Scientific Journal of the Military University of Land Forces
ISSN: 2544-7122 (print), 2545-0719 (online)
2023, Volume 55, Number 4(210), Pages 341-358
DOI: 10.5604/01.3001.0054.1631

Field Artillery in the defensive war of Ukraine 2022-2023
Part I. Combat potential, tasks and tactics

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INFORMATION

Article history:

Submitted: 27 July 2022

Accepted: 14 November 2023

Published: 30 December 2023

ABSTRACT

On 24 February 2022, the Russian Federation carried out an unlawful armed aggression against Ukraine, starting the largest armed conflict in Europe since World War II. In the course of hostilities, both sides deployed missile troops and artillery, which became essential means of fire support for ground troops due to restrictions in the use of air force and army aviaton. The aim of the article is to present the potential, tasks and tactics of the field artillery used in the Ukrainian war in the years 2022-2023. The subject of research is missile troops and artillery of the combatants. Primarily their organisation, armament, tasks and tactical assumptions. The author formulated the following questions: What was the combat potential of the warring parties' artillery at the beginning and during the conflict? What tasks are set for the artillery in the ongoing war? What tactics are used by the artillery of the warring parties in response to changing conditions during the war? The author, as a long-term theoretician and practitioner of field artillery, based the analyses made largely on his own observations and conclusions, which he formulated during many years of scientific research and participation in military exercises involving artillery, interviews with Ukrainian officers, as well as the latest studies and documents issued by opinion-forming research centres.
This study is the first part of the work which presents the combat potential, tasks and tactics of the artillery of Ukraine and the Russian Federation. In the second part the use of the artillery in individual phases of the war and the changes that occurred as a result of the combat experience obtained will be presented.

KEYWORDS

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

Introduction

On 24 February 2022, the Russian armed forces invaded Ukraine, starting an armed conflict in Europe on a scale not seen since World War II. Although Putin's propaganda referred to the attack as a special operation, it quickly became clear that it was a conventional war, unlawfully started by the Russian Federation. Russian troops launched offensive operations in four operational directions, namely north (towards Kiev), east (with the intent to seize Kharkiv), south-east (in order to seize Donbas and the land connection with Crimea) and south (in order to seize Odessa). A majority of military specialists, especially Western ones, predicted a quick victory of the Russians, but it turned out that the Ukrainian army had accomplished huge development since 2014, consistently preparing for a war with its invasive neighbour and managed to stop the aggressor's attack in virtually all directions, being even able to launch a counteroffensive over time.

Intensive use of field artillery in an ongoing conventional war is not a surprise for military analysts. Analysing the combat operations conducted in Donbas since 2014, it could have been assumed that field artillery might play an important role in a hypothetical armed conflict of high combat intensity, provided that it had at its disposal not only effective firepower assets and ammunition, but above all an efficient ISTAR reconnaissance system (Intelligence, Surveillance, Target Acquisition, and Reconnaissance) as well as a fire command and control system [1]. These assumptions were largely confirmed in Ukraine's ongoing defensive war against the aggression of the Russian Federation.

This article is the first part of the discussion on the use of field artillery in the Ukrainian war of 2022-2023. The aim of the paper is to describe the potential, tasks and tactics of the artillery deployed in the full-scale armed aggression of the Russian Federation against Ukraine. The subject of research in these deliberations is therefore the missile troops and the artillery engaged in the combat by both sides, above all their organisation, armament, tasks and tactics.

In their first part, the author assumed that the field artillery of the armed forces used in the war constitutes one of the military branches determining the success of a military operation, yet right since the beginning of the conflict the armed forces of the Russian Federation have retained a huge advantage in terms of combat potential. Initially, both sides were equipped only with post-Soviet or Russian equipment, but with the prolongation of warfare Ukraine received support from the West in the form of modern artillery equipment, ammunition as well as reconnaissance systems. This allowed the Ukrainian army to reduce the superiority of the Russian artillery to some

extent and to shape operations by long-range fire striking elements of the command system (C2) as well as logistic support (ammunition and fuel depots, communication hubs, etc.).

The assumptions formulated above necessitate answers to several fundamental problem questions: What was the combat potential of the warring parties' artillery at the beginning and during the conflict? What tasks are set for the artillery in the ongoing war? What tactics are used by the artillery of the warring parties in response to changing conditions during the war?

