

**Shelling of the Shakhtyorskiy residential quarter in
the city of Makeyevka, using Uragan MLRS on July 6,
2022**

PUBLIC INVESTIGATION

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CONTENT

| | |
|---|----|
| ABBREVIATIONS | 3 |
| PREAMBLE | 4 |
| INCIDENT LOCATION | 6 |
| WEAPON TYPE..... | 9 |
| Projectile debris..... | 9 |
| 9M27k Rocket Projectile 9M27K..... | 10 |
| Uragan MLRS | 11 |
| Bureviy MLRS | 12 |
| PROBABLE SECTOR OF SHELLING..... | 13 |
| Direction..... | 13 |
| Firing range | 14 |
| MILITARY PRESENCE | 15 |
| The 27th Rocket Artillery Brigade of the Ukrainian Armed Forces | 15 |
| CONCLUSIONS..... | 17 |
| LEGAL QUALIFICATIONS | 18 |
| REFERENCES..... | 20 |
| Sources used in the text..... | 20 |
| Additional Sources | 23 |
| ANNEXES | 25 |

ABBREVIATIONS

CV - combat vehicle
UAF - Ukrainian Armed Forces
DPR - Donetsk People's Republic
CMD - cluster munition dispenser
LPR - Luhansk People's Republic
MSK - Moscow Standard Time
FSM - fragmentation submunition
RABr - Rocket Artillery Brigade
MLRS - Multiple Launch Rocket System
RF - the Russian Federation
MP - missile part of the projectile
SMO - Special Military Operation
OC - operational capabilities
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.

In the area of the Donetsk front, offensive operations were constantly carried out on the positions of the Ukrainian armed formations. On July 04 and 05, 2022, the armed formations of Ukraine shelled many settlements of the Donetsk People’s Republic, particularly, four districts of the city of Donetsk, Horlivka, the settlements of Golmovsky and Aleksandrovka.³

And finally, in the evening of July 06, 2022, the Ukrainian military fired at the territory of Makeyevka using large-caliber MLRS.

On July 06, 2022, at about 17:40 (MST), artillery shelling of the Shakhtyorskiy Residential Quarter of the city of Makeyevka was conducted using the BM-27 Uragan MLRS projectiles with a cluster munition dispenser. The shells hit residential apartment buildings No. 8, 13, 20, 23 in the Shakhtyorskiy Quarter, and the territory of the Preschool Educational Institution “Day Care Center No. 117” at the address: 44, Shakhtyorskiy Quarter.

Three children were killed in this shooting (see Fig. 1):

- Dmitry Khrushch, born on 04.11.2005;
- Vladislav Pisarchuk, born on 02.09.2014;
- Maria Evtukhova, born on 08.04.2015.⁴

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/lysyhansk-luhansk-russia-ukraine-war/> (accessed on 06.07.2022)

³ The operational lines of the DPR JCCC received additional information about civilian casualties as a result of the shelling by the UAF of the cities of the Republic (published on 05.05.2022) Telegram channel of the DNR JCCC: official activities reports. URL: https://t.me/DNR_SCKK/9275 (accessed on 06.07.2022)

⁴ List of killed children. Day of Remembrance for Children - Victims of the War in Donbass https://donbassangels.com/#dead_list (accessed on 22.08.2022)

Four children received injuries of varying severity:

- a girl born in 2009;
- a boy born in 2012;
- a boy born in 2014;
- a boy born in 2014.

Also, **two women** born in 1946 and 1976 received injuries of varying severity.⁵

This investigation will examine in detail the shelling of the Shakhtyorskiy Residential Quarter of the city of Makeyevka (hereinafter the Shakhtyorskiy Quarter), where a projectile with a cluster warhead was used. Shell hit into a private residential building in 28, Sadovaya Str., will be considered in general terms as a fact that completes the picture of what had happened.

⁵ Updated information about the victims of the shelling in the city was received on 06.07.2022 (published on 06.07.2022) Telegram channel "Administration of the city of Makeyevka" URL: https://t.me/Novosti_Makeevka/23068 (accessed on 06.07.2022)

INCIDENT LOCATION

After examining the scene and analyzing the eyewitnesses' testimony, the photo and video materials, we were able to identify **33 traces of artillery ammunition detonation**. (see Fig. 2 - Fig. 7) Thirty traces represented holes on horizontal surfaces (on the ground, asphalted surfaces and building roofs), identified as craters from explosions of fragmentation submunitions (hereinafter referred to as FSM) employed in cluster munitions. The craters are round holes, about 5-10 cm deep, and about 10-15 cm in diameter. They have radial grooves up to 50 cm long, diverging to the sides from the crater center. At the same time, in cases of craters on the ground, the grass was damaged or absent at a distance of about 50-80 cm from the center of each hole. Also, two damages were found to the slate roof of residential building No. 13 in the Shakhtyorskiy Quarter of the city of Makeyevka (see Fig. 8, see Fig. 9), and the damage to the corner of the building of the *Vostochny* store (see Fig. 10).

In addition, local residents indicated the locations of recently appeared metal objects unknown to them (located at 82, Fruktovalaya St., and 18, Shakhtyorskiy Quarter), they presented a photo of a metal object sticking out of the roof of residential building No. 18 in the Shakhtyorskiy Quarter (see Fig. 11). During the inspection of the above locations, we found metal objects identified as the debris of the cluster munition (see Fig. 12) and missile (see Fig. 13) parts of the Uragan MLRS projectile. All of them were captured on Canon M200 camera

Also, the coordinates of each point of FSM detonation and the places where the CMDs and MP of the Uragan MLRS were recorded with a smart phone (see Table 1). This made it possible to plot the points on the map, and then create an updated diagram of the incident location (see Fig. 14), on which two sectors of the FSM destruction were highlighted and the points of impact of the cluster munition and missile parts of the MLRS rocket projectile were indicated.

It is noteworthy that this investigation will not consider each FSM detonation trace separately, since this is not necessary for determining the direction from which

the shelling was carried out (hereinafter referred to as the shelling direction), this is not necessary.

Sector 1 (see Fig. 15). This sector included 17 FSM detonation traces. Two of them were located in front of the residential building No. 13 in the Shakhtyorskiy Quarter, one trace being from the side of its eastern end, and two on its roof; and also 11 traces of detonation were between residential buildings No. 13 and No. 8 in the Shakhtyorskiy Quarter, one being from the eastern end of the residential building No. 8. Precisely in this sector, three children were killed as a result of the shelling, four children and two women got wounds of varying severity.

Sector 2 (see Fig. 16). This sector included 16 FSM detonation traces. Ten of them were in the territory of the Children's Day Care Center No. 117, located at 44, Shakhtyorskiy Quarter: two traces being on its roof and one in the canopy of the building. One detonation point was found between the residential building No. 18 and Day Care Center No. 117. Also, one detonation point was recorded to the south of the residential building No. 32 in the Shakhtyorskiy Quarter and another one in the north-east corner of the *Vostochny* store.

Cluster munition debris impact points. The CMD impact point was on the roof of the residential building No. 18 in the Shakhtyorskiy Quarter above entrance No. 2. By the time we arrived, Federal Rescue Service employees had neutralized possible debris of artillery ammunition and removed part of the frame sticking out of the roof of the building. However, local residents provided a photo of the frame of the cluster warhead before the work was done by the Federal Rescue Service employees (see Fig. 11).

When examined about a meter north-east of the superstructure for accessing the roof of the second entrance, we discovered a metal structure that was round in cross-section, about 20 cm in diameter (see Fig. 17), which protruded by about 5-10 cm above the roof surface. In the center of the structure there was a hollow cylindrical protrusion with a diameter of about 5-6 cm, and there were three holes located along the circumference around it, about 10-11 cm long and about 3-4 cm wide.

Missile part impact points. The projectile missile part impact point was located south-west of the residential building No. 81 in Fructovaya St., the city of Makeevka. A metal pipe with a diameter of about 22 cm was found at the impact point, it was deepened into the ground for its entire length (see Fig. 18), and had a cone-shaped narrowing of up to 7-10 cm at the end protruding from the ground.

