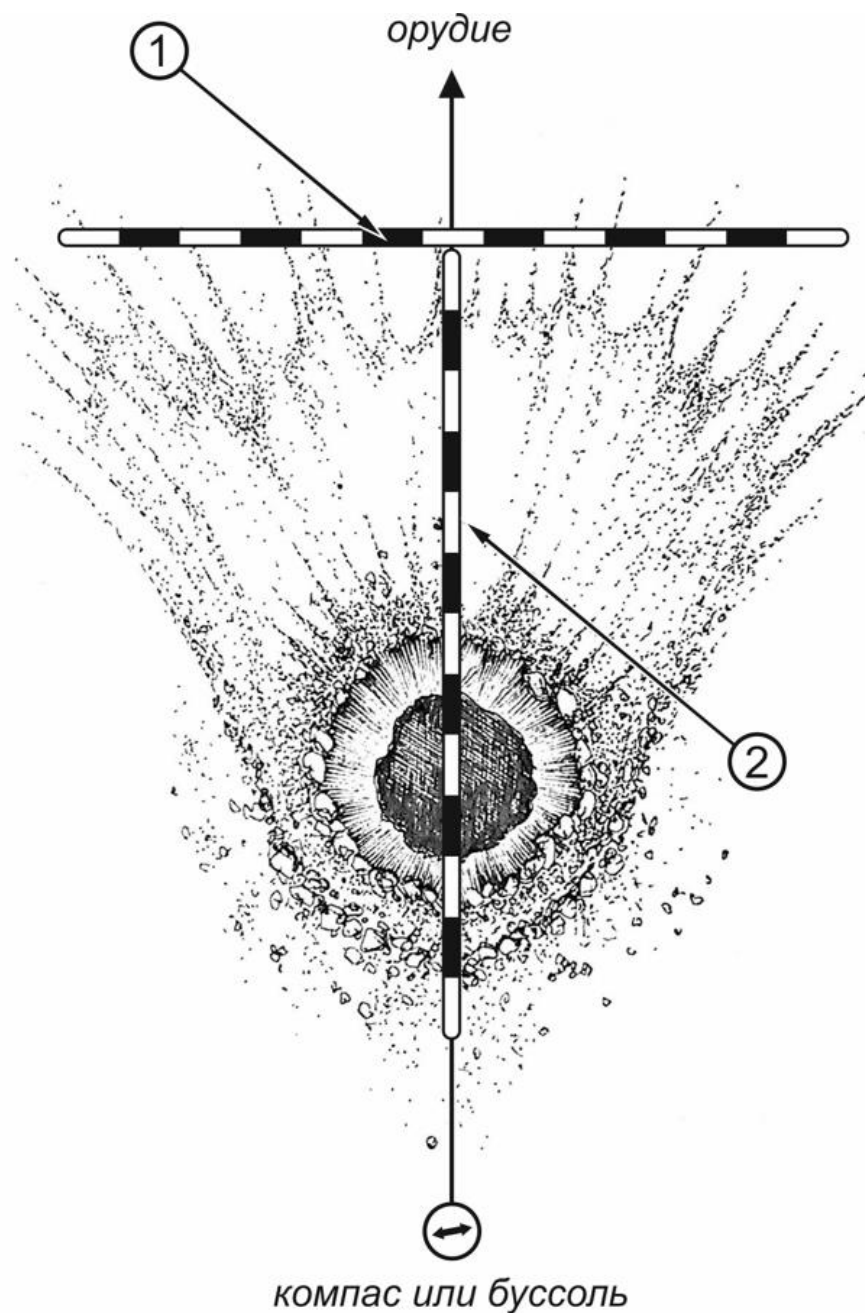


Fig. 22 – Determination of the shelling direction by the method of fragmentation grooves

In the case of shell hit 1, the photo taken by an eyewitness shows traces of fragments on the rail farthest from the explosion. This allows us to determine how the main flow of fragments spread in space. The line drawn between the point of the projectile contact with the surface and the extreme point of the trace from the main flow of fragments is perpendicular to the direction of the projectile flight. By orienting the above lines to the cardinal points, we obtained an azimuth of 195 degrees.

