

# Field Artillery in the defensive war of Ukraine 2022-2023

## Part II. Methods of task implementation

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### ABSTRACT

This article is a continuation of the considerations regarding the use of field artillery in Ukraine's defensive war in the period from 24<sup>th</sup> February 2022 to the 2023 summer offensive of the Ukrainian army. Artillery in this armed conflict is used by both sides with great intensity and is an essential means of fire support, often decisive for the success of the implemented operations. The aim of the second part of the article is to present ways of using field artillery units in selected operations of the Ukrainian war. As before, the subject of the research is the missile forces and artillery of the warring parties, but in this case, above all, the way they carry out their tasks. In his research, the author wants to answer the following problematic questions: How did the field artillery units of both parties involved in the conflict carry out combat tasks in selected phases of the war? What conclusions can be drawn from this for the Armed Forces of the Republic of Poland, which are currently increasing their capabilities, especially their artillery capabilities, as well as for other NATO armies? The Author, an artillery officer by education and currently a military academic teacher academically involved in the issue of state military security, based his academic analysis largely on his personal academic achievements and conclusions gained from participating in military exercises, conversations, and workshops conducted with Ukrainian officers before the outbreak of the war, as well as on the latest academic studies and reports on the course of warfare.

### KEYWORDS

Ukraine's defensive war, fire support, field artillery, artillery tactics



## Introduction

This article is a continuation of the considerations regarding the use of field artillery in Ukraine's defensive war in the period from 24<sup>th</sup> February 2022 to the 2023 summer offensive of the Ukrainian army. Artillery in this armed conflict is used by both sides with great intensity and is an essential means of fire support, often decisive for the success of the implemented operations.

The first part of the research compares the combat potential of the field artillery of the warring parties, lists the main tasks of artillery during combat, and presents the basic tactical assumptions. This article focuses primarily on the methods of performing tasks by field artillery in tactical operations carried out in various phases of the war. Thus, the **purpose** of the current considerations is to present the ways of using artillery units in the Ukrainian war, as well as to present conclusions from the war for the Missile Forces and Artillery of the Polish Armed Forces and other NATO armies. As before, the subject of research is the missile units and artillery of the warring parties, but in this case, above all, their mode of operation. In his research, the author wants to answer the following **problematic questions**: How did the field artillery units of both parties involved in the conflict carry out combat tasks in selected phases of the war? What conclusions can be drawn from this for the Armed Forces of the Republic of Poland, which are currently increasing their capabilities, especially their artillery capabilities, as well as for other NATO armies?

The Author, an artillery officer by education and currently a military academic teacher academically involved in the issue of state military security, based his analysis largely on his personal academic achievements and conclusions gained from participating in military exercises, conversations, and workshops conducted with Ukrainian officers before the outbreak of the war, as well as on the latest academic and analytical studies. The bibliography used has already been discussed in the first part. However, titles such as *Preliminary Lessons from Russia's Unconventional Operations During the Russo-Ukrainian War* (Watling et al., 2023) and *A War of Attrition. Assessing the Impact of Equipment Shortages on Russian Military Operations in Ukraine* (Schwartz, 2023) were particularly useful for considering how field artillery was used.

## **1. Use of artillery in the battles for Kiev in February and March 2022: preparation of combat operations as a condition for the effective use of field artillery**

At the start of the war on 24<sup>th</sup> February 2022, the Russians had 168 battalion tactical groups (BTGs) at their disposal, of which about 100 were involved in the attack on Ukraine (Baev, 2022). The attack was carried out from three main operational directions, i.e. from the north and north-east to Kiev, from the south to Mariupol and Odessa, and from the east to Kharkiv and other auxiliary directions.

Analyses of footage, media reports, and broadcasts, as well as reporting documents, allow for the assumption that the armed forces of the Russian Federation at the beginning of the conflict attempted to launch precision strikes against Ukraine's strategic targets, such as industrial facilities, energy infrastructure, command and control (C2) elements of the strategic and operational level, military airfields, communication nodes, television stations, elements of the country's air defence system, logistics facilities and ammunition depots. The attacks were carried out using cruise missiles launched from air and water, as well as ground-to-ground ballistic missiles. However, the Russians did not succeed in overpowering the country's air defence system or destroying the Ukrainian air force. The Ukrainian air force regrouped into field airports just before the start of the war, avoiding the first strike by the Russians (Masuhr, Zogg, 2022).