Also, a cone-shaped metal object about 30 cm long and having a narrowing in diameter from 20-22 cm to 7-10 cm was found next to the pipe (see Fig. 19), and a metal hollow cylindrical structure with a diameter of about 20-22 cm with four hinged characteristic curved plates (see Fig. 20)



Fig. 20

WEAPON TYPE

Projectile debris

The cone-shaped object found at the impact point of the projectile missile part had an external thread at the narrowing point, which coincided with the diameter of the internal thread of a metal tube immersed in the ground. This indicated the place and method of attaching these two structures to each other. Also; a cylindrical finned structure was located nearby. As assembled, they represent the missile part of a rocket projectile (see Fig. 21). Thus, a tube immersed in the ground is the body of a rocket engine, a cone-shaped object screwing into it acts as a nozzle, and a finned structure installed on them acts as a rocket stabilization unit. In this case, the diameter of the MP debris is approximately 20-22 cm.

Based on the amount and nature of the damage, it can be argued that a cluster munition was used. This opinion is also confirmed by the FSM fragments found at the detonation sites (see Fig. 22): the debris of fins, fuses, striking elements and fragments of the FSM body (see Fig. 23).

This is also confirmed by the object we found on the roof of the residential building No. 18, which we managed to identify as the front part of the Uragan MLRS cluster warhead.

According to witnesses, the debris of a cluster warhead and a rocket part of the projectile appeared in the above places at the time of the shelling, which tells us that these objects are directly related to the shelling of the Shakhtyorskiy Quarter in the city of Makeyevka.

The above facts allow us to assert that the shelling of the Shakhtyorskiy Quarter was carried out by a rocket projectile with a cluster warhead.

The cassette and missile parts of the projectiles have the same diameter, which is 20-22 cm. Of the MLRS projectiles used in the armed conflict in Ukraine, the

Uragan MLRS (caliber 220 mm⁶) and Himars MLRS (caliber 227 mm⁷) match these characteristics. However, the Himars MLRS projectile MP has fundamentally different design features from the one we had found (see Fig. 24). Characteristic oval-shaped holes in the attachment points of the cluster warhead also indicate the Uragan MLRS projectile (see Fig. 25). It is worth noting that the Grad MLRS cluster munitions did not participate in this conflict, and the Smerch MLRS cluster munition has other design features of the cluster warhead frame (see Fig. 26).

The above facts allow us to assert that this shelling of the Shakhtyorskii Quarter in the city of Makeyevka was carried out by the Uragan MLRS cluster munition.

9M27k Rocket Projectile 9M27K

The 9M55K cluster rocket projectile with 9H235 fragmentation submunitions (see Fig. 27) is intended to defeat personnel, armored, and soft targets in concentration areas. Mass production of 9M27K started in 1975.

Technical characteristics of the 9M27K rocket projectile:

| | |
|--|---------|
| Caliber, mm | 220 |
| Weight, kg | 271.1 |
| Length, mm | 5178.4 |
| Submunition availability, pc | 30 |
| Submunition weight, kg | 1.8 |
| Submunition diameter, mm | 65 |
| Submunition length, mm | 270 |
| Submunition explosive weight, kg | 0.3 |
| Preformed fragment weight, g | 2 |
| Preformed fragmentation availability, pc | 370–400 |
| Missile range, m | |

⁶9K57 Uragan multiple launch rocket system. Missilery website. URL: <https://missilery.info/missile/uragan-0> (accessed on 19.08.2022)

⁷HIMARS multiple launch rocket system. Missilery website. URL: <https://missilery.info/missile/himars> (accessed on 19.08.2022)

| | |
|---------|---------------------|
| minimum | 10 000 |
| maximum | 35 000 ⁸ |

Uragan MLRS

Uragan Multiple Launch Reactive System (MLRS) (see Fig. 28) is intended to destroy manpower, armored and lightly armored vehicles tank and motorized infantry units of the enemy on the march and in places of concentration, destruction of command posts, military infrastructure and communication centers, remote installation of antipersonnel and anti-tank minefields in combat zones at a distance of 10 - 35 thousand meters.

The 9P140 combat vehicle (CV) is carried out on the four-axle chassis of the ZIL-135LPM with high maneuverability (the wheel formula 8x8). The artillery unit consists of a package in which sixteen tubular guides are assembled, a rotary base with sighting devices and guidance mechanisms, a balancing mechanism, hydraulic and electrical equipment. Guidance mechanisms equipped with power drives make it possible to direct a package of guides from 5 to + 55 degrees in the vertical plane. The angle of horizontal guidance is ± 30 degrees from the longitudinal axis of the combat vehicle. There are two supports that are equipped with jacks driven by hand at the rear of the chassis to increase the stability of the launcher during the shot. Missiles can be transported directly in the guides. The CV is equipped with communications equipment (P-123M radio station) and a night vision device.

Tubular guides are smooth-walled tubes with a U-shaped screw groove, along which the projectile pin slides during a shot. Thus, it provides its initial spin to give the projectile the stability necessary in flight. When moving along the rotational trajectory the projectile is supported by the blades of a drop-down stabilizer, which are mounted at a certain angle to the longitudinal axis of the projectile. A salvo of one combat vehicle covers an area of more than 42 hectares. The main method of shooting is fire from a closed position. There is the possibility of firing from the

⁸ 9M27F unguided rocket projectile. Missilery website. URL: <https://missilery.info/missile/uraga/9m27k> (accessed on 22.08.2022)

cockpit. Operating personnel of the 9P140 CV includes 6 persons (4 persons in peacetime): commander of the combat vehicle, gunner (senior gunner), driver, and crew number (3 persons).⁹

Bureviy MLRS

Also, in recent months, the UAF have been using a modernized version of the Uragan MLRS – Bureviy MLRS (*Ukrainian for Hurricane: Bureviy*) (see Fig. 29).

In fact, the Bureviy MLRS is a noticeably redesigned 9K57 Uragan complex, developed in the early 1970s. The novel project provides for the preservation of the general scheme, caliber and a number of components. At the same time, other components of the system, inaccessible or obsolete, are replaced by advanced analogs.

First of all, the chassis was replaced. The Uragan system was built on the four-axle ZIL-135LM chassis, which was long out of production. The Bureviy project uses the Czech-assembled Tatra T815-7T3RC1 platform. An eight-wheeled chassis of this type shows sufficiently high performance and provides the required mobility. In the future, it is expected to introduce a novel armored cab that protects the crew.

Bureviy MLRS has a cutting-edge digital fire control system, which simplifies the generation of data for firing and the use of weapons. Novel communication means are used to ensure the transmission of target designation. It is argued that this promising MLRS can operate in single reconnaissance and strike contours of the tactical level and show rapid response time.

The launcher is borrowed unchanged from the basic Uragan MLRS. As before, a pack of 16 tubular guides with a side guide groove is used. Guidance is carried out with the help of a sight and drives installed on the side of the guide package.¹⁰

⁹ 9K57 Uragan multiple launch rocket system. Missilery Information News System. URL: <https://missilery.info/missile/uragan-0> (accessed on 22.08.2022)

¹⁰ Bureviy multiple launch rocket system - Uragan (Hurricane) in Ukrainian (published on 23.11.2020) Top War Military Review website. URL: <https://topwar.ru/177296-reaktivnaja-sistema-zalпового-ognja-burevj-uragan-po-ukrainski.html> (accessed on 26.08.2022)

PROBABLE SECTOR OF SHELLING

Direction

A rocket with a cluster warhead is divided into several elements: cluster FSMs, which, together with the cluster munition frame, rush along a steeper than the original trajectory to the surface of the earth, and a projectile MP, which continues to move along the original ballistic curve (see Fig. 30).

MP debris-based direction measurement gave an azimuth of 314 degrees (see Fig. 31). However, the MP is turned in the ground at least by 10-15 degrees clockwise. This is evidenced by a cavity in the ground to the right of the debris (see Fig. 32). This gives reason to believe that the projectile direction azimuth was less than the measured one.

In addition, we determined the impact points of the missile and cluster parts of the rocket projectile. By drawing a line between them, we can also get the azimuth, which is 285 degrees (see Fig. 14).