The author, as a long-term theoretician and practitioner of field artillery, based his detailed analysis data largely on his own observations and conclusions, but also on the latest studies and documents issued by opinion-forming research centres. In order to present the organisation, composition and potential of the artillery of Ukraine and the Russian Federation, the latest data contained in the yearly journal "The Military Balance", which showed in great detail the current inventory status and type of artillery equipment possessed by the combatants involved in February 2022, was used [2]. The current course and character of the conflict was presented on the basis of the latest analyses made, among others, by J. Watling and N. Reynolds in a study entitled *Meatgrinder: Russian Tactics in the Second Year of Its Invasion of Ukraine* [3] and N. Lange in a work entitled *How to beat Russia. What armed forces in NATO should learn from Ukraine's homeland defence* [4]. In the studies presented a lot of attention is paid to the artillery both as a military branch inflicting the greatest losses on the enemy and allowing to gain tactical, and even operational, advantage. Among the Polish authors, it is worth mentioning J. Bartosiak, who tries to present and interpret the course of warfare on an ongoing basis, also devoting a lot of space to artillery [5]. Detailed information on the organisation and equipment of the artillery of Ukraine's armed forces was presented in the latest study by T. Lisiecki and L. Szostek entitled *Wojska rakietowe i artyleria sił zbrojnych Ukrainy 1991-2023* (*Rocket troops and artillery of the Armed Forces of Ukraine 1991-2023*) [6].

In his scientific inquiries the author of this study devoted a lot of effort to present the evolution of the organisation, equipment and ways of using Russian field artillery in armed conflicts preceding the war in Ukraine and presented their results in scientific articles and monographs [7-10]. He also participated in many staff and field exercises in which artillery was used as part of coalition operations, which allowed him to obtain a lot of valuable information about combat capabilities and ways of executing tasks by the artillery units of NATO countries as part of full-scale military operations. The author has visited Ukraine several times, he has been acquainted with the training

system, organisation and equipment of the Ukrainian artillery. He also had an opportunity to familiarise himself with the experience gained by the artillerymen during the warfare in Donbas after 2014.

1. Combat potential of the warring parties' artillery

Just before the Russian aggression, the Ukrainian armed forces numbered 196,600 soldiers, including 125,600 in the ground troops. From 2014, immediately after the Russian annexation of Crimea, Ukraine focused on expanding the potential of the army, including the Missile Troops and Artillery (MTaA). Five new Field Artillery Brigades (FAB) and several independent field artillery regiments (FAR) were organised in the land forces. In addition, the 19th Tactical Missile Brigade (TMB) was enlarged by two Toczka-U squadrons. The Ukrainian navy, in turn, received a new FAB and a few FARs. All general army brigades in the land forces, as well as naval infantry brigades, received organic artillery groups of the power of one to several artillery battalions. By 2019, the total number of field artillery battalions in the Ukrainian army had doubled in relation to 2014 [11].

In February 2022, the MTaA of Ukraine consisted of ten FAB and one FAR, while the navy had one FAB and one FAR. The equipment of the Ukrainian artillery consisted of 1,176 guns, including 742 pieces of 152 mm calibre, 421 pieces of 122 mm calibre and 13 pieces of 203 mm calibre. Tremendous firepower was supplied by rocket artillery systems in the calibres of 122, 220, and 300 mm, numbering in total 1,680 units, many of which were kept in depots. In addition, MTaA had 40 Toczka-U tactical missile systems [11].

The number of individual firepower assets in the Ukrainian army at the beginning of the Russian invasion was as follows: 122 mm self-propelled howitzer 2S1 Gvozdika – 292 units; 152 mm self-propelled howitzer 2S3 Akatsiya – 249 units; 152 mm self-propelled howitzer 2S5 Giatsint-S – 18 units; 152 mm self-propelled howitzer 2S19 Msta-S – 35 units; 203 mm self-propelled howitzer 2S7 Pion – over 90 units (mostly stockpiled); 122 mm towed howitzer D-30 – 75 units; 152 mm towed howitzer 2A36 Giatsint-B – 180 units; 152 mm towed howitzer 2A65 Msta B – 130 units and over 130 units – 122 mm towed howitzer D-20. The rocket artillery had 185 units at its disposal. 122 mm BM-21 Grad Launchers 70 units Uragan 220 mm BM-22 Launchers 81 units 300 mm of the Smerch rocket launcher and a fair amount of firepower assets remaining in the reserve [2].

In February 2022, the Armed Forces of the Russian Federation numbered about 900,000 soldiers, while a total of about 200,000 soldiers were involved in the so-called special operation. The Russian field artillery had at its disposal about 5,000 pieces of various artillery firepower assets, including self-propelled artillery – nearly 2,000 units, towed cannons – 150 pieces, rocket artillery – over 1000 units, mortars – over 1000 pieces, tactical and operational rocket launchers – 150 units [2].