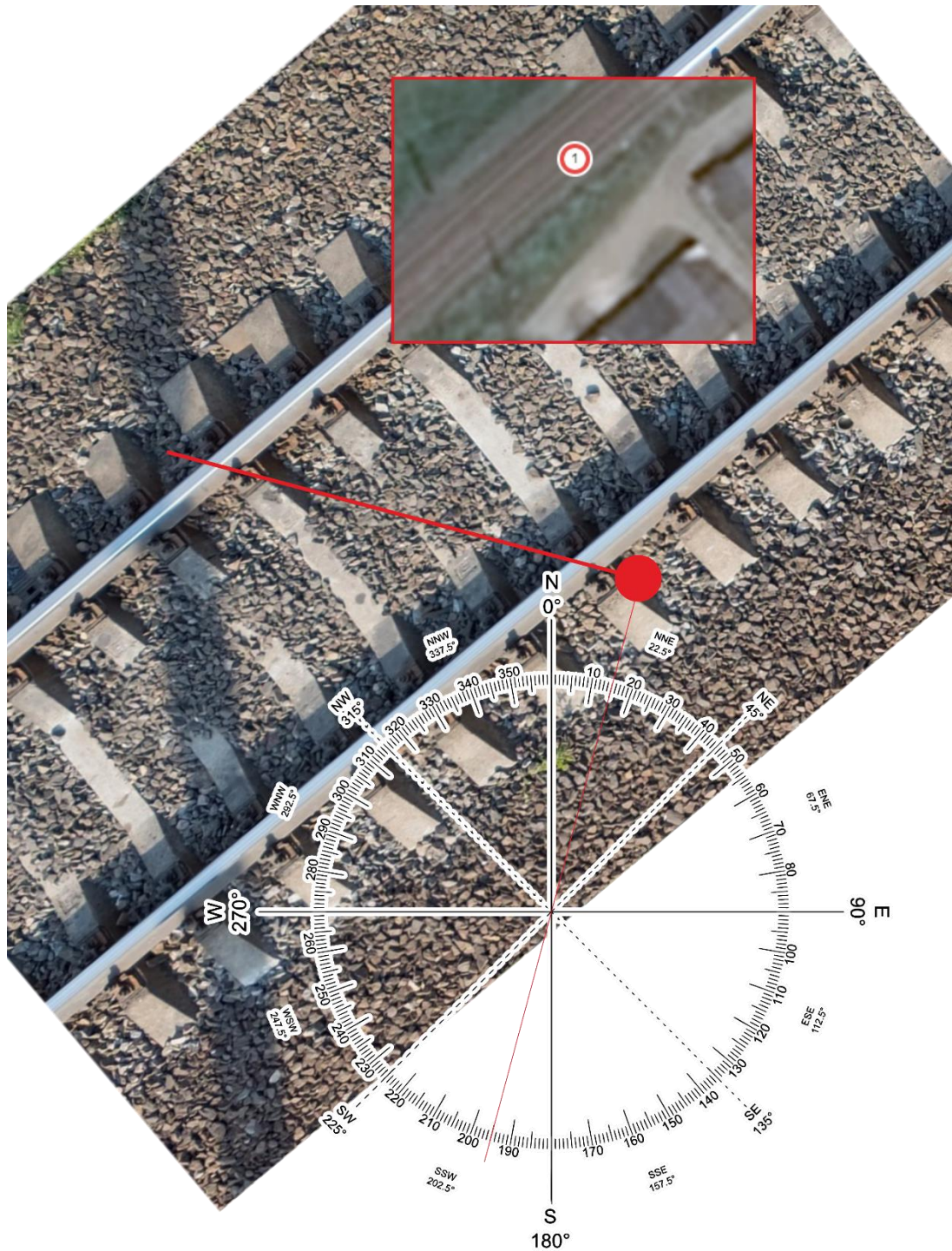


Fig. 23 – Fire direction determination in the case of shell hit 1.

In the case of shell hit 6, the explosion left a clear trace from the main scatter of fragments on the pavement surface. By orienting along the lines of the seams between the paving slabs laid parallel to the sidewalk, it is possible to determine the azimuth of the shelling direction. In this case, the azimuth was 192 degrees.