It is also worth noting that the CP frame was tilted along the azimuth of 104 degrees (see Fig. 33). Most likely, the CP came into contact with the roof surface at an angle close to the right one, and the kinetic energy accumulated by the structure forced the rear part of the CP frame to move along the direction of the projectile flight. Thus, the azimuth of 284 degrees is the direction opposite to that measured by us, which is the azimuth of the shelling direction.

Considering all of the above, it can be argued that the shelling was carried out from the west - north-west to the east - south-east. And for the purposes of this investigation, the almost complete coincidence of the azimuths in the last two measurements makes it possible to determine the shelling azimuth, equaling 285 degrees with an error of plus or minus 15 degrees.

Firing range

Based on tactical and technical characteristics of the 9M27K missile for Uragan MLRS, the minimum firing range is 10 km, and the maximum is 35 km. By mapping the sector with regard to these figures, and the azimuth of 285 degrees with an error of 15 degrees, we obtain the sector from which the Shakhtyorskiy Residential Quarter in the city of Makeyevka was shelled (see Fig. 34).

According to the maps of the armed confrontation in Ukraine, as of July 06, 2022, we determined where the line of contact was located that day¹¹. After plotting it on our map, it is well visible that the entire shelling sector is located in the territory controlled by the UAF.

Proceeding from the practice of using, the Uragan MLRSs are not used in the immediate vicinity of the line of contact, but are usually located at a distance from it. Thus, the distance from the incident location to the demarcation line is about 12 km, and minimum Uragan MLRS firing range is 10 km. This allows us to assert that the shelling was carried out from the UAF-controlled territory.

¹¹ SMO Map. LostArmor website. URL: <https://lostarmour.info/offtopic/map/> (accessed on 07.07.2022)

MILITARY PRESENCE

At the beginning of the SMO, Uragan MLRSs were in operational service with only the 27th Rocket Artillery Brigade.

By July 06, 2022, Bureviy MLRS has not received sufficient distribution¹². Some samples to be used in this conflict could be deployed by the 27th Separate Rocket Artillery Brigade. This would be the most logical, since the 27th Separate Artillery Brigade is the only brigade that has extensive experience in the use of the Uragan MLRS, and the Bureviy MLRS is only its modification.

The facts of the movements or presence of UAF units are a military secret; therefore, they are indirectly and extremely rarely covered in open sources. However, we can assert that since July 3, 2014, the 27-th Separate Rocket Artillery Brigade has been actively participating in hostilities in certain areas of the UAF-controlled territories of the DPR and LPR¹³, where it continued to operate after the start of the SMO¹⁴. Let us consider this military unit in more detail.

The 27th Rocket Artillery Brigade of the Ukrainian Armed Forces

The 27th separate Sumy rocket artillery brigade or the 27-th ReABr is a military formation of the artillery ground forces of the Armed Forces of Ukraine.

Previously, this formation was unofficially called the Uragan Regiment, after the main artillery armament – 9K57 Uragan, the name of which was even embroidered on their sleeve patches (see Fig. 35).

By the Directive of the Minister of Defense of Ukraine dated January 18, 2008, the 27th Rocket Artillery Regiment was formed in the city of Sumy. It became the first new unit of this type, already created as part of the Armed Forces of independent Ukraine. The formation took place in the barracks of the disbanded in

¹² For the first time in Ukraine, a unique and cutting-edge Bureviy MLRS was noticed (published on 09.06.2022) Voennoe Delo website. URL: <https://voennoedelo.com/posts/id24875-y6m9nqptz07mdlkkg6p4> (accessed on: 29.08.2022)

¹³ 27th Rocket Artillery Brigade (published on 30.11.2015) Ukrainian Military Pages. URL: <https://web.archive.org/web/20201024031928/https://www.ukrmilitary.com/2015/11/27th-rocket-artillery-brigade.html> (accessed on: 26.08.2022)

¹⁴ Time and again, it was decided to respond to the request not to post photos and videos with the equipment of the Ukrainian Armed Forces (published on 18.03.2022) Donbass Men's Club VKontakte Community. URL: https://vk.com/wall-120546367?day=18032022&w=wall-120546367_264090%2Fall (accessed on 29.08.2022)

2007 Sumy Military Institute of Missile Troops and Artillery (MT&A) named after Bohdan Khmelnytsky. In reality, the regiment began to be formed in April - May 2008 on the basis of units (battalions) that were transferred from the 15th and 107th Rocket Artillery Regiments and from the 26th Artillery Brigade. The regiment was armed with a 220-mm complex of 9K57 Uragan multiple launch rocket systems, preserved due to the decision of the then commander of the MT&A of the Ukrainian Ground Forces M. Gritsay.

On March 13, 2015, the regiment was reorganized into a brigade, the number of battalions was increased from 3 to 4.¹⁵

Based on these facts, we can assert that with a high degree of probability precisely the battalions of the 27th Separate Rocket Artillery Brigade shelled the Shakhtyorskiy Quarter in the city of Makeyevka.

As for the persons who could order the shelling of civilians using large-caliber shells, the first person in charge is the commander of the 27th brigade, Colonel Dmitry Khrapach, or his deputy Colonel Dmitry Horb (see Fig. 36).

As of August 9, 2014, Dmitry Alexandrovych Khrapach was the commander of the battalion of 2S3 Acacia self-propelled howitzers¹⁶. In January 2019, he was appointed commander of the 27th Rocket Artillery Brigade¹⁷.

¹⁵ 27th Rocket Artillery Brigade. Warriors and Military Equipment Wiki. URL: https://warriors.fandom.com/ru/wiki/27-я_реактивная_артиллерийская_бригада (accessed on: 26.08.2022)

¹⁶ Izvarinsky Encirclement (published on 11.02.2016) Piotr and Mazepa. URL: <https://web.archive.org/web/20190202202551/http://petrimazepa.com/izvarino.html> (accessed on 29.08.2022)

¹⁷ Valery Ismailov, commander of the 27th Sumy Artillery Brigade, resigned (published on: 28.01.2019) "STS TV Company" YouTube Video hosting. URL: <https://www.youtube.com/watch?v=drtvBAo0tQ> (accessed on 29.08.2022)

CONCLUSIONS

It follows from the above that on July 06, 2022, at about 17:40 (MST), the Shakhtyorskiy Quarter in the city of Makeyevka underwent artillery fire from the Uragan multiple launch rocket system (or its “Bureviy” modification). The shells flew in a direction from west, north-west to east, south-east (azimuth 285 degrees). The shelling was carried out using 220 mm rocket-propelled ammunition. The Shakhtyorskiy Quarter, considered in this investigation, was hit by a cluster munition - a 9M27K rocket projectile.

With a high degree of probability, the units of the 27th rocket artillery brigade of the Ukrainian Ground Forces under the command of Colonel Dmitry Khrapach or his deputy Colonel Dmitry Horb could be located in this shelling sector. Precisely these persons are responsible for the actions of their subordinates, resulting in the deaths and injuries of women and children.

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.

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 he same acts accompanied with an intended murder, shall be punishable by imprisonment for a term of ten to fifteen years, or life imprisonment.

In compliance with **Art. 13 of Additional Protocol II to the Geneva Conventions** of 12 August 1949, concerning the protection of victims of armed conflicts of a non-international character, dated 8 June 1977: “The civilian population as such, as well as individual civilians, shall not be the object of attack. Acts or threats of violence the primary purpose of which is to spread terror among the civilian population are prohibited”.

In compliance with **Rule 71 of Customary International Humanitarian Law** (Volume 1, ICRC, 2006): “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”

“The use of weapons which are by nature indiscriminate is prohibited”.

In compliance with **Art. 3 common to all Geneva Conventions of August 12, 1949**, , extending its effect to non-international 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.