The number of the most crucial fire means in the Russian artillery was as follows: 122 mm self-propelled howitzer 2S1 Gvozdika – 150 units; 152 mm self-propelled howitzer 2S3 Akatsiya – 800 units; 152 mm self-propelled howitzer 2S5 Giatsint-S –100 units; 152 mm self-propelled howitzer 2S19 Msta-S – 500 units and 2S19 Msta-SM – 350 units; 203 mm self-propelled howitzer 2S7 Pion – 60 units; 152 mm towed howitzer 2A65 Msta B – 150 pieces. The rocket artillery had, among others, 550 units of 122 mm BM-21 Grad Launchers, 200 units of Uragan 220 mm BM-22 Launchers and 100 units of 300 mm of the Smerch rocket launcher. Missile artillery also includes 220 mm TOS 1A systems, firing thermobaric missiles, of which the Russians may have had, according to various sources, about 45 units [2, 12]. We should add 150 Iskander tactical-operational rocket launchers to the above-mentioned [2].

The most important aspect in the case of Russia, however, is that the figures presented relate only to systems in frontline service. The actual quantity of artillery equipment in Russia is much larger, as there could have been up to 20,000 pieces of artillery firepower assets of all types stockpiled in the depots. This equipment serves as replenishment of the losses incurred during the fights, which, although they seem to be high, do not significantly affect the potential of Russian artillery owing to its capability of supplementing them. And so, by July 2023, the Russians had lost about 500 artillery firepower assets, i.e., 10 percent of the active equipment from the beginning of the invasion, and a small percentage of the equipment generally available in Russia [13]. The number of individual firepower assets lost is as follows: 122 mm 2A18 D-30 – 56 pcs; 152 mm 2A36 Giatsint B – 36 units; 152 mm 2A65 Msta-B – 95 units; 122 mm 2S1 Gvozdika – 60 units; 152 mm 2S3 Akatsiya – 199 units; 152 mm 2S5 Akatsiya-S – 26 units; 152 mm 2S19 Msta – 131 units; 203 mm 2S7 Pion – 7 units; 122 mm BM-21 Grad – 135 units; 122 mm Tornado G – 16 units; 220 mm BM-21 Uragan – 59 units; 300 mm BM-30 Smerch – 1 unit, and other artillery assets not listed here [14].

The effectiveness of artillery fire systems is determined by the ammunition available for them. In February 2022, the Ukrainian Armed Forces had at its disposal ammunition for about six weeks of intense fighting. Due to the

Russian sabotage, many ammunition depots were blown up between 2014 and 2018, and it is estimated that as a result, the Ukrainian army lost more than 210,000 tons of ammunition, mostly for 152 mm cannons and 122 mm artillery rocket launchers. For comparison, during five years of fighting in Donbas, the Ukrainian army used a total of about 70,000 tons of artillery ammunition [11]. After only a few months of the war, Ukrainians began to suffer a considerable shortage of artillery ammunition for post-Soviet equipment and began to acquire it from the countries of the former Eastern Bloc, which still had a large stockpile of 122 and 152 mm projectiles. Over time, however, their stockpiles ran dry, and Ukrainian artillery, along with supplies of Western fire means, became entirely dependent on supplies of Western ammunition, mainly 155 mm, cannon ammunition, and 227 mm rocket ammunition [15].

At the beginning of the war, the Russian artillery had at its disposal massive stocks of 122, 152, and 203 mm cannon ammunition as well as 122, 220, and 300 mm rocket ammunition. Part of the missiles and projectiles most likely dated back to the times of the Soviet Union, which did not hinder their use during combat. During the most intense fights in 2022, the Russians could have expended up to 20,000-40,000 projectiles and missiles a day, but as their stockpiles were beginning to run low and with insufficient efficiency of domestic industry, this superpower was forced to purchase ammunition overseas, including even North Korea, Egypt, and Iran, which were former customers of Russia [16] and reduce frontline consumption of artillery ammunition. Ukrainian attacks with GMLRS missiles on field ammunition depots as soon as these weapons were obtained from the US also contributed to ammunition problems. It is estimated that in 2022 the Russians used a total of 12 million artillery projectiles and missiles, while judging by the current lower daily ammunition consumption, they will probably use 7 million pieces in 2023. The Russian Federation is capable of producing about 2.5 million missiles per year, although these capabilities may be increased with the protracted war [16].