The Russian field artillery lacked the appropriate range of fire and precision to actively participate in deep battles. On the day of the commencement of combat operations, artillery units were among long columns of marching troops heading towards Kiev from Belarus and western Russia. The large length of the divisional and brigade columns and the inability to develop artillery in the crowded and difficult terrain north and north-east of Kiev meant that Russian artillery was not used effectively during this period of fighting. During the Russians' attempt to capture Kiev, it was precisely this difficult battlefield topography and misguided tactics that prevented the effective involvement of Russian artillery. Russian troops were jammed on two main supply routes, having their leading elements within the range Ukrainian field artillery fire and their own artillery and its ammunition trapped in blockages in the deep rear (Watling, Reynolds, 2022). The coordination of armoured units with infantry, artillery, aviation, and electronic warfare equipment was completely unsuccessful, resulting in some tank units being isolated on the roads by light Ukrainian infantry

forces and destroyed by portable anti-tank means. Due to logistical problems, Russian tank crews in many cases abandoned their vehicles, which were immobilised after running out of fuel.

The columns of approaching Russian troops were tracked by the Ukrainians using all available military and civilian means of reconnaissance, i.e., satellite reconnaissance provided by NATO as well as civilian consortia, as exemplified by the Starlink system, UAVs, and even videos from mobile phones made by both soldiers and civilians (Watling et al., 2023). Importantly, from the very beginning of the war, the Ukrainians managed to create a reconnaissance system that efficiently transferred data to field artillery units (Kamaras, 2023). Ukrainian troops were prepared for the scenario of an attack on Kiev and patiently waited for the main mass of Russian forces to enter the pre-planned *kill zones*, where they were destroyed with precision artillery fire. Then, Ukrainian units retreated to the next defence perimeter and the above-mentioned combat scenario was repeated (Lange, 2023).

Field Artillery units of Ukraine were deployed in pre-planned and prepared areas of fire positions (RSO), from which they could strike targets that went out on the delay perimeters and entering the kill zones. Both the batteries of self-propelled and towed guns tried to carry out a counterfire movement and masking against air reconnaissance. The principal type of fire for targets entering the firing zones was concentrated fire, while precise single fire was also often used, even on targets such as tanks, infantry fighting vehicles or self-propelled howitzers. Light infantry from ambushes struck columns of troops with the help of shoulder-launched anti-tank guided missiles (APBs) and grenade launchers, stopping them, while artillery struck the fronts of standing columns, dispersing them and forcing them to turn back, what caused chaos and made the Russian troops disorganized.

During this period of fighting, Ukraine had only domestic field artillery equipment, mainly 2S1 Goździk and 2S3 Acacia self-propelled guns, D-30 towed guns and also BM-21 Grad, BM-22 Uragan and, to a lesser extent, BM-30 Smiercz multiple launch rocket system (MLRS). With the aim of increasing the real range of artillery fire, several 203 mm self-propelled howitzers 2S7 Pion were restored to service, which hit targets at a distance of up to 40 km. The guns and launchers occupied pre-prepared fire positions (SO), on which they were positioned in batteries, which in turn were most often lined up with fire means at a distance of 20-40 m from each other – in the case of cannons and up to 150 m – in the case of rocket launchers (Watling, Reynolds, 2022). It was a standard deployment for

this type of fire equipment, not equipped with system of land navigation and oriented in the SO with the help of artillery compass aiming circle, i.e. equipment requiring direct visibility between the fire officer and the cannons (launchers). What is interesting, a similar way of orienting cannons was seen in some film reports depicting the action of Russian artillery. This confirms that despite the modernization of equipment, equipping artillery with computerized fire control systems, and fire means with navigation equipment, most of the Russian subunits were equipped with non-upgraded systems and operated in a manner typical of old-type artillery.

The effectiveness of the use of field artillery by the Ukrainian army was especially determined by the preparation of combat actions by the Ukrainian command, which provided for the major directions of strikes, prepared the perimeters of delay and defense, and also planned the use of artillery as the basic means of fire support in advance. The RSOs which were prepared in advance, enabled the fast development of fire subunits and their efficient maneuvering, preventing the enemy from implementing effective counter-battery fire. In turn, the Russians were not prepared for powerful resistance from Ukrainian defenders and did not put enough emphasis on providing effective and coordinated fire support to marching and advancing columns. The congestion created in the long troops' columns made it difficult to develop the artillery, which also felt the deficiency of information about the objects of enemy, and was not able to coordinate fire closely with the advancing troops. This may have been one of the causes for the failure of the Russian attack on the capital of Ukraine.