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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/lysyhansk-luhansk-russia-ukraine-war/> (accessed on 06.07.2022)

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¹⁵ 27th Rocket Artillery Brigade. Warriors and Military Equipment Wiki. URL: https://warriors.fandom.com/ru/wiki/27-я_реактивная_артиллерийская_бригада (accessed on 26.08.2022)

¹⁶ Izvarinsky Encirclement (published on 11.02.2016) Piotr and Mazepa. URL: <https://web.archive.org/web/20190202202551/http://petrimazepa.com/izvarino.html> (accessed on 29.08.2022)

¹⁷ Valery Ismailov, commander of the 27th Sumy Artillery Brigade, resigned (published on 28.01.2019) "STS TV Company" YouTube Video hosting. URL: <https://www.youtube.com/watch?v=drtvBAoO0tQ> (accessed on 29.08.2022)

¹⁸ This is how the place of death of children in Makeyevka looks now (published on 07.07.2022) DONtime URL: <https://dontimes.ru/tak-sejchas-vyglyadit-mesto-gibeli-detej-v-makeevke/> (accessed on 22.08.2022)

¹⁹ Missilery. Missilery in the territory of the Patriot Congress and Exhibition Center in the exhibition pavilions as part of the Army-2015 International Military-Technical Forum (Kubinka, Moscow Region) (Part 1) URL: <https://missilery.info/gallery/raketnaya-tehnika-na-territorii-kongessno-vystavochnogo-centra-patriot-v-vystavochnyh> (accessed on 19.08.2022)

²⁰ 9H235. Ukrainian Wikipedia. URL: <https://uk.wikipedia.org/wiki/9H235> (accessed on 22.08.2022)

²¹ The effect of the shelling of the town of Krasny Luch (LPR) by the UAF (published on 24.08.2022) DPR JCCC Telegram Channel. URL: https://t.me/DNR_SCKK/9585 (accessed on 19.08.2022)

²² Missilery. Missilery in the territory of the Patriot Congress and Exhibition Center in the exhibition pavilions as part of the Army-2015 International Military-Technical Forum (Kubinka, Moscow Region) (Part 1) URL: <https://missilery.info/gallery/raketnaya-tehnika-na-territorii-kongessno-vystavochnogo-centra-patriot-v-vystavochnyh> (accessed on 19.08.2022)

²³ Missilery from the stock of the Mikhailovskaya Military Artillery Academy (St. Petersburg, Russia). Missilery Information News System. URL: <https://missilery.info/gallery/raketnaya-tehnika-iz-fonda-mihaylovskoy-voennoy-artilleriyskoy-akademii-rossiya-gsankt>

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²⁶ Bureviy multiple launch rocket system – Uragan (Hurricane) in Ukrainian (Published on 23.11.2020) Top War Military Review website. URL: <https://topwar.ru/177296-reaktivnaja-sistema-zalpovogo-ognja-burevj-uragan-po-ukrainski.html> (accessed on 26.08.2022)

²⁷ 27th Rocket Artillery Brigade. Warriors and Military Equipment Wiki. URL: <https://warriors.fandom.com/ru/wiki/27->

я_реактивная_артиллерийская_бригада?file=27_%25D0%259E%25D0%25A0%25D0%25B5%25D0%2590%25D0%2591%25D1%25801.png (accessed on 26.08.2022)

²⁸ 13 09 27 Sumy Artillery Brigade (published on: 24.09.2022) Vladimir Ivo YouTube Channel. URL: <https://www.youtube.com/watch?v=ShllHCSL-3c> (accessed on 26.08.2022)

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² As a result of another shelling of Makeyevka, a child killed (published on: 06.07.2022) Administration of the city of Makeyevka Telegram channel. URL: https://t.me/Novosti_Makeevka/23064 (accessed on 10.07.2022)

³ Updated information about the victims of the shelling in the city was received on 06.07.2022 (published on 06.07.2022) Administration of the city of Makeyevka Telegram channel. URL: https://t.me/Novosti_Makeevka/23068 (accessed on 10.07.2022)

⁴ Ukrainian missile killed three children in Makeyevka (published on: 07.07.2022) DPR People's Militia URL: https://t.me/nm_dnr/8415 (accessed on: 10.07.2022)

⁵ 20.10 - A third girl from Makeyevka reported to have died in intensive care. Details under hold (published on 06.07.2022) AGS_Z_Donbass Telegram channel. URL: https://t.me/Ags_Donbass/77285 (accessed on: 10.07.2022)

⁶ As a result of another shelling of Makeyevka, a child killed (published on 06.07.2022) Republican Active Telegram channel. URL: https://t.me/reactiv_dnr/9192 (accessed on: 10.07.2022)

⁷ Another video from Makeyevka. Motor vehicles damaged (published on: 06.07.2022) Republican Active Telegram channel. URL: https://t.me/reactiv_dnr/9190 (accessed on: 10.07.2022)

⁸ Residents of Makeyevka send videos after the shelling by the Armed Forces of Ukraine (published on 06.07.2022) Republican Active Telegram channel. URL: https://t.me/reactiv_dnr/9188 (accessed on 10.07.2022)

⁹ Killed today in Makeyevka (published on: 06.07.2022) Republican Active Telegram channel. URL: https://t.me/reactiv_dnr/9207 (accessed on 10.07.2022)

¹⁰ The killed children were playing at the playground in Makeyevka when the tragedy occurred (published on 06.07.2022) Republican Active Telegram channel. URL: https://t.me/reactiv_dnr/9198 (accessed on 10.07.2022)

¹¹ Incoming strikes in Makeyevka now (published on: 06.07.2022) Republican Active Telegram channel. URL: https://t.me/reactiv_dnr/9186 (accessed on 10.07.2022)

¹² Recording the consequences of shelling (published on: 07.07.2022) DPR JCCC Telegram Channel. URL: https://t.me/DNR_SCKK/9314 (accessed on: 10.07.2022)

¹³ According to updated data, two children were killed in Makeyevka, three children were injured (published on 06.07.2022) Typical Donetsk Telegram channel. URL: <https://t.me/itsdonetsk/20586> (accessed on: 10.07.2022)

¹⁴ A child killed during the shelling of the center of Makeyevka by the Ukrainian military (published on 06.07.2022) Ukraine.ru Telegram channel. URL: https://t.me/ukraina_ru/83867 (accessed on 10.07.2022)

ANNEXES

Annex 1



Fig. 1 – Commemorative plaques organized by local residents at the site of the children’s death in the Shakhtyorskiy Quarter in the city of Makeyevka¹⁸.

¹⁸ This is how the place of death of children in Makeyevka looks now (published on 07.07.2022) DONtime URL:<https://dontimes.ru/tak-sejchas-vyglyadit-mesto-gibeli-detej-v-makeevke/> (accessed on 22.08.2022)



2022-07-07 11-20



2022-07-07 11-21



2022-07-07 11-22



2022-07-07 11-25



2022-07-07 11-29



2022-07-07 11-31

Fig. 2 – Photo table for recording FSM explosion craters (sheet 1).



2022-07-07 11-32



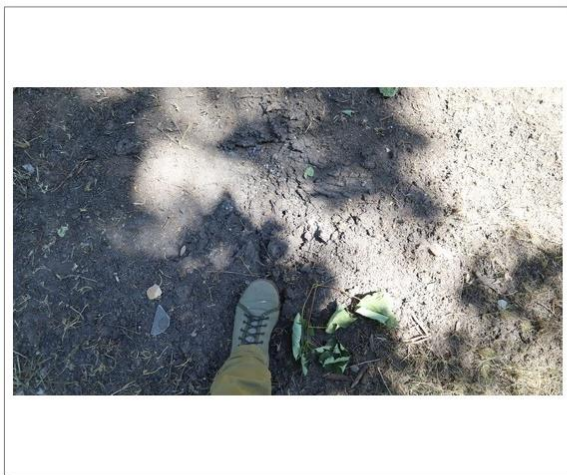
2022-07-07 11-36



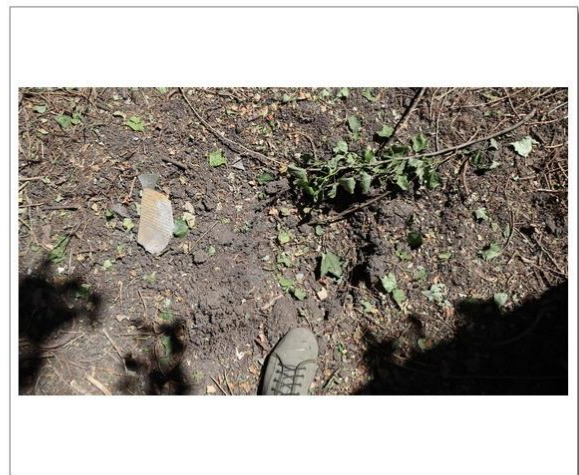
2022-07-07 11-46



2022-07-07 11-48



2022-07-07 11-49



2022-07-07 11-50

Fig. 3 – Photo table for recording FSM explosion craters (sheet 2).