The type of ammunition is also an important issue affecting the capabilities of artillery. The Ukrainians had primarily unguided high-explosive shells and projectiles at their disposal for both barrel and rocket artillery. Their lack of precision ammunition as well as cluster munitions was acutely felt, which could have been particularly useful to stop the summer offensive of the Russians in 2022. On the other hand, the Russians had a number of 152 mm Krasnopol precision missiles, as well as at least two types of cluster missiles for the 122 mm BM21 launcher, i.e., 9M217 and 9M218 [8] missiles. Thus, in addition to the advantage in firepower, the Russians also had a greater potential in artillery ammunition.

While preparing for the Russian invasion, the Ukrainians also tried to modernize and provide supplementary equipment for their armed forces, including, of course, the MTaA. After 2015, all artillery battalions began to receive unmanned aerial vehicles (UAVs) such as Furia, Leleka, PD-1, and others, which significantly improved their reconnaissance capabilities. The AN/TPQ-36 field artillery radar stations acquired from the US improved the capabilities of counter-battery fire, especially by rocket artillery battalions. The Kropyva (Nettles) fire command and control system, a program provided by a non-profit organization (Army SOS), made it possible to automate the process of determining settings and sending commands to fire measures from the single level of the cannon to the artillery division [17]. It is estimated that the system allows for reducing the time needed by an artillery unit to become emplaced from the transport mode into a combat group and achieve fire readiness by as much as 80%. It has reduced the time needed to determine the target settings for firing at an unplanned target by two thirds, and it has reduced the time needed to prepare and execute a counter-battery barrage by as much as 90% [11].

Since the beginning of the conflict, the Russians have deployed a very good artillery reconnaissance system. Modernized artillery radar stations Zoopark and Rys allowed them to detect and combat actively firing Ukrainian artillery. Many types of UAVs cooperating with artillery provided capabilities for precise and deep delivery of fire as well as determining the effects of strikes. Since the beginning of the aggression, Russia has had a huge numerical superiority in artillery firepower assets, as it continued to use equipment manufactured back in the days of the Soviet Union. Many pieces of older equipment have been modernised and equipped with modern fire control systems. The firepower superiority of the Russian army was particularly conspicuous in the possibility of carrying out long-range delivery of fire. Moreover, Russia had enormous capabilities to provide air support and electronic warfare, which further hampered the capacity of the Ukrainian fire support [15].

During the war, Ukrainian field artillery received significant support in the form of artillery equipment and ammunition from Western countries, including Poland. By using a wide range of artillery systems on the battlefield, Ukrainian artillerymen gained more experience in their use than their parent armies. Today, it can be concluded that, for example, the German PzH 2000 self-propelled howitzers are very well-armoured, resistant to enemy fire, but therefore very heavy, and the daily fire rate is insufficient; the barrels heat up quickly and wear out. The Polish Krab howitzer, similar to them, is very effective when firing Excalibur missiles, but, like its German counterpart, its ability to conduct prolonged rapid fire is also too low. The French Caesar is lighter

and more mobile system, equipped with an excellent fire control allowing for the fire and manoeuvre tactics, while the American M-777 towed field guns are light and can be easily towed by pickup trucks, having a considerable range and precision of fire. The Ukrainians emphasize that there are still serious differences in charges and ammunition in various NATO systems, which hampers their training and logistical support [4]. The equipment of the Ukrainians with American HIMARS rocket artillery systems turned out to be the decisive factor. The range of this system with 227 mm GMLR missiles is up to 80 km and allows them to strike key logistic elements of the Russian army [18].

When comparing the artillery potential of the armed forces of the Russian Federation and Ukraine, it should be emphasised that the former held a several-fold superiority in the number of firepower assets, had a huge stock of ammunition, including precision and cluster ammunition, and had an efficient reconnaissance system and an effective command system. The Ukrainian army, in turn, was forced to use their artillery potential sparingly. After several weeks of fighting, they had practically no domestically produced ammunition and became dependent on Western supplies. They were equipped with radar stations and unmanned aerial vehicles (UAVs), which significantly improved their reconnaissance system and adopted innovative command and fire control systems, which made the MTaA of Ukraine a formidable opponent for the Russians. Above all, however, Western long-range fire systems such as HIMARS, PzH 2000, Krab and Caesar, as well as the Ukrainian 155 mm self-propelled howitzer-cannon Bohdana, which has just been put into service, have largely eliminated the Russians' firepower advantage.