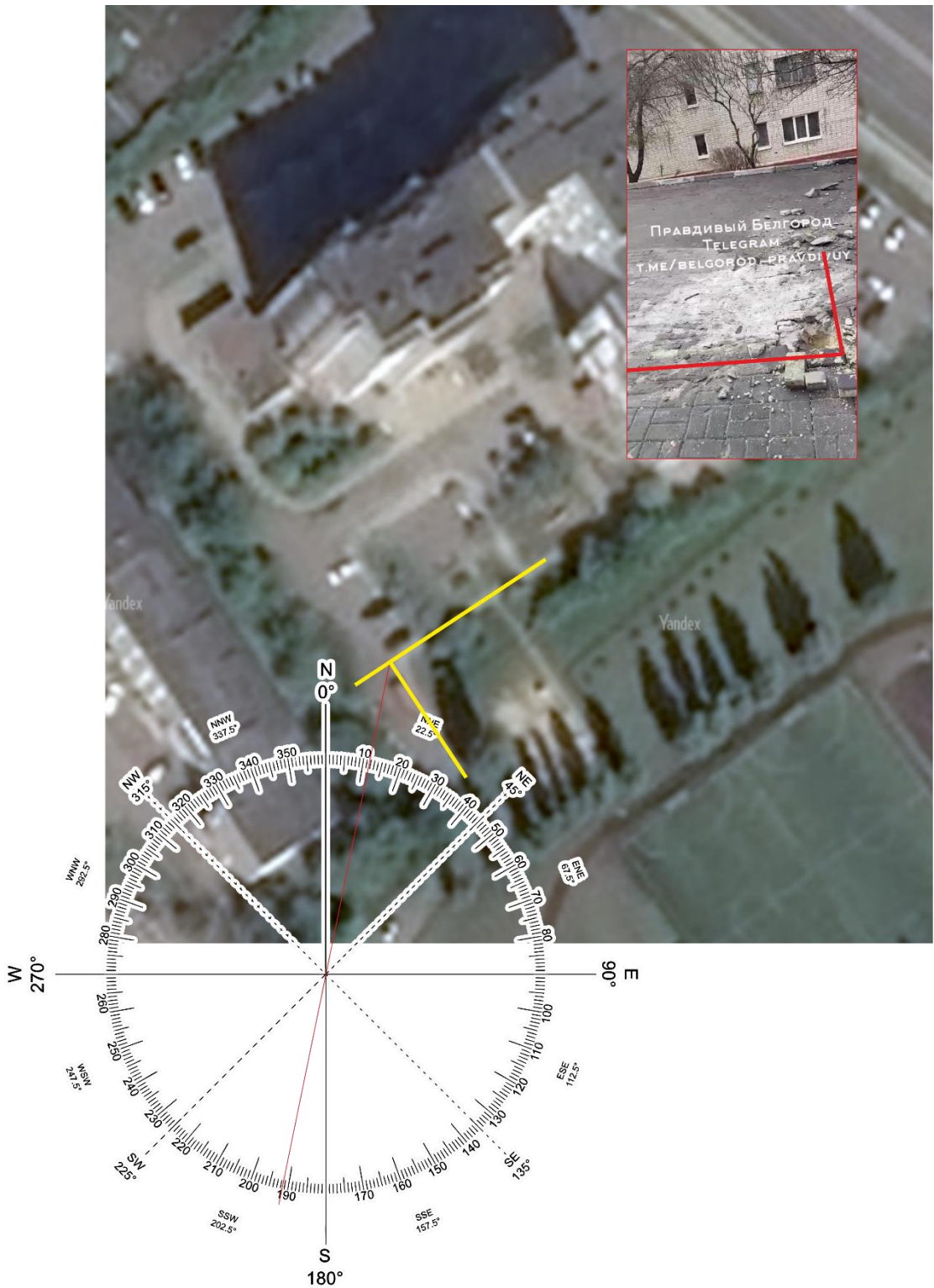


Fig. 24 – Fire direction determination in the case of shell hit 6.

In the case of shell hit 10, one of the published videos shows that the line of intersection of the plane of the main flow of fragments with the surface passed not far from the residential building at 10, Sportivnaya Street, which also allows us to

plot it on the scheme and determine the azimuth of the shelling direction. In this case, the azimuth was 195 degrees.