2022-07-07 11-51



2022-07-07 11-52



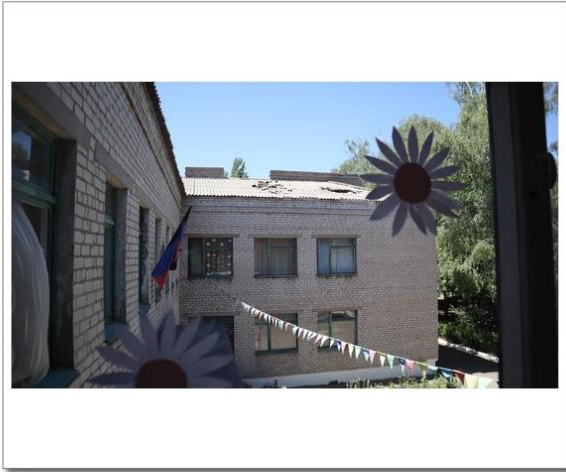
2022-07-07 11-57



2022-07-07 11-59



2022-07-07 12-15



2022-07-07 12-43

Fig. 4 – Photo table for recording FSM explosion craters (sheet 3).



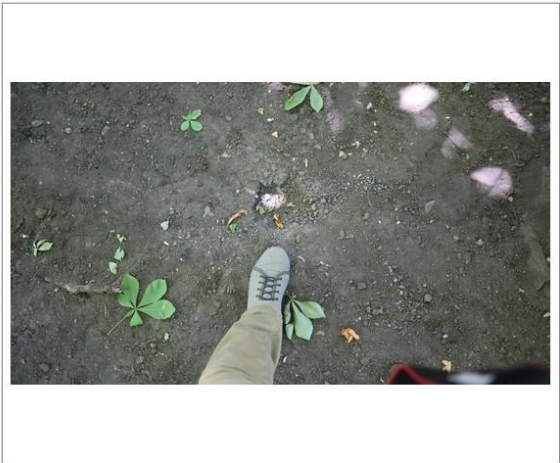
2022-07-07 12-44



2022-07-07 12-50



2022-07-07 12-51



2022-07-07 12-52

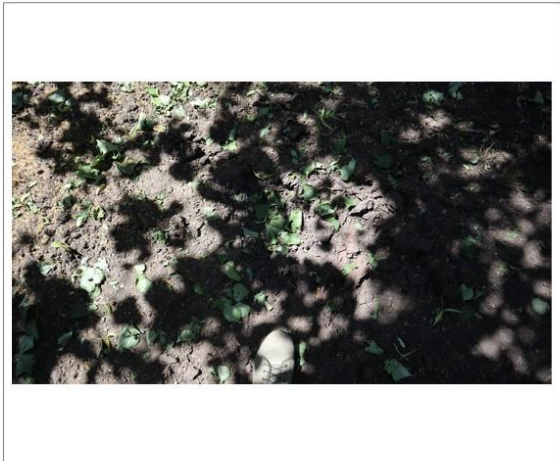


2022-07-07 12-53



2022-07-07 12-54

Fig. 5 – Photo table for recording FSM explosion craters (sheet 4).



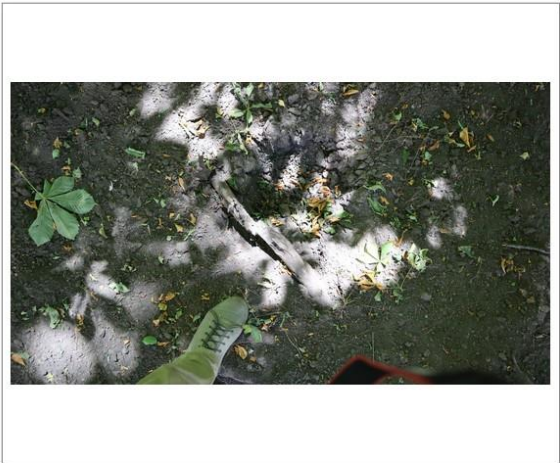
2022-07-07 12-55 (1)



2022-07-07 12-55



2022-07-07 12-56



2022-07-07 12-59



2022-07-07 13-01



2022-07-07 13-09

Fig. 6 – Photo table for recording FSM explosion craters (sheet 5).



2022-07-07 13-11



2022-07-07 16-30

Fig. 7 – Photo table for recording FSM explosion craters (sheet 6).



Fig. 8 – The first trace of the FSM detonation on the roof of the residential building No. 13



Fig. 9 - The second trace of the FSM detonation on the roof of the residential building No.13.



Fig. 10 – FSM detonation trace at the corner of the Vostochny store.



Fig. 11 – The cluster warhead frame protruding from the roof of the residential building No. 18.



Fig. 12 - Debris of the cluster warhead frame on the roof of the residential building No. 18 in Shakhtyorskiy Quarter.



Fig. 13 - Debris of the projectile missile part.

Table 1 – Coordinates of photos of FSM explosion craters.

| № | Photo | Coordinates: |
|----------|----------------------|----------------------|
| 1 | 2022-07-07 11-20 | 48.096611, 37.966984 |
| 2 | 2022-07-07 11-21 | 48.096616, 37.967204 |
| 3 | 2022-07-07 11-22 | 48.096621, 37.967682 |
| 4 | 2022-07-07 11-25 | 48.096514, 37.967355 |
| 5 | 2022-07-07 11-29 | 48.096418, 37.967473 |
| 6 | 2022-07-07 11-31 | 48.096488, 37.967811 |
| 7 | 2022-07-07 11-32 | 48.096542, 37.967811 |
| 8 | 2022-07-07 11-36 | 48.096377, 37.967750 |
| 9 | 2022-07-07 11-46 | 48.096442, 37.967146 |
| 10 | 2022-07-07 11-48 | 48.096573, 37.966921 |
| 11 | 2022-07-07 11-49 | 48.096621, 37.966916 |
| 12 | 2022-07-07 11-50 | 48.096677, 37.966857 |
| 13 | 2022-07-07 11-51 | 48.096769, 37.966924 |
| 14 | 2022-07-07 11-52 | 48.096787, 37.967138 |
| 15 | 2022-07-07 11-57 | 48.096740, 37.967197 |
| 16 | 2022-07-07 11-59 | 48.096740, 37.967420 |
| 17 | 2022-07-07 12-15 | 48.098967, 37.967188 |
| 18 | 2022-07-07 12-43 | 48.099569, 37.967517 |
| 19 | 2022-07-07 12-44 | 48.099440, 37.967922 |
| 20 | 2022-07-07 12-50 | 48.099788, 37.967519 |
| 21 | 2022-07-07 12-51 | 48.099925, 37.967603 |
| 22 | 2022-07-07 12-52 | 48.099797, 37.967286 |
| 23 | 2022-07-07 12-53 | 48.099815, 37.967088 |
| 24 | 2022-07-07 12-54 | 48.099716, 37.967090 |
| 25 | 2022-07-07 12-55 | 48.099542, 37.967200 |
| 26 | 2022-07-07 12-55 (1) | 48.099224, 37.967270 |
| 27 | 2022-07-07 12-56 | 48.099253, 37.967342 |
| 28 | 2022-07-07 12-59 | 48.099275, 37.967503 |
| 29 | 2022-07-07 13-01 | 48.099278, 37.967455 |
| 30 | 2022-07-07 13-09 | 48.099458, 37.965849 |
| 31 | 2022-07-07 13-11 | 48.099558, 37.965944 |
| 32 | 2022-07-07 16-30 | 48.096278, 37.966814 |



Fig. 14 – Automatically mapped FSM detonation locations.