2. Artillery tasks in the Ukrainian conflict

In both Russian and Ukrainian military doctrine, artillery is considered the basic type of land forces, occurring organically in battalions, brigades and divisions, as well as forming independent Field Artillery Brigades (FAB) and Artillery Regiments (FAR) subordinated to the command of a corps or army. In the ongoing war, artillery is the primary and most accessible means of fire support for both sides, although to a slightly greater extent for the Ukrainian army, which has lower capabilities to implement air support. This military branch inflicts the greatest losses on the enemy, especially during periods of trench warfare, influencing combat tactics. Firepower superiority over a specific section of the front is the key to achieving operational goals, especially during the offensive, significantly limiting the opposing side's freedom of action.

According to the Russian doctrine, field artillery performs two basic tasks, i.e., direct fire support, supporting fighting troops with close fire, and general fire support, implemented in the form of deep long-range strikes at the enemy's facilities, which are essential for maintaining their combat capability.

Both sides are trying to eliminate the enemy's facilities which have a direct and indirect impact on conducting combat. During the offensive, the main task of field artillery is to clear the way for the attacking troops with fire, protect them against enemy fire, create gaps in the enemy group, destroy approaching reserves, suppress defence positions and create conditions for the introduction of another echelon and the development of the assault in the enemy's operational zone. On the other hand, its main tasks in defence include destroying troops in concentration areas before the attack and directly in front of the defending troops, as well as creating favourable conditions for a counterattack [10].

In the Ukrainian war, the belligerents use field artillery for deep long-range artillery strikes in order to defeat targets important for conducting operations, such as command posts, communication systems, routes of approach, areas of troop concentration, military bases, ammunition depots, fuel depots and other important logistic installations. Artillery can also hit military airfields (as long as they are within its range) and the planes, helicopters and air defence units located there. In addition, artillery delivers scatter-able mines.

A separate task is to combat the enemy's field artillery as part of the so-called counter-battery fire. For this task, it is necessary to create reconnaissance and combat modules connected by an efficient command and fire control system. Both sides are trying to improve their capabilities for executing this task during the conflict – the Russian side by engaging an increasing number of reconnaissance UAVs and improving the use of their Zoopark and Rys artillery radar stations – and the Ukrainian side by acquiring radar stations from the West (e.g., AN/TPQ-36) and increasing the range and precision of fire (Excalibur and GMLRS missiles).

An important tactical task of field artillery is to limit the opponent's freedom of operation. With the increase in the range of artillery fire, both sides are forced to move objects such as logistics facilities, warehouses and ammunition depots, army recruitment and training bases, higher-level command posts and many other one deeper into their formation, which negatively affects the command process, speed and accuracy of decisions made, as well as logistic support for troops.

Firing missions performed by the artillery of both sides include strikes against single targets, concentrated fire, subsequent concentrations of fire,

suppressive fire (fixed and mobile, single and double) as well as a barrage. The destruction of a target occurs after eliminating 70-90 percent of its combat potential, while incapacitation – 30 percent [19].

The tasks of field artillery in the Ukrainian war do not differ from the doctrinal assumptions of both the armed forces of the Russian Federation and Ukraine. Artillery is primarily intended to create conditions for troops to perform combat tasks and inflict as many losses as possible on the enemy, reducing their potential and limiting their freedom of action. It may be surprising for outside observers that Ukrainian artillery often devotes a lot of effort to strike individual armoured targets with unguided howitzer or cannon projectiles, which can be seen in the media reports from the battlefield. In NATO doctrine, such firing is unprofitable because the probability of destroying, for example, a tank with high-explosive ammunition fired by indirect fire is very low. However, it is possible that these are just propaganda messages aimed at raising the morale of the troops and society.

3. Field Artillery tactics

The field artillery of both belligerents is organized into brigades, regiments, battalions, batteries and platoons. The basic fire module is a field artillery battalion, although it can assign batteries to frontline infantry companies and battalions. In such a case, a field artillery battery forms an independent fire module, consisting of command, reconnaissance and fire subsystems. In the Ukrainian artillery, which already has a large quantity of Western equipment, there is a tendency to disperse artillery units and use them as single artillery pieces (HIMARS launchers), pairs of artillery pieces (HIMARS launchers) or platoons. This is possible thanks to the long range of fire of this equipment and the equipment of firepower assets with land or satellite navigation systems, as well as computerised fire command and control systems.

The field artillery of both sides is deployed within the formation of its own troops, depending on the tasks assigned as well as the combat capabilities of the equipment, especially the fire range. Mortars are deployed closest to the front line (1.5 km from the front of one's own troops), then brigade artillery groups (up to 8 km) and the general support artillery with the longest range (10-15 km) is deployed the furthest from the frontline. Of course, these distances may vary, especially since both sides often move artillery forward to increase its real range of fire. The Ukrainians observed that the Russians

sometimes deploy firepower assets far from the front edge of their troops, at a depth of about one-third of their maximum range of fire [20].