## **2. Field artillery in the Russian offensive in the Donbas in the summer of 2022 – the old Russian concept of fire support still effective, but expensive**

After the failure at Kiev, the Russian command changed tactics and during the summer offensive in the Donbass in 2022 advanced on a wide front, using a mass of troops and powerful fire support, provided primarily by field artillery, but also combat helicopters and attack aircraft. First of all, it was hoped to lure the main Ukrainian forces to Donbas and destroy them in combat, if not by encirclement, then at least with the help of strong artillery fire and aviation. By 3<sup>rd</sup> July, major cities on the East of Donbas, namely Severodonetsk and Lisichansk, were captured, and Ukrainian troops suffered significant losses. On 1<sup>st</sup> August, the battle for Bakhmut began, the

capture of which was intended to enable the cutting off of Ukrainian troops in the Donbas. The fights for the city lasted as long as 10 months and ended with pushing the Ukrainians a few kilometers west of its borders, but did not bring an operational breakthrough in the war. The significance of Bakhmut to the Russians decreased in September 2022, when the Ukrainians liberated the occupied territories of the Kharkiv region, approaching the Luhansk region from the west (Shopa, 2023).

During the offensive, Russian field artillery came back to the old tactics of massed fire, tried in the Chechen wars, carried out in front of the front of the advancing troops, in order to bleed the Ukrainian defenders. In these operations, it was not uncommon to use TOS-1 and TOS-1A thermobaric missile launchers, which demonstrated powerful firepower, but nevertheless did not determine the success of the fighting. Massed fire was the basic form of fire support for troops, while precision fire, e.g. with the use of laser-guided missiles of the Krasnopol type, was used by the Russians relatively rarely. The concentrated fires inflicted significant losses on the army of Ukraine and enabled the attacking Russians to slowly, although quite systematically, conquer the area (Henkin, 2022).

In the fights for Bakhmut, which became the focus of the Russian offensive in late summer 2022, the Russian artillery literally destroyed everything that stood in the direction of the advance with massive fire, hoping to inflict heavy losses on the Ukrainians in terms of men and equipment, as well as depriving them of points of support in buildings and fortifications. Ukrainian strongpoints were destroyed with methodical fire during the fire preparation of the attack, and during the attack of the troops, artillery overpowered the revealing means of combat of the Ukrainians. This often led to local paralysis of the defenders' command system and slow conquest of the territory. This tactic, however, resulted in a serious consumption of artillery ammunition (Schwartz, 2023).

During this period, the Ukrainians had limited possibilities to carry out counter-battery fire, which could significantly reduce the activity of the aggressor's artillery. There was a deficit of both means of reconnaissance, fire systems of appropriate range and precision, ammunition, as well as specialists, who were trained for such a fight. The situation in the implementation of counter-battery tasks was somewhat saved by the AN/TPQ-36 and AN/TPQ-49 firefinder radars supplied by the USA, but the post-Soviet fire means owned by the Ukrainians at that time were unable to strike Russian artillery subdivisions effectively and accurately at long distances. This caused that during the summer Russian offensive in the

Donbas in 2022, Russian field artillery had a lot of freedom of action, and as a consequence, infantry of Ukraine was constantly under intense fire and suffered large losses. In these battles, the predominance of artillery of Russia over Ukrainian artillery on some sections of the front was 10 to 1. The Russians still had large stocks of 122 and 152 mm ammunition, in all likelihood dating back to Soviet times (Bertrand et al., 2023), which was used to implement massed fire in the form of barrage fires, moving barrage fires and successive concentrations of fire. Brutal but simple tactics resulted in substantial Ukrainian losses in men and equipment. During the summer, the Russian army used an average of 20,000 to 30,000 artillery shells (including rocket artillery) per day, although there were days when the Russians fired up to 60,000 shells (Ponomarenko, 2022).

Meanwhile, in late June 2022, the Ukrainian army began to experience a shortage of artillery ammunition for post-Soviet systems. Its daily usage has been reduced from 12,000-15,000 to 5,000-6,000 of missiles. At that time, quick support from Western countries, including Poland, proved to be critical. The former Eastern bloc countries still had a substantial arsenal of ammunition for post-Soviet firepower that were sent to Ukraine (Siska, 2022). Above all, however, a total of dozens of artillery systems were handed over to Ukraine, including 155 mm self-propelled howitzers Krab, PzH 2000 and Caesar, and M777 towed howitzers. The US handed over a dozen Himars multiple rocket launchers with a stockpile of 227 mm of GMLRS rockets, which occurred to be critical. In this manner, the crisis related to the predominance of Russian artillery was mitigated, and in many respects even averted. However, in the autumn, Ukraine used between 4,000 and 7,000 artillery shells per day, compared to 20,000 Russian shells. This numerical advantage in used ammunition on the part of the Russian army has been slightly reduced as a result of the use of precision ammunition by Ukrainian forces. In addition to the above-mentioned GMLR rockets, the Ukrainians received at least 5,000 155 mm of high-precision Excalibur cannon shells, with a range of about 60 km and a maximum circular error probable (CEP) of less than 4 meters (Hammes, 2023).