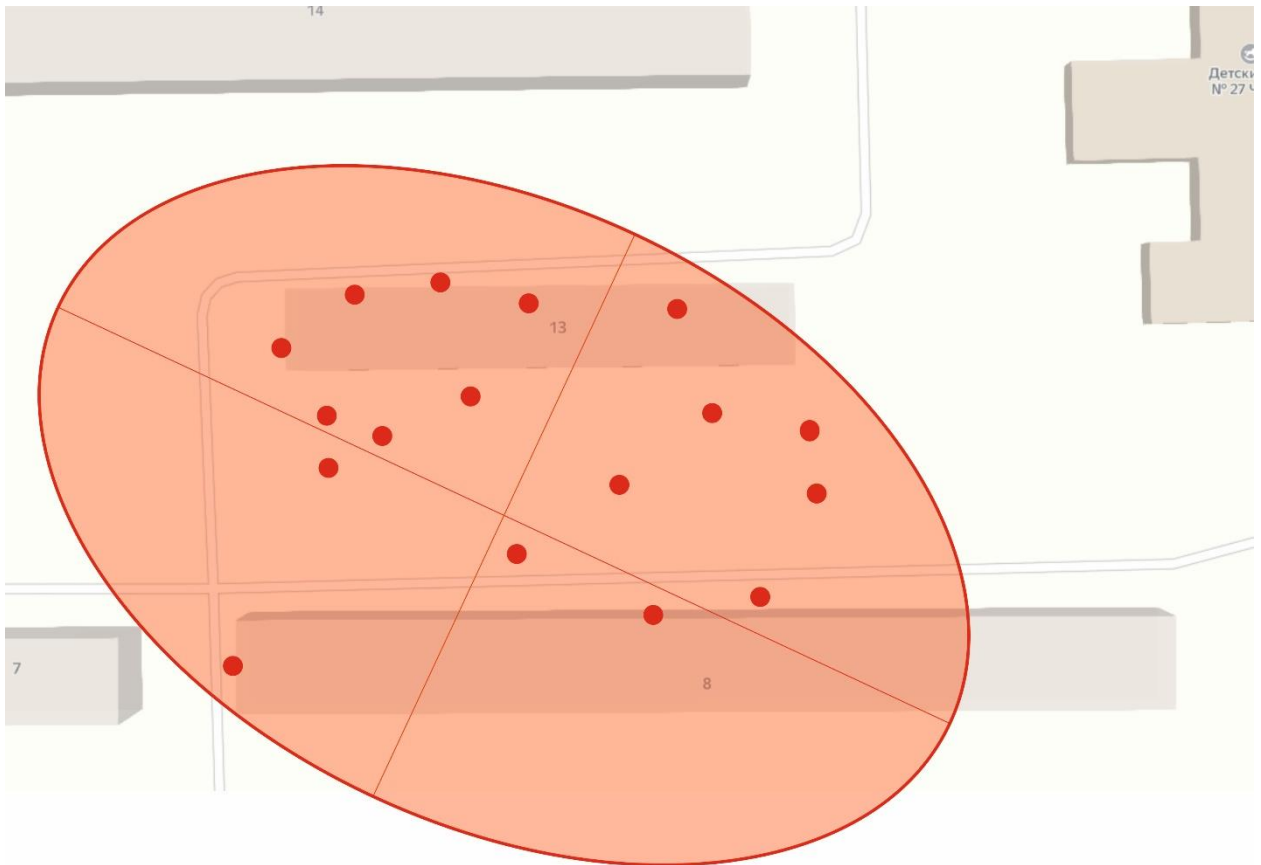


Fig. 15 – Automatically mapped FSM detonation locations in Sector 1.

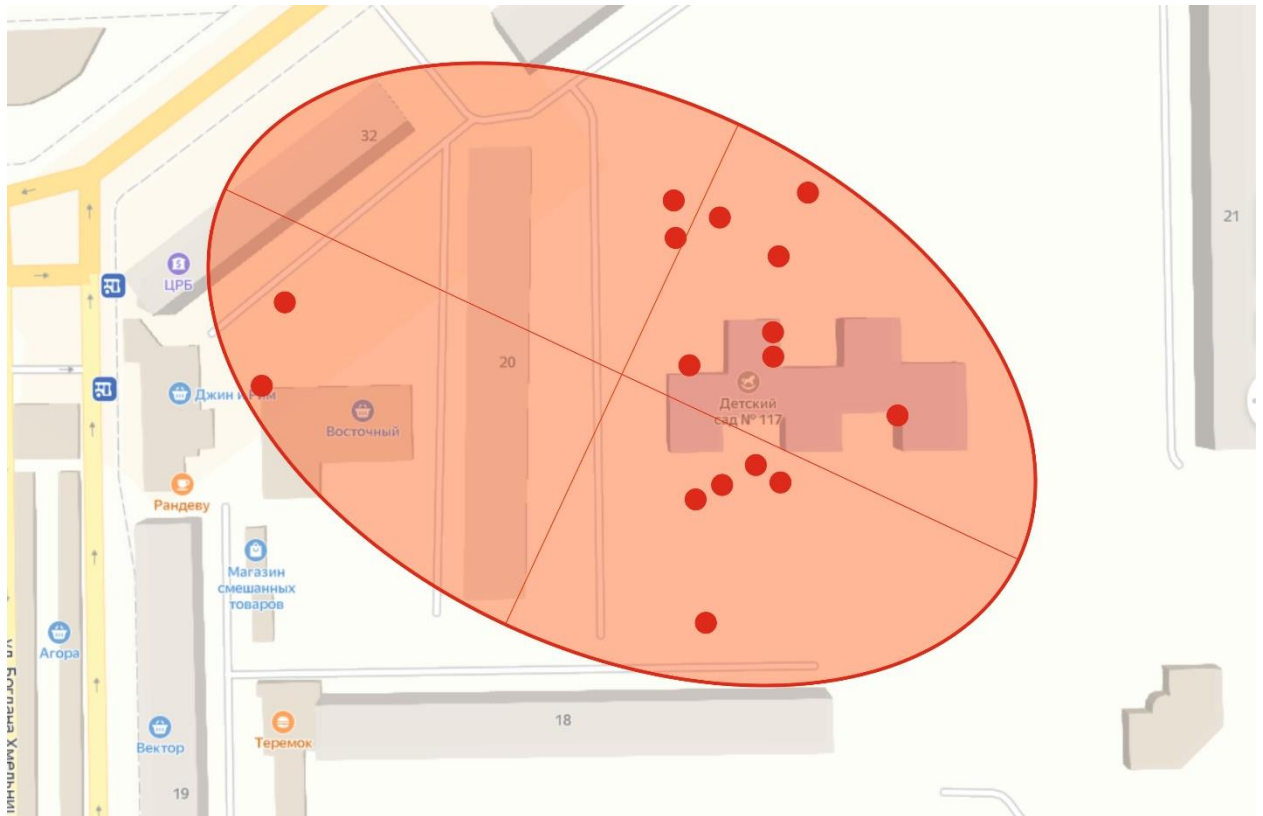


Fig. 16 – Automatically mapped FSM detonation locations in Sector 2.