On the offensive, field artillery is deployed at the minimum possible distance from the front edge of the troops. This is conditioned by several factors, including, above all, the need to increase the effective range of fire and ammunition savings because for targets not requiring observation and located closer the standards of ammunition consumption are reduced. However, the most important factor is the increased possibility of ensuring the continuity of fire support, because artillery situated closer to the enemy performs manoeuvres between areas of fire stations less frequently, and thus has more time to perform fire support tasks. In defence, field artillery can be deployed deep within the formation of one's own troops, waiting for the enemy columns to approach and develop into an assault formation.

At firing positions (FP), guns (launchers) can be deployed in a linear and compact manner (most often this applies to towed guns, but in the case of Russian artillery this can be seen in self-propelled and rocket artillery batteries) or in a non-linear and dispersed manner, which makes it difficult to hit them with counterbattery fire. A battery of barrel artillery typically occupies a firing position measuring 300 by 100 meters with distances between firepower assets ranging from 20 to 40 meters. Rocket artillery launchers are most often deployed on FP linearly with intervals of up to 150 meters [20].

To increase the service life, artillery subunits perform a counter-fire manoeuvre, changing fire positions immediately after the completion of the fire mission. The Ukrainians also carry out counter-fire manoeuvres with towed artillery, which has not been seen in practice so far. Thus, each fire battery has pre-prepared spare firing positions to which it moves in the course of combat. Instead of counter-fire manoeuvres, the Russians sometimes leave firepower assets at firing positions, and their personnel are protected in pre-prepared shelters. The Ukrainians prepare up to 8-9 of such firing positions for one battery (platoon)[1].

Field artillery is in principle used in warfare in accordance with the doctrine adopted, although there are deficiencies in the coordination of the command and reconnaissance system (C4ISTAR) of the troops combatting fire units, which extends the fire response time. Unmanned aerial vehicles (UAVs) and electronic warfare (EW) play a considerable role in identifying artillery targets. For both sides, the prerequisite for gaining an advantage is fire superiority,

[1] In 2019, during a presentation of experiences from the Donbas conflict by invited Ukrainian commanders at the Military University of Land Forces, the author conducted an interview with a Ukrainian artillery division commander.

which can be achieved mainly as a result of the creation of strong artillery groups on a specific combat section as well as the use of innovative tactics. Artillery, thanks to the high precision of fire (the use of guided and seeking ammunition) and its increasing range (in the case of rocket artillery over 70 km) is an extremely effective combat tool, allowing for concluding operations to one's own advantage. The concept of possessing fire superiority in the Russian doctrine contrasts with the NATO doctrine, which assumes that the decisive factor for success on the battlefield is holding information advantage which allows one to make quick and accurate decisions, and thus achieve a faster pace of action than the opponent. However, the Russian-Ukrainian war shows that in the case of evenly matched armies, outmanoeuvring the enemy is extremely difficult, and the operations turn into a trench war, during which fire superiority is extremely important. Fire superiority, however, is not possible without an efficient command and reconnaissance system, and therefore also in this case information, especially regarding the location and nature of the enemy's military facilities, is extremely important.

The field artillery of the Armed Forces of the Russian Federation is usually formed into tactical artillery groups (TAG). They are created to concentrate the right number of firepower assets and achieve the maximum fire potential in the direction of operations. TAG can be formed at the level of a corps, division or brigade, less often a battalion. The size, composition and manner of command of the formed artillery group depends on the forces and manner of operation of the enemy. They usually consist of organic artillery of general military units engaged and artillery separated from the superior level. At the beginning of the war, the Russians allocated one to two barrel artillery batteries, and sometimes even one rocket artillery battery, to battalion tactical groups (BTG). In the summer of 2022, artillery was consolidated into the above-mentioned TAG [3].

During the analysed hostilities, there are also cases of allocating individual cannons, pairs of cannons or platoons from artillery batteries to combat units scattered across a large front, which perform fire missions assigned to a full battery according to instructions. The reason for this is the apparent lack of artillery in battalion and brigade tactical groups. Sometimes, however, these allocated firepower assets cooperate with UAVs in order to strike key Ukrainian facilities. Individual Russian cannons or launchers sometimes occupy mock firing positions, which are supplemented with equipment damaged or destroyed in order to confuse Ukrainian artillery and cause it to open fire. Russian rocket artillery denies the Ukrainians possibility to occupy areas and limits their manoeuvre on the battlefield by shelling the surface of a given

terrain. Howitzers and cannons, in turn, are used to destroy point targets and important, but limited in size, surface targets. In order to execute anti-battery fire, the Russians use groups of heavy artillery from the divisional level or even Toczka-U rockets. However, along with the decreasing stockpiles of missiles and rockets, counterbattery strikes against Ukrainian artillery began to be carried out increasingly often with the use of Lancet type loitering munitions [3].