During the offensive in Donbas, OTR-21 Tochka tactical missile launchers were used by the Russians in diametrically opposed to the adopted doctrine. By 2019, they were virtually withdrawn from the frontline service, but they were restored due to the exhausting arsenal of Iskander missiles. The OTR-21 were usually used in a deep strike, especially to destroy elements of the command system and the systems of electronic warfare. However, there have been instances where they have been used for less

significant facilities and also in a non-economic manner. In at least one instance, a single Ukrainian M109 howitzer was hit by as many as three Tochka-type missiles and was only slightly damaged, and the personnel who hid were not injured. On the one hand, this shows the poor coordination of fire support of Russian troops, but on the other hand, it confirms that the Russians still possessed a huge amount of artillery and missile ammunition at that time, because no principles of war economy were taken into account. Tochka missiles served doctrinally to combat operational targets, not individual cannons. Thus, the given manner of their use demonstrates considerable prodigality of the Russian commanders or their incompetence.

Undoubtedly, Russian artillery during the 2022 summer offensive in the Donbas was an essential means of achieving fire superiority and creating favorable conditions for Russian ground troops to attack. Overall, the average results of the Russian ground forces were increasingly compensated by massive artillery shelling, which allowed the infantry to conquer the area slowly but methodically. Continuous shelling levelled villages and cities that were defended, inflicted heavy losses on Ukrainian forces, especially in Severodonetsk, and forced them to withdraw. Fire control of the area by Russian artillery prevented the concentration of Ukrainian forces for a counterattack and did not allow them to take the initiative, as happened earlier in Kiev (Watling, Reynolds, 2022). It was only the supply of Western equipment that allowed for, at least, partial elimination of Russian advantage by launching fire attacks on elements of the command and reconnaissance system and, above all, artillery ammunition depots, which reduced the activity of Russian artillery and contributed to the exhaustion of the advancing troops and the final halt of the offensive.

### **3. Field artillery in the Ukrainian counteroffensive – not quantity, but quality**

The year 2023 began with heavy fighting on many sections of the front, especially in the area of Bakhmut, which was fiercely defended by Ukrainian units. Strong resistance to the advancing Russian troops, especially the so-called Wagner group, was aimed at exhausting the Russians and creating conditions for the Ukrainian armed forces to move to a large-scale counteroffensive.

Prior to the launch of the offensive by the Ukrainians in June 2023, it was evident that the Russians began to use field artillery in their several



primary, key directions of action, because they no longer had sufficient supplies of equipment and ammunition. In the first quarter of 2023, the Russians used an average of 12,000 to 38,000 projectiles per day, but as the fighting dragged on, they increasingly rarely exceeded the number of 24,000 projectiles fired per day (Watling, Reynolds, 2023). Less involvement of 152 mm guns in favor of greater use of 120 mm mortars was also noted. On the other hand, since the beginning of 2023, the constant use of a fairly limited amount of 152 mm of Krasnopol precision ammunition by the Russians has been noted, for which the targets were most often indicated by the Orlan-30 UAV (Watling, Reynolds, 2023).

Apart from the advantages and disadvantages of Russian artillery, it should be emphasized that it is a fundamental obstacle for the Ukrainian army in the implementation of offensive operations and the recovery of the occupied area. For this reason, limiting its combat capabilities has become an essential condition for the Ukrainian forces to achieve their operational goals. The most serious weakness of the Russian artillery is still its extensive logistics system, under which huge quantities of ammunition are transported by rail to divisional warehouses, located deep in its own group, outside the range of Ukrainian fire. Then, this ammunition must be transported in vehicles, often civilian, which can only move on paved roads, to extended ammunition depots, often located just behind artillery groups concentrated in fire areas, from where it is taken to fire subunits. The transport routes of materials, due to their rare network, are easily predictable and can be blocked by the fire of Ukrainian artillery. In addition, the ammunition depots are extensive facilities and difficult to camouflage, making them a fairly easy target for, for example, the long-range and precision Himars launchers possessed by the Ukrainians since the summer of 2022. As a consequence, since the beginning of 2023, Russian ammunition depots have been a priority target for GMLRS rockets, and many of them have been destroyed, weakening the combat potential of Russian artillery. It should be noted, however, that the warhead of the 227 mm GMLRS precision-guided rocket has limited firepower, often insufficient to initiate a series of munitions bursts in a depot, hence several were used to destroy a single depot. Providing the Ukrainian army with ATACMS missiles – capable of being fired by Himars launchers too – with a range exceeding 300 km and warheads for various purposes, including fragmentation and destruction that would pose a threat to ammunition depots, could strongly bolster the Ukrainian offensive, but the USA has not decided to transfer these weapons in that time. To sum up, the wise tactics

for the implementation of deep strikes against the Russian logistics system create the conditions for the implementation of the offensive, but this is not a sufficient factor for the success of the offensive.

