

ANALYSIS OF THE ROLE OF HIGH TECHNOLOGY IN THE RUSSIAN-UKRAINIAN WAR

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Summary. The article describes the factors that influenced the situation between the parties on the line of contact during the Russian-Ukrainian war, as well as the role of UAVs in the outcome of operations. It analyzes the use of high-tech weapons and the combat tactics they generated.

Additionally, the article reviews the types of troops and weapons most in demand, the causes of combat losses, the “gray zone” that emerged between the parties, and the combat episodes that occurred within this zone. It also discusses the advantages and tensions created by “Starlink” satellite communication.

Keywords: Russian-Ukrainian war, modern weapons, artificial intelligence, role of UAVs, Starlink satellite communications, ground robot

Introduction

When Russia started the war with Ukraine, it believed it could achieve its strategic goals within three days, or ten days if faced with resistance. Through years of information propaganda, Russia successfully convinced its society and allies of this expectation. On the first day of the war, Russian forces launched a large-scale offensive with a significant strike group from three directions, advancing toward Kyiv in the north and northeast. This constituted part of the “Lightning Fast” war plan. However, numerous factors were overlooked, leading to the withdrawal of Russian troops from Kyiv, Chernihiv, and Sumy regions after a month of combat. Russia did not meet its operational objectives within the planned timeframe, and since then, the war has continued with attrition tactics. As the conflict drags on, both sides face increasing combat losses, societal fatigue, and economic difficulties.

According to official data, the U.S. suffered 58,000 casualties during the twenty-year Vietnam War (1955-1975), the USSR lost 15,000 soldiers in the ten-year Afghanistan War (1979-1989), and Iran and Iraq incurred 188,000 and 250,000 losses, respectively, in the eight-year Iran-Iraq War (1980-1988). It is challenging to compare the combat losses of the ongoing Russian-Ukrainian War - now in its fourth year - with those of the aforementioned conflicts, as the Russian-Ukrainian War is evolving according to a different scenario influenced by modern weaponry and the dynamic nature of combat episodes. The 30,000 casualties suffered by Russia within one month of the war can be attributed to this unique scenario.

Several factors contribute to the war's prolongation, including the use of high-tech precision weaponry and multi-purpose UAVs. The initial “lightning-fast” phase of the war saw the Russian army employing conventional weapons based on traditional combat tactics. In preparation for the conflict, the Ukrainian army effectively shifted the battlefield dynamics by

employing Javelin and NLAW anti-tank guided missiles, as well as the Turkish-made Bayraktar TB2 UAVs.

During the second “exhaustive” phase of the war, the Russian army utilized all types of weaponry, except for nuclear arms, in an effort to achieve its strategic objectives. Meanwhile, the Ukrainian army received a steady supply of modern weapons from Western allies and developed its defense industry to produce ballistic missiles, advanced multi-purpose UAVs, missile drones, FPV drones, unmanned naval vehicles, ground robots, and more. This development has granted the Ukrainian forces a qualitative advantage over the numerically superior Russian forces, shaped by the diverse combat tactics these capabilities allow.

Throughout the war, Russia has procured various types of UAVs, artillery, missiles, and munitions from Belarus, Iran, North Korea, and China, while also increasing domestic UAV production with their assistance.

The application of cutting-edge technology and modern weapons during the Russo-Ukrainian War, along with their role and impact on the conflict's outcome, remain central to ongoing research and analysis.

The primary objective of this research is to analyze the features of high-tech precision weaponry and the evolving combat tactics in the Russian-Ukrainian War. The following tasks are set forth: to determine the capabilities of modern weapon models utilized by the Russian and Ukrainian armies during the conflict, assess their advantages and disadvantages, examine the roles of key troop types and weapon models, analyze their influence on emerging combat tactics, and evaluate the significance of other combat means affecting the course of the war.

Ultimately, this analysis of the Russian-Ukrainian War underscores the increasing demand for high technology, artificial intelligence, and modern weaponry, highlighting their significant role as primary means of warfare. In conclusion, it is evident that the combined use of combat vehicles, various UAVs, hypersonic ballistic missiles, missile drones, ground robots, and Starlink satellites within the arsenals of both nations significantly impacts operational outcomes and the combat tactics of modern warfare.

The methods of comparative analysis and a systematic approach were employed in the preparation of this article.