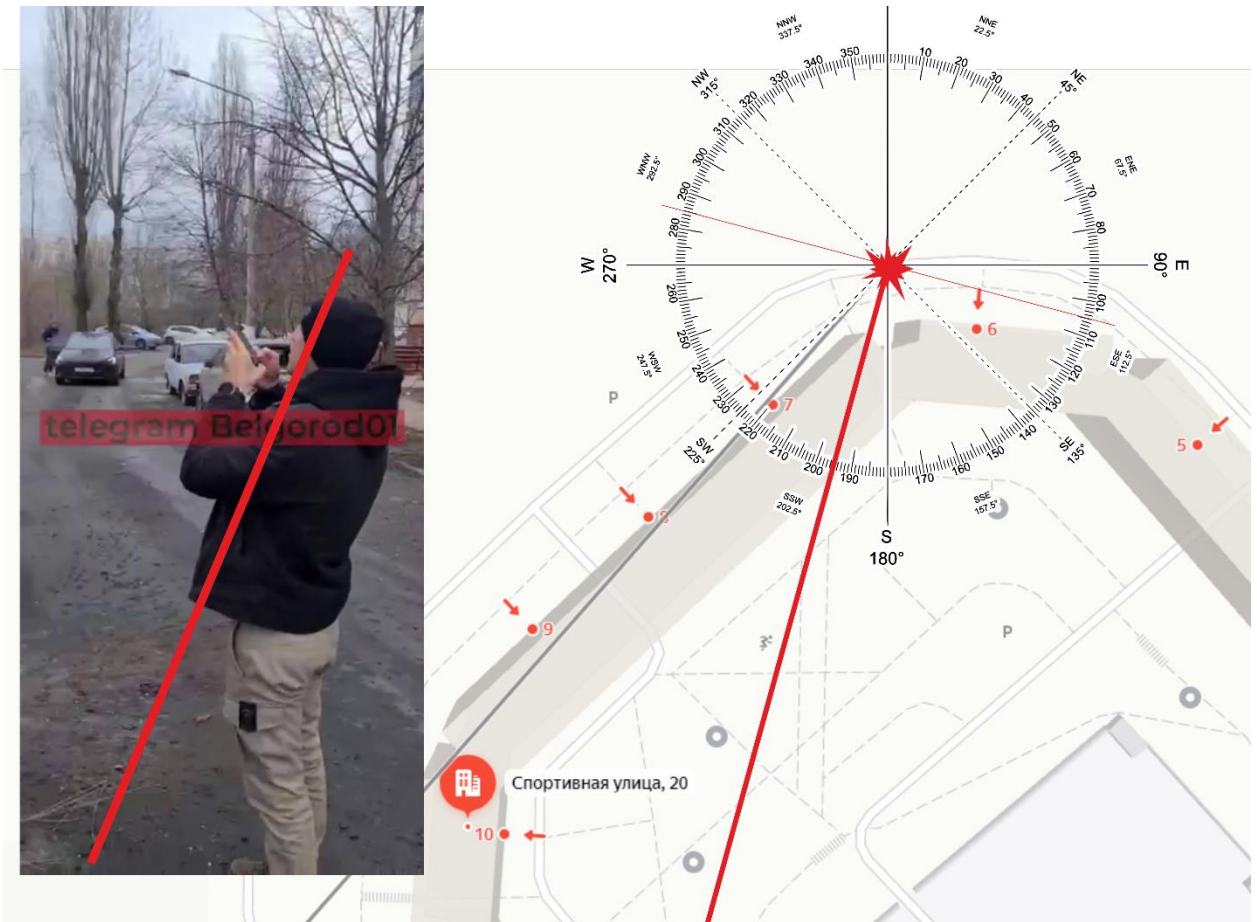


Fig. 25 – Fire direction determination in the case of shell hit 10.

Another sign confirming the azimuth we have determined is that all locations of shell hits can be inscribed in an ellipse elongated along an azimuth of 195 degrees. This picture is usually observed in cases where firing was carried out from one gun in one salvo without correcting missile guidance.