During the winter and spring, the Ukrainians built up their operational reserves to be used for the offensive. They counted primarily on units armed with heavy Western weapons, including Leopard 2 and M1 Abrams tanks. Twelve brigades of 50,000 to 60,000 soldiers were involved in the strike (Sabbagh, 2023). Strikes were planned in three operational directions, namely Luhansk (probably auxiliary), Mariupol, and Melitpol. The general idea of the Ukrainian command was to reach the Sea of Azov and cut Crimea off from Russia. It quickly became apparent that the strong resistance of the Russian troops and extensive minefields do not allow for the operational development of troops to attack without the risk of incurring heavy losses, and the offensive took on the form of an attack by small battle groups, slowly displacing the enemy from the occupied area. In these battles, the Ukrainians did not achieve two conditions for an effective offensive, i.e., aerial and artillery dominance, but despite this, they managed to move forward quite systematically. As a result of the Ukrainians' inability to use air forces, the main means of fire support is artillery.

As many as three artillery brigades could be involved in the Ukrainians' offensive, as the 55<sup>th</sup>, 53<sup>rd</sup>, and 45<sup>th</sup> artillery brigades operated in the Donbas. These units already operated in this area in the winter of 2023 (Center for Strategic & International Studies, n.d.). Added to this is the organic artillery of the fighting brigades, largely equipped with Western equipment. Certainly, Himars launchers are being actively used in the direction of operations to strike high-value targets deep within the Russian grouping. It is difficult to determine the total number of artillery fire systems used in the offensive, but according to the author's estimates, it may range from 200 to 300 fire means.

The Russians, preparing for defence, planned and prepared in advance the field artillery position areas at a distance of up to 30 km from the front edge of the troops, for artillery units organised into tactical artillery groups assigned to brigades and divisions. The artillery saturation of Russian defences is certainly very high; for each defending brigade, there may be a tactical artillery group consisting of several barrel artillery batteries and a rocket artillery battery. Another tactical artillery group consisting primarily of rocket artillery is maintained at the division level. Overall, the Russians certainly outnumber the Ukrainian artillery; however, they feel deficiencies in radar and imaging reconnaissance, which reduces their

combat capabilities. In accordance with their doctrine, they also prepared fires in the field, which allowed them to shorten their fire response time to the emerging Ukrainian targets, especially the advancing assault groups and units supporting them. For this purpose, fixed and movable barrages in front of individual defence positions were prepared, along with concentrated fires covering the prepared minefields and engineering barriers and massed fires at important road junctions and crossings (Scott et al., 2016). Both the Russian and Ukrainian artillery are constantly conducting counter-battery fire, the aim of which is to overpower the enemy's fire support system (details of the counter-artillery combat are written later in the article).

At the time of writing, the Ukrainian offensive was still ongoing, and it was difficult to predict its outcome. According to the opinion of some Western commanders, including D. Rice, a former US Army officer and West Point graduate, providing the Ukrainians with several thousand cluster missiles could significantly increase the pace of operations and even lead to victory in the war. In the opinion of the author of this article, this type of ammunition is particularly effective in defensive operations, and the unexploded submunitions left behind would pose a threat to the attacking Ukrainian subunits. At this stage, however, it can already be stated that precise Western missiles combined with an efficient reconnaissance and command system allow to offset the Russian quantitative advantage in artillery. According to the opinion of Western experts, Ukrainian artillery inflicts greater losses on Russians in equipment and people, especially in howitzers and rocket launchers (Stetson, 2023). It should also be noted that the Ukrainians have been using only a dozen HIMARS launchers since last year, none of which have been destroyed, and their precise and long-range fire allows the operation to be shaped as the Ukrainian command intended. This is an important lesson for the Polish Armed Forces, which intend to purchase as many as five hundred pieces of this type of equipment. It seems that a much smaller number would completely meet the needs of the Missile Forces and Artillery, and the funds saved could be used to purchase a larger amount of precision ammunition, including GMLR and ATACMS.

#### **4. Field artillery in attrition warfare: artillery as the only argument in military powerlessness**

The war in Ukraine is largely waged in a static manner in the trenches and is directed, especially by the Russian side, to fatigue and exhaust the opponent. Undoubtedly, without the help of the West, Ukraine would not have had any chance in this form of warfare with the Russian Federation. Field artillery during operational breaks is the basic and safest means of destruction, as it allows military facilities to be destroyed and incapacitated without risking more serious losses.

The Russians regard the maintenance of fire superiority as a fundamental determinant of trench warfare effectiveness. The fire dominance of Russian artillery over Ukrainian artillery is based on the combined and coordinated use of multiple fire support systems. It is therefore based not only on the material, i.e., the amount of artillery and ammunition, but also on adequate range and coverage of the area with reconnaissance from UAVs acquiring target data. It is also an electronic warfare (EW) and anti-aircraft defence resource to combat Ukrainian UAVs in order to deny the recognition of Russian artillery batteries in waiting areas and fire positions, which makes it difficult to destroy them with counter-battery fire (Schwartz, 2023).