As the Ukrainian artillerymen present it, Russian artillery cooperating with UAVs is capable of performing a precise fire mission within 3 to 5 minutes of detecting a target, however, with the use of EW or radar stations, this time is extended to about 30 minutes, and the fire is no longer as precise. UAVs play such a large role in Russian artillery that the Ukrainians were forced to maintain light anti-aircraft assets in the areas of their artillery firing positions to deny drones the possibility to conduct reconnaissance [21]. Continuously improved Russian UAVs can fly longer at ever higher altitudes and be inaudible and invisible to the Ukrainian objects being reconnoitred, and when they cooperate with artillery batteries, they can carry out tasks in real-time, delivering fire and correcting effective fire, even against moving targets.

An important task for the field artillery of both sides is counter-battery fire. The Russians possess the capability of detecting operationally active Ukrainian artillery using artillery radar stations Zoopark and Rys, as well as silent artillery – using electronic warfare assets and UAVs. If the Russians manage to combine their firepower assets under the Akatsiya fire control system, they carry out the fight against Ukrainian artillery in a coordinated manner, and the fire missions are performed by undetected and previously not shelled artillery batteries. In the initial phase of the conflict, Ukrainians had fewer capabilities in this area, but after receiving radar stations from the US, they also became an increasingly dangerous opponent for Russian batteries. As a consequence, rocket and self-propelled artillery subunits of both sides are trying to carry out counter-fire manoeuvres when necessary, leaving cannons and launchers on firing positions (FP) for a longer period increasingly seldom. Engineering development of firing positions is rather not undertaken, except for carefully camouflage of howitzers and cannons with masking nets or any means at hand. The ammunition needed to carry out planned fire missions is usually placed nearby a FP.

Summing up the content regarding the tactics of field artillery of the armed forces of the Russian Federation and Ukraine, it should be emphasized that the party adapting faster to the conditions of the conflict is the Ukrainians. Knowing the enormous potential of Russian artillery, and especially its ability to implement counter-battery fire, they use their firepower assets in smaller

formations (platoon, pair, single firepower asset), dispersing them across the field so that they do not constitute a valuable and profitable fire target. They extensively implement equipment manoeuvre, and camouflage it perfectly, avoiding UAV reconnaissance. With the information support from NATO, the Ukrainians locate valuable assets deep within the enemy formation, which are crucial for maintaining their ability to operate, and then strike them with precision firepower. Meanwhile, the Russians largely continue to depend on concentrated firepower, typically preceding the assault of their troops with a barrage aimed at eliminating anything in their path. This tactic yielded certain results during the summer offensive in Donbas in 2022, with Ukrainians suffering substantial personnel and equipment losses under intense enemy fire. Yet, this approach led to the depletion of Russian ammunition stocks, and in 2023, they are unable to restore them to the same level as they were at the outset of the war. Both parties are highly proficient in counter-battery operations, often using reconnaissance UAVs and artillery radar stations. In order to perform counter-battery strikes, the Russians often employ combat drones, known for their superior precision compared to artillery.

Conclusions

Without any doubt, field artillery holds immense importance for both sides in the Ukrainian war. From the very beginning of the conflict, a significant disparity in the combat capabilities of the parties involved was evident. The Russian army held a substantial advantage in terms of equipment, personnel, and, above all, the quantity of artillery ammunition. In the midst of battle, the Russians were using dozens of thousands of projectiles and missiles daily, while the Ukrainians typically did not exceed several thousand. Ukraine could never equal the artillery potential of the Russian Armed Forces, which is why it had to make significant adjustments to its artillery tactics in response to the substantial threat posed by enemy firepower. The firepower was often used in a dispersed manner, with a strong emphasis on counter-battery manoeuvres and superb tactical and operational camouflage.

The Russians have suffered heavy losses in fire equipment, but they can easily replenish them from the huge resources of guns and launchers they still have in their depots. However, for Ukraine, which sustains fewer equipment losses, but ones being more acutely felt in percentage terms, the primary focus has shifted to sourcing equipment and firepower from Western nations. This has been the case since the summer of 2022, when its artillery began receiving

deliveries of heavy equipment. In the autumn of 2022, the Ukrainians had already amassed a diverse array of firepower assets, most often 155 mm howitzers and 227 mm rocket launchers. The challenge is that despite NATO's process of standardization in artillery ammunition, it is not always possible to use projectiles of the same calibre in artillery systems from various countries.