It is also worth noting that the shape of the craters and the location of the trace from the main flow of fragments at a fairly low level relative to the crater indicates that the projectile came into contact with the surface at an angle close to 60 degrees, which in turn indicates that the **shelling was carried out at a distance close to the maximum.**



Fig. 26 – Direction finding by the hitting area/

Thus, it can be argued that **the shelling under consideration was conducted from the south-southwest to the north-northeast along an azimuth of 195 degrees.** Let us take the measurement error to be plus or minus 15 degrees.

Having plotted on the map the lines drawn on the basis of the data we described, as well as the border between Russia and Ukraine (the latter was also the

line of combat contact that day), we received the sector from which this shelling was carried out. This sector covers the area of the settlements of **Глубокое** and **Лукьянцы**.



Fig. 27 - The sector from which a 12-mm MLRS salvo was fired into the city of Belgorod on February 15, 2024.

PRESENCE OF THE UKRAINIAN ARMED FORMATIONS

The main role in the attacks on Belgorod was played by the Russian Volunteer Corps (listed as a terrorist organization in the territory of the Russian Federation⁴⁶), subordinate to the main intelligence department of the Ministry of Defense of Ukraine⁴⁷. According to data from open sources, since November 2022, the Russian Volunteer Corps has left the territory of the Zaporozhye region^{48 49}, moving to the northeast of Ukraine to carry out terrorist activities in the border area.

In March 2023, the RVC arranged a raid in the Bryansk region⁵⁰ and in April 2023 in the Kursk region⁵¹. On May 22, 2023, their activities in the Belgorod region were mentioned for the first time⁵², and in June 2024, the RVC attempted to invade the territory of the Russian Federation, capturing the village of Novaya Tavolzhanka in the Belgorod region⁵³. The presence of this unit as of December 2023 in the designated sector is confirmed by the liquidation of their curators as a result of shelling of Kharkov⁵⁴, and the demonstration of their subversive activities on the air of the Ukrainian TV channel “Channel 24” in January 2024⁵⁵.

⁴⁶ The FSB added the Russian Volunteer Corps to the list of terrorist organizations (published on 30.12.2023) RG.RU Mass Media. URL: <https://rg.ru/2023/12/30/fsb-vnesla-russkij-dobrovolcheskij-korpus-v-spisok-terroristicheskikh-organizacij.html> (accessed on 16.05.2024)

⁴⁷ “Several waves of volunteers have already arrived in Ukraine” (published on 22.04.2023) Novaya Gazeta Mass Media. <https://novayagazeta.eu/articles/2023/04/22/nas-v-ukrainu-priekhlo-uzhe-neskolko-voln-dobrovoltsev> (accessed on 16.05.2024)

⁴⁸ “Russian Volunteer Corps” as part of the UAF: why the Russians are fighting against Putin (published on 20.12.2022) “Crimea. Realities” Mass Media. URL: <https://ru.krymr.com/amp/russkiy-dobrovolcheskiy-korpus-vsuvoy-na-intervyi/32185108.html> (accessed on 16.05.2024)

⁴⁹ Results of the year (published on 02.01.2023) Telegraph website. URL: <https://telegra.ph/Itogi-goda-01-02-2> (accessed on 16.05.2024)

⁵⁰ Russian far-right fighter claims border stunt exposes Putin’s weakness. Financial Times <https://www.ft.com/content/c4ffe9b8-a3f5-4f33-a420-effe32754bbf> (accessed on 16.05.2024)

⁵¹ The authorities hid the death of a border guard during a “raid” of the Ukrainian hit squad in the Bryansk region (published on 12.04.2023) Komsomolskaya Pravda. URL: <https://novayagazeta.eu/articles/2023/04/12/vlasti-skryvaiut-gibel-pogranichnika-vo-vremia-reida-ukrainskoi-drg-v-brianskoi-oblasti-news> (accessed on 16.05.2024)

⁵² “Subversive reconnaissance unit” entered the Belgorod region. What is known (published on 22.05.2023) BBC News. URL: <https://www.bbc.com/russian/news-65673136> (accessed on 16.05.2024)

⁵³ Russia thwarts more Belgorod attacks, blames Ukraine. ALJAZEERA URL: <https://www.aljazeera.com/news/2023/6/2/russia-says-thwarts-more-belgorod-attacks-blames-ukraine> (accessed on 16.05.2024)

⁵⁴ A resistance fighter reported on the liquidation of RVC curators in Kharkov (published on 18.01.2024) RIA News Mass Media. <https://ria.ru/20240118/kharkov-1922063782.html> (accessed on 16.05.2024)

⁵⁵ Unique footage! RVC showed a RAID in the Bryansk region / Watch UNTIL THE END (published on 20.01.2024) YouTube channel of Ukrainian TV channel “Channel 24” URL: <https://www.youtube.com/watch?v=ca8CTNB7P3M> (accessed on 16.05.2024)

Noteworthy, on June 1, 2023, the official Telegram channel of the Russian Volunteer Corps confirmed the presence of 122mm MLRS in their arsenal⁵⁶.