In turn, the Ukrainians are trying to gain a fire advantage by building an appropriate counterbattery fire system. During the 1991 Gulf War, the simplest fire and reconnaissance module was the MLRS battery connected directly to the AN/TPQ-37 firefinder radar, which efficiently recognised active Iraqi artillery fire means (Świętochowski, 2017). Now that the artillery has much greater mobility and is able to perform a shoot-and-scoot tactic after each fire task, this is no longer enough. The system is complemented by a developed network of reconnaissance drones, electronic warfare means, and even satellite reconnaissance. The information is transmitted to the general command system or directly to the fire subdivision. Fire tasks are executed more often with precision ammunition, and secondarily with conventional ammunition. Artillery fire can also be replaced by combat drone strikes.

Since the beginning of the war, both sides have intensively used UAVs to conduct reconnaissance and correct artillery fires. The war became a testing ground for all types of UAVs, both reconnaissance and strike, commercial, including many low-cost structures adapted for reconnaissance and even dropping bombs and grenades, as well as specialized ones, produced

exclusively for the army. It was only after 2014 when the Russian army began to intensively implement and develop the UAV, and in February 2022 it had about 2,000 different apparatuses (Schwartz, 2023). The Russians use drones such as Orlan-10/30, Tachyon, Merlin-VR, Mohajer-6 and occasionally Cartographer to conduct reconnaissance for artillery. Ukraine, on the other hand, engages all systems it manages to acquire from abroad or develop at home, including such drones as Bayraktar Mini, FlyEye, Leleka-100, Ukrjet UJ-22, Lemur, PD-1, RQ-20 Puma, EOS C-VTOL "Magyla", UAS A1-CM Fury, H10 Poseidon II. It is worth noting that the one of the UAVs which perform quite well in reconnaissance is Polish FlyEye, which can fly on a programmed track, is quite resistant to electromagnetic interference and provides accurate data on the location of opponent objects in the field, because its rangefinder and navigation system allows to determine the coordinates of objects with an accuracy of several meters.

For the Russians, the reconnaissance UAVs, the most important of which is the Orlan-10, are critical to predominate the artillery's firepower advantage. In a correctly functioning reconnaissance and fire module, UAVs allow to reduce the time from the detection of the target to the moment of its firing by artillery to five minutes. They also allow the Russians to reduce the quantity of artillery ammunition used, because the fire is conducted to the observed target, i.e. with a series of effective fire rather than using the ammunition consumption standards for unobserved targets, which are incomparably higher (Schwartz, 2023). The Russians incurred high losses in the UAV, but thanks to the acquisition of civilian drones from China, they are able to further saturate the battlefield with an appropriate number of this equipment. Cutting them off from supplies would undoubtedly contribute to a serious weakening of the effectiveness of Russian artillery.

UAV operators of both sides of the conflict move covertly to the designated operational areas and occupy areas convenient for hiding and launching drones. When conducting reconnaissance, they search for the opponent's objects, which are usually well hidden and masked. The data about objects can be sent to the command and control system, in which they are analyzed by trained specialists, and in the case of Ukraine even by artificial intelligence and then selected for destruction by artillery or strike drones. Usually, it is a small percentage or even per mille of the number of all objects detected. The operator can also send the coordinates of the object directly to the artillery subunit, which immediately executes the fire. The summer 2022 initiated an extremely intensive use of UAVs for reconnaissance in favour of artillery. Currently, both sides have no problems with

obtaining information about the position of the enemy's troops and means of combat, the problem is to fire at them, because there is a shortage of ammunition and accessible means of fire. However, all the time, especially during operational pauses, the hunt for and destroying of enemy objects continues whenever the opportunity arises. This is a typical example of a war of attrition, because firing to individual combat systems, when it is not coordinated with general military operations, does not contribute much to the operational and tactical assumptions.

In the artillery war of attrition, Ukrainians are more successful because they pay special attention to the detection and destruction of objects of operational importance, e.g. command posts (SD). Ukrainian UAVs locate the enemy's SD with the use of a combination of image and radio reconnaissance or by tracking the movement of military vehicles. After detecting and determining the position of the SD, and especially the main tent, wagon or building, the artillery makes fire first with precision ammunition, in order to inflict maximum losses or literally physically eliminate the object. Generally, it is the 155 mm Excalibur shell, which Ukrainians very often fired from the Polish Krab howitzer, or the GMLRS rocket launched from the Himars launcher. This is followed by concentrated fire using conventional munitions, and may still be followed by surface fire using rocket artillery, for example. Generally, Ukrainian batteries change their SO within the next 20 minutes and become ready to carry out another combat task (Bolton, 2023; Greer 2023).