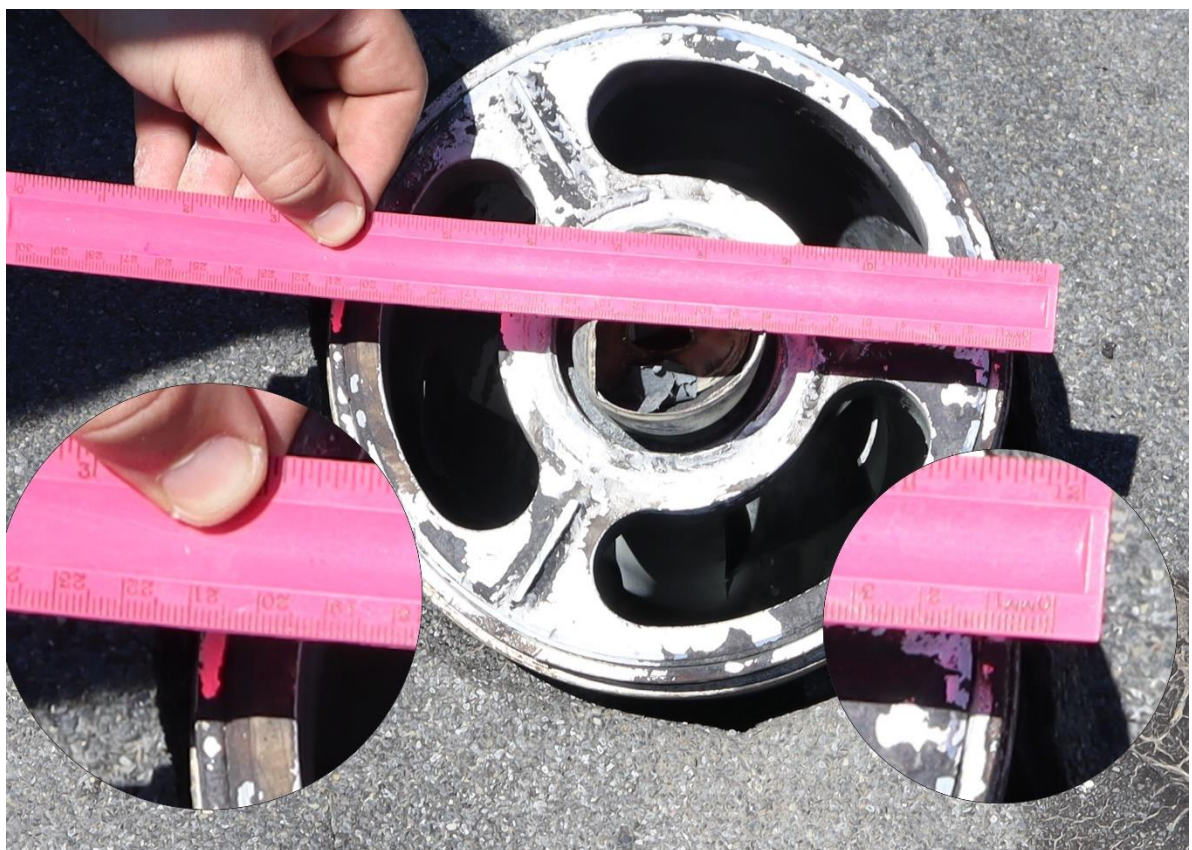


Fig. 17 – Measuring the diameter of the cluster warhead frame.



Fig. 18 – On the left– debris of the projectile MP; on the right – the smart phone used to record the measurements in photos.



Fig. 19 – The cone-shaped object found nearby the missile part impact point.



Fig. 20 – On the left – the smart phone used to record the measurements in photos; on the right - objects found nearby the projectile missile part

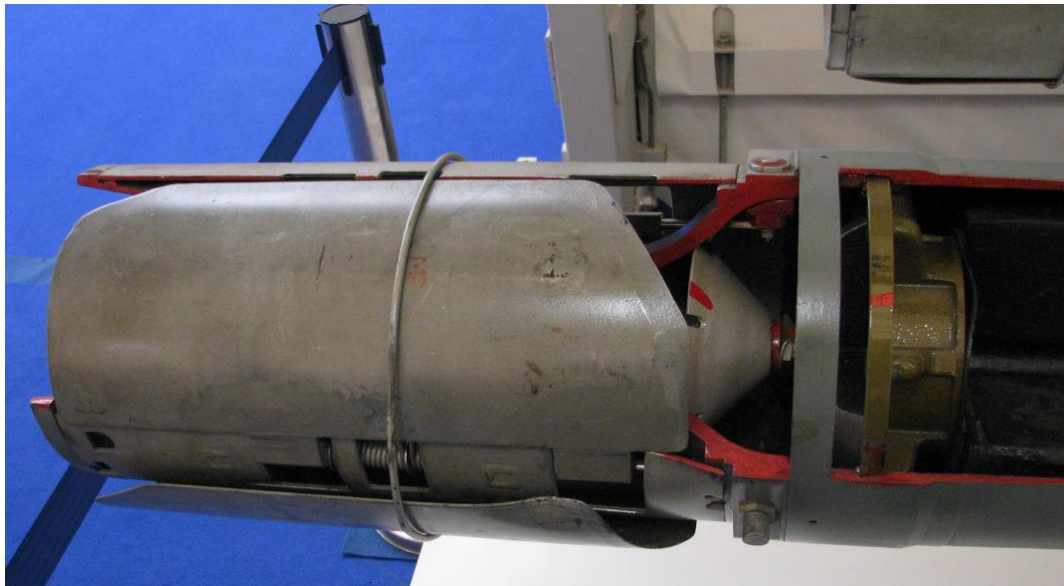


Fig. 21 - Missile part of the Uragan MLRS munition¹⁹.

¹⁹ Missilery. Missilery in the territory of the Patriot Congress and Exhibition Center in the exhibition pavilions as part of the Army-2015 International Military-Technical Forum (Kubinka, Moscow Region) (Part 1) URL: <https://missilery.info/gallery/rakelnaya-tehnika-na-territorii-kongressno-vystavochnogo-centra-patriot-v-vystavochnyh> (accessed on: 19.08.2022)



Fig. 22 – Top – debris of cluster FSM, found next to the residential building No. 8 in the Shakhtyorskiy Quarter; bottom – debris of cluster FSM, found in the territory of the Day Care Center No. 117.



Fig. 23 – Top – debris of cluster FSM, found in the Shakhtyorskiy Quarter; bottom – 9H235 FSM, used in the Uragan MLRS munitions²⁰.

²⁰ 9H235. Ukrainian Wikipedia. URL: <https://uk.wikipedia.org/wiki/9H235> (accessed on 22.08.2022)



Fig. 24 – Debris of the Himars MLRS projectile²¹

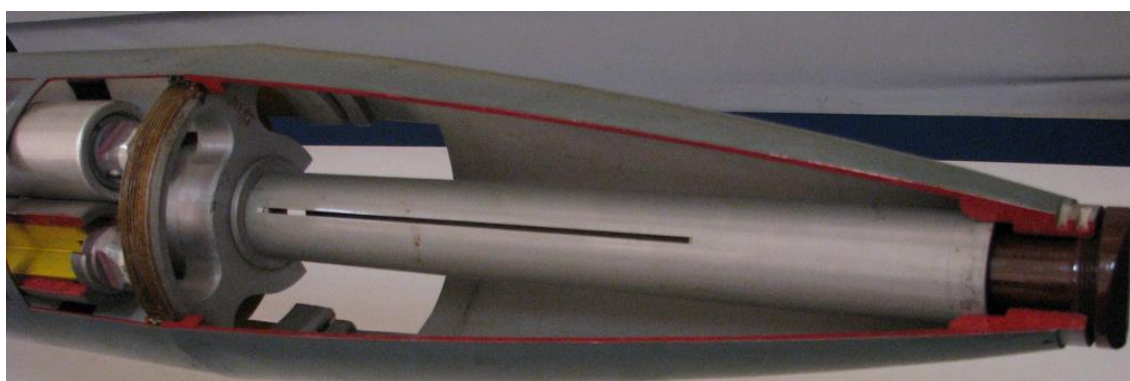


Fig. 25 – Top - a fragment of a projectile cluster warhead found in the roof of the residential building No. 18 in the Shakhtyorskii Quarter; bottom - the cross-section view of the front part of the Ugan MLRS projectile²².

²¹ The effect of the shelling of the town of Krasny Luch (LPR) by the UAF (published on 24.08.2022) DPR JCCC Telegram Channel. URL: https://t.me/DNR_SCKK/9585 (accessed on 19.08.2022)

²²Missilery in the territory of the Patriot Congress and Exhibition Center in the exhibition pavilions as part of the Army-2015 International Military-Technical Forum (Kubinka, Moscow Region) (Part 1) Missilery website. URL: <https://missilery.info/gallery/raketnaya-tehnika-na-territorii-kongessno-vystavochnogo-centra-patriot-v-vystavochnyh> (accessed on: 19.08.2022)



Fig. 26 – Cross-section view of the Smerch MLRS projectile with a cluster warhead²³.