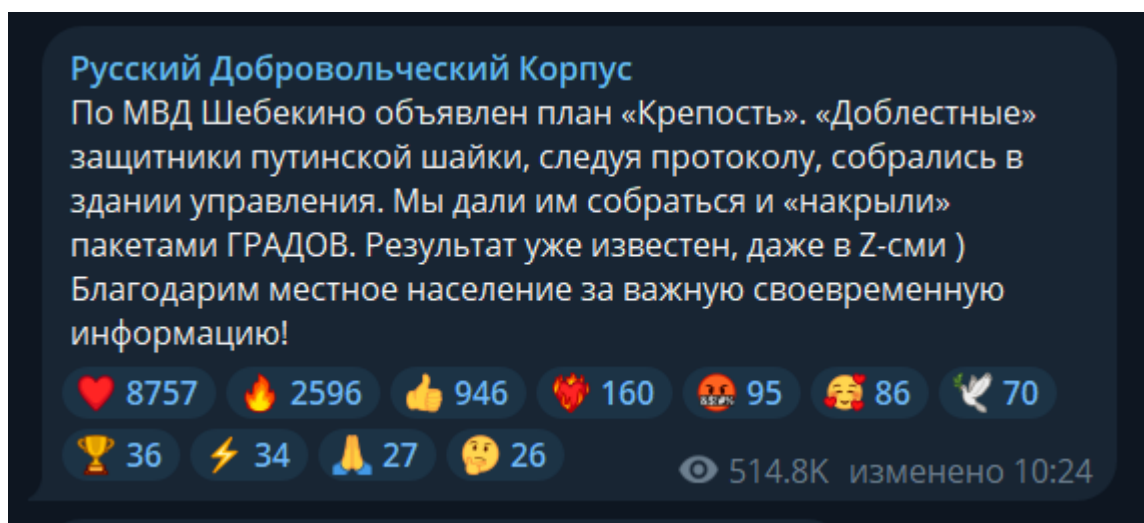


Fig. 28 – Excerpt from a message on the RVC Telegram channel

Thus, it can be argued that in the vicinity of the settlements of Glubokoe and Lukyantsy, Kharkov region, there were combatants from the Russian Volunteer Corps, which is armed with 122mm MLRS.

As for the persons who could give the order to shell a crowded place in Belgorod using 122-mm projectiles, the RVC commander, Denis Evgenievich Kapustin with the call sign “White Rex” is primarily responsible for this «White Rex»⁵⁷..

⁵⁶ The “Fortress” plan announced for the Shebekino MIA (published on 01.06.2023) Russian Volunteer Corps Telegram channel. URL: <https://t.me/russvolcorps/568> (accessed on 16.05.2024)

⁵⁷ The founder of RVC is wanted in the Russian Federation (published on 27.03.2023) “DW” URL: <https://www.dw.com/ru/osnovatel-russkogo-dobrovolceskogo-korpusa-obavlen-v-rozysk-v-rf/a-65131489> (accessed on 16.05.2024)



Fig. 29 - RVC leader Denis Kapustin.⁵⁸

However, open sources contain very little information about Ukrainian units located in the period under consideration nearby the settlements of Glubokoe and Lukyantsy, Kharkov Region. In our understanding, we will be able to obtain more detailed information in the future.

At the same time, the fact remains undoubted that the highest military-political leadership of Ukraine is responsible for the illegal actions of the UAF, Namely, they are President and Supreme Commander-in-Chief **Vladimir Zelensky**, Commander-in-Chief of the Armed Forces of Ukraine **Alexander Syrsky** and head of the Main Intelligence Directorate **Andrey Budanov**.