In the Ukrainian conflict, the tasks executed by artillery do not deviate from standard ones. As a fundamental firepower asset, its primary role involves establishing favourable conditions for the fighting troops through the execution of direct and complete fire support. In defence, its main focus is on striking the enemy in front of one's own forces, while on the offensive, it serves to incapacitate enemy resistance points, paving the way for advancing troops. Another critical task is to limit the enemy's operational freedom and influence the course of operations by destroying key targets deep within the adversary's formation, which are pivotal to their ability to continue the fight. Considerable effort is dedicated to countering the enemy's artillery batteries, using increasingly advanced reconnaissance tools and precision strike systems. Recently, Ukraine has gained a slight advantage in this area, by having access to precision missiles like Excalibur and GMLRS, whereas the Russians compensate for artillery shortages by using combat drones.

Both sides in this conflict display a degree of flexibility in their artillery tactics, trying to adjust them to the demands of the battlefield. However, there is an evident issue concerning the principle of force economy. Both Russians and Ukrainians tend to expend a significant quantity of ammunition for tasks that do not inflict substantial damage to the enemy. The Russian side frequently covers a large expanse of the battlefield with intense artillery fire, destroying buildings and infrastructure, yet without inflicting significant physical harm on the enemy. The Ukrainians, on the other hand, tend to focus on striking individual concealed or armoured targets, which are typically difficult to hit with indirect fire. This promotes the conclusion that when developing artillery capabilities in armed forces, it is advisable to invest in simulators equipped with suitable software for simulating the effectiveness of artillery ammunition when firing at various objects [22]. This will enable the development of the effective strike and fire control doctrine, thereby avoiding the execution of time-consuming and ineffective fire missions.

Field artillery will continue to be a fundamental element in shaping future battlefields for the foreseeable future. When planning its development, it is essential to bear in mind that the ability to deliver precision strikes through indirect fire depends not only on the artillery platforms and ammunition employed but also, perhaps primarily, on reconnaissance and command systems [23].

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Artyleria w wojnie obronnej Ukrainy 2022-2023
Część I. Potencjał bojowy, zadania i taktyka

STRESZCZENIE

24 lutego 2022 r. Federacja Rosyjska dokonała bezprawnej agresji zbrojnej na Ukrainę, rozpoczynając największy konflikt zbrojny w Europie od czasów II wojny światowej. Obydwie strony zaangażowały w wojnie wojska rakietowe i artylerię, które stały się zasadniczym środkiem wsparcia ogniowego wojsk lądowych z powodu ograniczeń w użyciu lotnictwa. Celem artykułu jest zaprezentowanie potencjału, zadań i taktyki artylerii wykorzystanej w wojnie ukraińskiej w latach 2022-2023. Przedmiotem badań są wojska rakietowe i artyleria stron walczących, a przede wszystkim ich organizacja, uzbrojenie, zadania i założenia taktyczne. Autor sformułował następujące pytania problemowe: Jaki był potencjał bojowy artylerii walczących stron na początku i w trakcie konfliktu? Jakie zadania stawiane są przed artylerią w toczonej wojnie? Jaka taktyka stosowana jest przez artylerię stron walczących w odpowiedzi na zmieniające się uwarunkowania w wojnie? Dokonane analizy Autor, jako wieloletni teoretyk i praktyk artylerii, oparł w dużej mierze na własnych obserwacjach i wnioskach, które sformułował podczas wieloletnich badań naukowych i udziale w ćwiczeniach wojskowych z artylerią, wywiadach przeprowadzonych z oficerami ukraińskimi a także najnowszych opracowaniach i dokumentach wydanych przez opiniotwórcze ośrodki badawcze.
Niniejsze opracowanie stanowi część pierwszą pracy, w której przedstawiono potencjał bojowy, zadania i taktykę artylerii Ukrainy i Federacji Rosyjskiej. W drugiej części zostanie zaprezentowany sposób wykorzystania

artylerii w poszczególnych fazach wojny i zmiany, jakie w niej zaszły w wyniku uzyskanych doświadczeń bojowych.

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

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Acknowledgement

No acknowledgement and potential funding was reported by the author.

Conflict of interests

The author declared no conflict of interests.

Author contributions

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

Ethical statement

The research complies with all national and international ethical requirements.