In a war of attrition, artillery becomes the primary, and sometimes even the only, tool of kinetic impact. Developed reconnaissance means constantly try to detect objects in the group of enemy that can be attacked. This disperses equipment and troops so that they do not become a valuable target for fire-centered rocket or barrel artillery. Artillery fire means themselves become a frequent object of destruction when ammunition is loaded, often even single cannons or launchers. Platoon or battery ammunition points can show up in the field at the sight of multitudinous track tracks going to one point, as guns and launchers in such intense combat have to load ammunition up to several times a day. As a result, both parties try to deliver ammunition in advance to the SO, from which the next task will be carried out, or to deliver it directly to the fire system hidden in the waiting position. In modern artillery, each fire means should therefore have its own dedicated ammunition truck, preferably adapted to load ammunition directly into the cannon (launcher) or at least palletized.

## Conclusions

The field artillery in Ukraine's defensive war is a key element of fire support. Its range of destruction and precision, mostly as a result of supplies of Western equipment to Ukraine, are greater than in previous armed conflicts. Some analyses prove that artillery in the first year of the war could have caused up to 90% of losses on both sides (Mertens et al., 2023). The effectiveness of artillery is mostly determined by the time of the fire reaction, i.e. the time from the detection of the target to its destruction. In this war, it happened that this time was shorter than one minute, which resulted in the lethal effectiveness of the fire (Mertens et al., 2023). Artillery is a serious threat to the opponent, when it has efficient reconnaissance, command and communications systems and logistical support.

One of the determinants of effectiveness is precision ammunition, increasingly used especially by Ukraine. Russia's massive artillery bombardments during the summer 2022 offensive in the Donbas failed to crush defenses of Ukraine. Even when command and control centers or logistic facilities were struck, the damage was minor and the facilities quickly recovered. In contrast, HIMARS, which fires GPS-guided rockets at distances of up to 70 km, has repeatedly and permanently eliminated Russian ammunition depots, command posts and key bridges. Ukraine could carry out attacks from a safe distance, avoiding a Russian counterattack. There is no doubt that NATO armies should develop their arsenals of precision-guided munitions, bearing in mind, however, that it should have alternative manners of targeting, e.g. using GPS and the inertial navigation system simultaneously. Indeed, in this war, both armies sought to disrupt satellite navigation systems, preventing guided missiles from accurately hitting their targets. The Excalibur "shells" and GMLR rockets are very advanced, and yet they may have been "blinded" by Russian EW measures. Nevertheless, even in the event of disruption of GPS, the inertial navigation system still allowed for obtaining satisfactory precision. The author believes that, due to the nature of the modern battlefield, it is not worth investing in laser-guided artillery shells, as their use requires a lot of coordination efforts and is dangerous for target-identifying forward observers, who can easily be detected and destroyed.

In this conflict, artillery performs many tasks based on imagery intelligence conducted with the use of UAVs. Equipping all artillery gun modules with this equipment is a necessity. In the Missile Forces and Artillery of the Armed Forces of the Republic of Poland, there are still no UAVs in the

Direct Fire Support Field Artillery Battalions that have only visual recognition.

The Ukrainians, compensating for the lower amount of artillery, used tanks that were not involved in combat operations for indirect fire (Mertens et al., 2023). Such a manner of the use of tanks is also envisaged in the Polish Army, however, the training of tank crews in this task has been significantly neglected in recent years.

When the conflict turns into a war of attrition, which, given the difference in potentials, favors the Russian Federation in this war, artillery, in particular, becomes for Russia the center of gravity and the primary multiplier of the combat potential of the armed forces involved in Ukraine. For this reason, the Ukrainians must aim to overpower the Russian fire support system (even if only locally) and gain their own fire superiority. This is crucial for the Ukrainian army to break the repeated cycles of war of attrition and to maintain freedom of action and the ability to maintain logistical support of troops at an acceptable level. The assistance of the West supplying Ukraine with artillery firefinder radars, UAVs, strike drones and artillery precision munitions is essential in this case. The Ukrainian army must also increase its capabilities in electronic warfare (EW) and countering reconnaissance and strike UAVs, which will increase the freedom of operation of its own artillery. The conclusion for the Missile Forces and Artillery of the Armed Forces of the Republic of Poland and other NATO armies is that a simple module created by an artillery firefinder radar and an artillery battery is no longer sufficient to combat artillery. It is necessary to build capabilities including multi-measure reconnaissance, efficient command and destruction, above all precise, regarding not only artillery, but also the use of strike drones.