⁵⁸The identity of one of the terrorists who attacked the Bryansk region established (published on 02.03.2023) Reporter Mass Media. URL: <https://topcor.ru/32686-ustanovlena-lichnost-odnogo-iz-terroristov-napavshih-na-brjanskiju-oblast.html> (accessed on 16.05.2024)

CONCLUSIONS

As follows from the above, on February 15, 2024, at approximately 15:00 a.m. (Moscow time), Belgorod downtown came under artillery fire by 122-mm MLRS. During the attack, extended-range rockets produced by one of the Western bloc countries were used. The shells flew in a direction from south-southwest to north-northeast along the azimuth of 195 degrees. Let us take the measurement error to be plus or minus 15 degrees.

All shell hits fell on densely populated residential areas of the city and led to damage to civilian objects, death and injury to civilians. Thus, the principles of selectivity and proportionality were violated.

The UAF units were located in the shelling sector. Extended-range 122-mm missiles had been supplied in large quantities by Western bloc countries to Ukraine and are in service with UMF units.

The commander of the RVC, **Denis Kapustin**, is primarily responsible for the illegal actions of his subordinates. Moreover, the highest military-political leadership of Ukraine is responsible for crimes committed during this armed conflict. Namely, they are President and Supreme Commander-in-Chief **Vladimir Zelensky**, Commander-in-Chief of the Armed Forces of Ukraine **Alexander Syrsky** and head of the Main Intelligence Directorate **Andrey Budanov**.

LEGAL QUALIFICATIONS

Indiscriminate shelling of a densely populated residential area in the town of Makeyevka, in which civilians were killed and injured, is a crime for which responsibility is provided by the norms of national legislation of Ukraine and by the norms of international law.

The acts described above first of all violate the principle of **proportionality**, which declares as prohibited “*attacks which may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof, which would be excessive in relation to the concrete and direct military advantage anticipated*”.

This principle is enshrined in **Article 51(5)(b)** and is repeated in **Article 57 of Additional Protocol I** to the 1949 Geneva Conventions. It is also recognized as **rule 14 of customary international humanitarian law** and applies to both international and internal armed conflicts.

Moreover, the acts in question can be qualified as **indiscriminate attacks**.

Article 51(4) of Additional Protocol I to the 1949 Geneva Conventions expressly prohibits indiscriminate attacks and reckons the following among them: “*(a) those which are not directed at a specific military objective; (b) those which employ a method or means of combat which cannot be directed at a specific military objective; or (c) those which employ a method or means of combat the effects of which cannot be limited as required by this Protocol*”.

In compliance with **Rule 71 of Customary International Humanitarian Law**: “*States must never make civilians the object of attack and must consequently never use weapons that are incapable of distinguishing between civilian and military targets*”

In compliance with **Art. 3 common to all Geneva Conventions of August 12, 1949**, extending its effect to all types of armed conflicts, “*persons taking no active part in the hostilities, including members of armed forces who have laid down their arms and those placed ‘hors de combat’ by sickness, wounds, detention, or any other cause, shall in all circumstances be treated humanely, without any adverse*

distinction founded on race, colour, religion or faith, sex, birth or wealth, or any other similar criteria”.

To this end, violence to life and person, in particular murder of all kinds and mutilation, are prohibited inter alia with respect to the above-mentioned persons.

In addition to the above, it should be noted that **the practice of the International Criminal Tribunal for the former Yugoslavia** allows us to assert that deliberate terror of civilians includes deliberate and indiscriminate firing at civilian targets.

This makes it possible to state about the violation of **Article 51(2) of Additional Protocol I to the 1949 Geneva Conventions**, which prohibits “*acts or threats of violence the primary purpose of which is to spread terror among the civilian population*”.

In compliance with **Art. 438 of the Criminal Code of Ukraine**, for “... *use of methods of the warfare prohibited by international instruments, or any other violations of rules of the warfare recognized by international instruments consented to be binding by the Verkhovna Rada (Parliament) of Ukraine, and also giving an order to commit any such actions*”, shall be punishable by imprisonment for a term of eight to twelve years, and if the same acts accompanied with an intended murder, shall be punishable by imprisonment for **a term of ten to fifteen years, or life imprisonment.**

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