Main part

The war began with a large-scale attack by the Russian army on Ukrainian territory from three directions. The assault group, consisting mainly of armored combat vehicles, was able to advance in the planned directions deep into Ukrainian territory without encountering strong resistance. Later it turned out that this was a planned combat tactic planned in advance by the Ukrainian army. Forested areas and swamps, as well as arable land, which was not suitable for the movement of heavy combat vehicles due to melting snow, forced the formations and units of the Russian army to be tied to asphalt roads. The Ukrainian army skillfully used this situation and set up ambushes in convenient areas to destroy combat vehicles. At the entrances to settlements, in narrow passages, at road junctions and bridges, small mobile groups armed with anti-tank weapons of the “Javelin” and “NLAW” type were able to easily destroy the advancing combat vehicles in columns [1]. In the first three days of the war, the Ukrainian side began to officially distribute video footage of downed combat vehicles advancing in columns in the press. After that, Russia could not hide its numerous combat losses from the public and lost the information conflict.

The airborne units of the Russian army deployed in the vicinity of Kyiv, Hostomel, and other strategic directions were unable to merge with ground forces in a timely manner, resulting in significant losses. Due to a lack of support for the airborne troops, a substantial portion of

them was destroyed. Management issues and difficulties in supplying troops advancing over long distances and across a wide front, combined with the strong resistance from the Ukrainian army, disrupted the course of the “Lightning Fast” operation as planned by the Russian command. In March 2022, Russia was compelled to withdraw its forces from the Kyiv, Chernihiv, and Sumy regions. Consequently, the war transitioned from the initial “Lightning Fast” offensive phase to a new, prolonged “attrition” phase.

The “exhaustion” phase of the war, characterized by its dynamics and the efficient use of resources, has persisted for over four years with the strategy of “weakening the opposing side and prolonging the conflict.” Although the course of the war has changed significantly due to a variety of factors, the strategic goals and objectives have remained constant. Despite the heavy losses, destruction, and economic difficulties faced by both sides, the production of modern weapons, their testing in combat conditions, and their widespread application have not altered the situation on the front lines.

Despite the extensive use of high-precision weapons and UAVs, neither side has been able to achieve a clear advantage, rendering progress through negotiations impossible. The resolution of this long-term conflict, which is characterized by tension, exhaustion, and destruction, will likely depend on the weakening of one side's combat potential or on its economic collapse. It is important to note that Ukraine would not have been able to maintain such a resilient stand against Russia without Western support. Recognizing that Russia is unlikely to be satisfied with just Ukraine, the European Union allocated 90 billion euros to Ukraine on February 4, 2026, to sustain its war effort. This funding has facilitated the production of advanced, high-tech weaponry capable of influencing the course of the conflict and strengthening Ukraine's position against Russia.

During the war, the Russian army relied on its numerical superiority and traditional combat tactics, employing more frontal attacks. However, its inability to adapt to the evolving situation resulted in significant losses. In contrast, the Ukrainian army adopted a maneuverable defense strategy in response to Russian numerical superiority. This approach allowed Ukraine to maintain its positions at the front through rapid assaults by small, mobile groups and effective maneuvering of firepower. Capitalizing on favorable conditions, the Ukrainian forces successfully liberated large areas and settlements by launching counterattacks in the Kharkiv and Kherson directions, aided by the quick deployment of operational reserves deep into enemy defenses.

This situation persisted until the spring of the second year of the conflict. As the war dragged on, the artillery units of the Ukrainian army, reliant on Western supplies for combat equipment and munitions, began to face shortages of shells. The Russian army's firepower advantage became increasingly evident, with Ukrainian forces able to respond with only three shells for every twenty fired by the Russians. Eager to break through Ukrainian defenses and capture more territory, the Russian army pressed its advantage on the front lines.

Delays in Western supplies of ammunition further weakened Ukraine's defensive capabilities. Understanding that the Russian army lacked experience in urban warfare—a significant vulnerability—the Ukrainian command intentionally drew Russian forces into populated areas. The outcomes of the battles in Chechnya serve as a testament to this strategy. The battle for the city of Bakhmut lasted approximately six months, resulting in around 20,000 casualties for the Russian army. Nonetheless, the Russian forces were unable to capture Bakhmut, and, faced with ammunition shortages and a desire to prevent personnel losses, the Ukrainian army was compelled to withdraw systematically to better-prepared defensive

positions. Consequently, Ukraine lost strategically important settlements such as Bakhmut and Avdiivka after a prolonged defense.