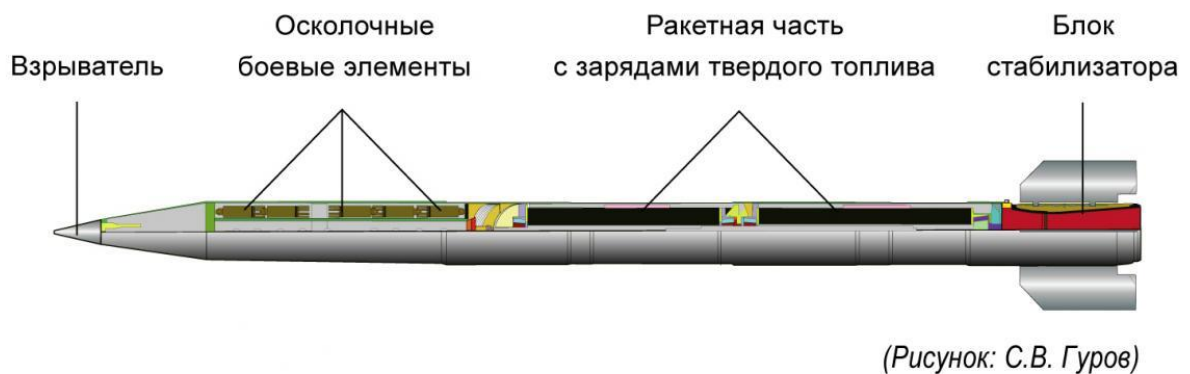


Fig. 27 - 9M27K Uragan MLRS projectile²⁴

²³ Missilery from the stock of the Mikhailovskaya Military Artillery Academy (Russia, St. Petersburg). Missilery Information News System. URL: <http://rbase.new-factoria.ru/gallery/raketnaya-tehnika-iz-fonda-mihaylovskoy-voennoy-artilleriyskoy-akademii-rossiya-gsankt-peterburg> (accessed on

²⁴ 9M27K series cargo rockets used in Ukraine (published on: 11.07.2014) // Ares Armament Research Services URL: <https://armamentresearch.com/9m27k-series-cargo-rockets-used-in-ukraine/>



Fig. 28 - 9K57Uragan MLRS.²⁵



Fig. 29 - Bureviy MLRS.²⁶

²⁵ 9K57 Uragan multiple launch rocket system. Missilery Information News System. URL: <http://rbase.new-factoria.ru/missile/wobb/smerch/smerch.shtml> (accessed on 12.12.2019) 22.08.2022)

²⁶ Bureviy multiple launch rocket system - Uragan (Hurricane) in Ukrainian (published on 23.11.2020) Top War Military Review website. URL: <https://topwar.ru/177296-reaktivnaja-sistema-zalпового-ognja-burevj-uragan-po-ukrainski.html> (accessed on 26.08.2022)

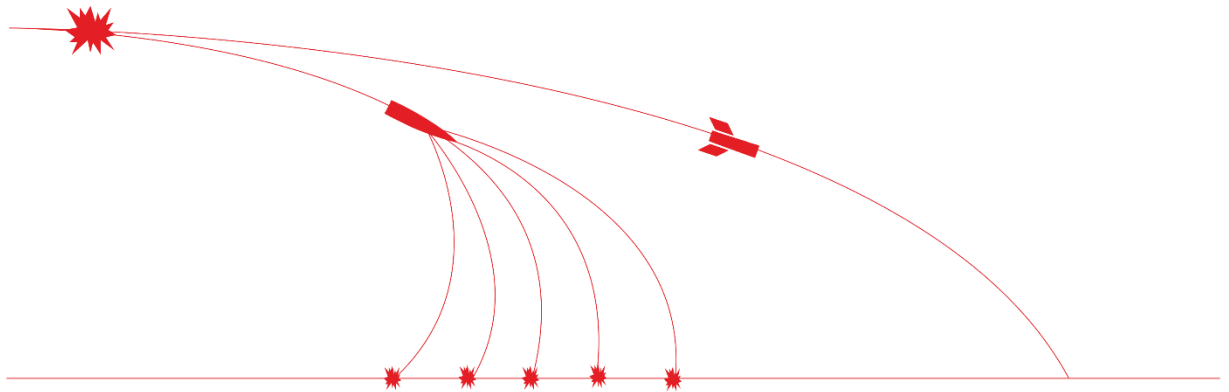


Fig. 30 – The actuation scheme of a rocket projectile with a cluster warhead.



Fig. 31– Determination of the shelling direction by the tracks at the site of the MP fall.



Fig. 32 – Deviation of a missile part.



Fig. 33 – Inclination angle of a cluster part.

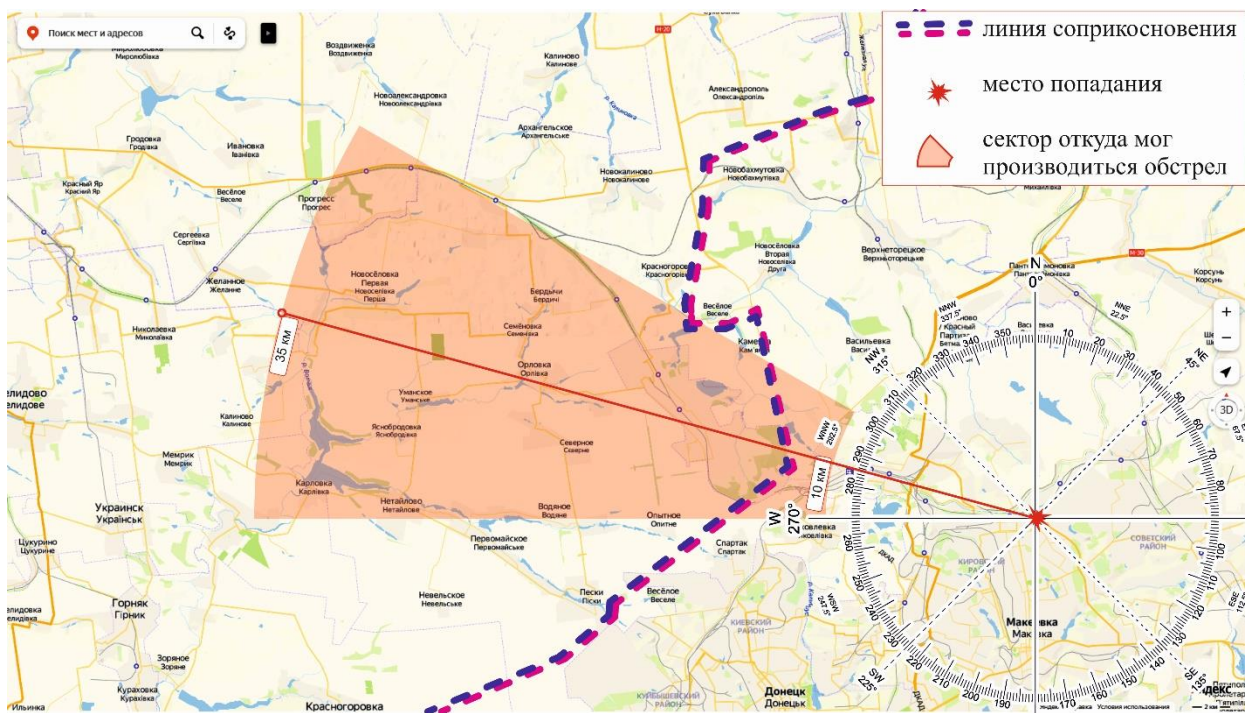


Fig. 34 – The shelling sector.



Fig. 35 - Uragan Regiment shoulder patch.²⁷



Fig. 36 – Deputy Commander of the 27th Rocket Artillery Brigade.²⁸

²⁷ 27th Rocket Artillery Brigade. Warriors and Military Equipment Wiki. URL: https://warriors.fandom.com/ru/wiki/27-я_реактивная_артиллерийская_бригада?file=27_%25D0%259E%25D0%25A0%25D0%25B5%25D0%2590%25D0%2591%25D1%25801.png (accessed on 26.08.2022)

²⁸ 13 09 27 Sumy Artillery Brigade (published on 24.09.2022) Vladimir Ivo YouTube Channel. URL: <https://www.youtube.com/watch?v=ShllHCSL-3c> (accessed on 26.08.2022)