Without any doubt, artillery holds immense importance for both sides in this conflict. Ukraine will probably not be able to match the artillery potential of the Russian Armed Forces, so it must take unconventional steps to limit its combat capabilities. And this is how combating its logistics has become one of them. This has been the case since the summer of 2022, when its artillery began receiving deliveries of heavy equipment from the West and acquire precise deep-strike capability. With Western support, the Ukrainian artillery is transforming, becoming a type of army capable of shaping operations, abandoning the conduct of massed and surface fire in favor of deep-strike and precise shelling to eliminate key enemy targets.

Russia's use of artillery, despite its effectiveness and deadliness, still relies, to a large extent, on massed surface fire and shows that the army is



still in a state of transition and is not yet a state-of-the-art combat force. The Russians still have a long way to go in terms of doctrinal transformation and modernization, which they have experimentally started in recent years and intended to implement on a large scale. Although battalion tactical groups (BTGs) formally possess organic artillery, primarily mortars and a number of self-propelled or towed howitzers, the majority of sub-units had incomplete artillery armament, often not upgraded to the latest versions. Most of the brigade and division commanders, who formed artillery groups at their level, did not want to assign it to lower ranks, keeping it for the implementation of deep fire and general fire support. As a consequence, there was a lack of artillery implementing coordinated close supporting fire. This problem was exacerbated by, among other things, equipment losses incurred early in the conflict, which meant that Russian artillery operated largely independently of – rather than in close support of – maneuvering elements, carrying out fire tasks with extended fire response times (Watling, Reynolds, 2022).

In this war, it became apparent that proper preparation and planning of artillery operations, as well as the efficient command of artillery during combat, could seriously reduce the material advantage of the enemy. Russian artillery has traditionally been considered a very formidable adversary, as it is extremely numerous in the ground troops of the armed forces of the Russian Federation and doctrinally constitutes the most important component of fire support, yet despite this, it has failed to achieve fire dominance over the numerically weaker Ukrainian artillery. The Ukrainians use their systems purposefully and efficiently, better coordinated with the operational objectives, which has a stronger impact on achieving success, or at least preserving the viability of supported units on the battlefield. Certainly, Western support proved crucial here, first in post-Soviet munitions and later in Western firepower and munitions, but it is the innovative command of artillery by the Ukrainians that largely contributes to the fact that the armed forces of the Russian Federation are at times powerless in the face of Ukrainian resistance and have still failed to achieve operational and strategic objectives in this conflict.

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## Artyleria w wojnie obronnej Ukrainy 2022-2023

### Część II. Sposoby realizacji zadań

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#### STRESZCZENIE

Artykuł jest kontynuacją rozważań dotyczących użycia artylerii w wojnie obronnej Ukrainy w okresie od 24 lutego 2022 r. do letniej ofensywy wojsk ukraińskich w 2023 r. Artyleria w tym konflikcie zbrojnym jest wykorzystywana przez obydwie strony z dużą intensywnością i stanowi zasadniczy środek wsparcia ogniowego, często decydujący o powodzeniu realizowanych operacji. Celem drugiej części artykułu jest zaprezentowanie sposobów wykorzystania jednostek artylerii w wybranych operacjach wojny ukraińskiej. Tak jak poprzednio przedmiotem badań są wojska raketowe i artyleria stron walczących, ale w tym przypadku przede wszystkim sposób realizacji przez nie zadań. Autor w swoich dociekaniach pragnie odpowiedzieć na następujące pytania problemowe: W jaki sposób jednostki artylerii obydwu zaangażowanych w konflikcie stron realizowały zadania bojowe w wybranych fazach wojny? Jakie wnioski z tego płyną dla zwiększających obecnie swój potencjał, zwłaszcza artyleryjski, Sił Zbrojnych Rzeczypospolitej Polskiej, a także innych armii NATO? Dokonaną analizę naukową Autor, z wykształcenia oficer artylerii, będący obecnie wojskowym nauczycielem akademickim i zajmujący się naukowo problematyką bezpieczeństwa militarnego państwa, oparł w dużej mierze na własnym dorobku naukowym i wnioskach zdobytych podczas udziału w ćwiczeniach wojskowych, rozmowach i warsztatach przeprowadzonych z oficerami ukraińskimi przed wybuchem wojny, a także na najnowszych opracowaniach naukowych i relacjach z przebiegu działań wojennych.

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**SŁOWA KLUCZOWE** wojna obronna Ukrainy, wsparcie ogniowe, artyleria, taktyka artylerii


#### Biographical note

**Norbert Świętochowski** – Colonel (Reserve), Ph.D., Eng., professor at the Military University of Land Forces. A graduate of the Higher School of Missile and Artillery Forces in Toruń (1994), Nicolaus Copernicus University in Toruń (2002) and The National Defence University

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#### **Author contributions**

The author contributed to the interpretation of results and writing of the paper. The author read and approved the final manuscript.

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#### **Ethical statement**

The research complies with all national and international ethical requirements.