By the middle of the third year of the war, artillery units maintained a fire damage advantage estimated at 50-60%. However, due to ongoing ammunition shortages, the Ukrainian army began employing FPV drones on the front lines alongside its artillery units to bolster defense stability and provide fire support. As the use of UAVs and missile drones for various purposes expanded, the Ukrainian army seized the initiative on the front lines, marking the start of a new phase in the “attrition” period of the war. Since that time, the advantage in fire damage has gradually shifted from traditional artillery to UAVs, with the latter now accounting for up to 60% of fire damage.

Ukraine has accelerated the production of cheap and easy-to-use FPV drones. By sourcing some parts of UAVs from the West, it has organized their assembly in basements, workshops, and homes with its own capabilities. By producing more than 2 million UAVs by 2024, Ukraine could increase its combat power in the fight against Russia and gain a significant advantage in the field of UAV deployment [5].

The Russian side was compelled to take significant steps toward the production of UAVs and the development of this area. It began to procure UAVs from allied countries while also producing them with their assistance. Upon deploying the Iranian-made “Shahed 136” strike drones into the strategic depths of Ukraine, the Ukrainian army initially faced significant challenges in countering these threats. Engaging more expensive missiles against relatively inexpensive drones was deemed impractical.

The introduction of the “Shahed 136” strike drones revealed vulnerabilities in Ukraine’s air defense systems and highlighted its unpreparedness to combat such UAVs effectively. Throughout the war, in addition to targeting military installations, strikes were conducted on energy infrastructure, water pumping stations, logistics centers, and elements of the military-industrial complex. Particularly during the winter, these actions heightened psychological pressure on the population and played a crucial role in shaping various combat tactics in response to the deployment of UAVs.

Considering the effectiveness of the deployment of the “Shahed 136” strike drone, its mass production began in Russia and this drone was named “Geran-2” (Figure 1). The use of the Geran-2, with a range of 1,400 km and a warhead weighing 50 kg, throughout the entire depth of Ukraine significantly affected the course of the war. The composition of the combined strike launched by Russia against Ukraine consists of ballistic and cruise missiles, strike drones and guided bombs. At a tactical depth of up to 10 km on the contact line, the Mayvik and X-2

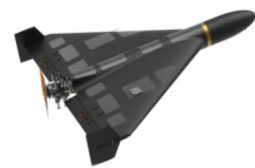


Figure 1.

Geran-2

quadcopter-type UAVs (Figure 2), the Slepens and PVX-1 FPV UAVs (Figure 3) are widely



used. The widespread use of UAVs by both sides on the contact line has greatly affected the combat activity of armored combat vehicles and artillery and limited their operational capabilities.

Figure 2. "Mayvik" and "X-2" quadcopters Figure 3. "Slepen" and "PVX-1" type FPV drones

Ukrainian-made strike UAVs of the "Lyutiy" and "Baber" types were able to be used at a strategic depth of up to 1,500 km, and the "Polyanitsa" missile drone at a strategic depth of up to 700 km (Figure 4).



Figure 4. "Lyutiy", "Baber" strike UAV and "Polyanitsa" missile drone

Ukraine's strikes on energy facilities, oil refineries, ammunition depots, factories producing military goods, as well as on communication and railway junctions and airports located deep within Russia, significantly weakened the combat potential and logistical capabilities of the Russian army. The production of the "Flamingo" ballistic missile by Ukraine and its deployment against targets situated at a depth of up to 3,000 km marked a significant turning point in the course of the war.

Currently, the front width of the contact line between the parties exceeds 1,000 km, and a "gray zone" has formed between the two sides, extending 15 km in each direction and 30 km deep along this contact line. In this zone, UAVs utilized by both parties dominate, and a defensive barrier against these drones has been established. The activities occurring within this area are crucial for the development of combat tactics.

Active combat operations are not conducted along the entire front line; rather, intense battles are taking place in strategically important directions. During an assault, only six mobile groups, each consisting of 12 to 20 personnel, operate within the "gray zone" in favorable conditions. The operations of these mobile groups in open areas are severely limited, as UAVs can easily detect their movements. Consequently, the groups can only advance in small teams of 3 to 4 individuals, making short leaps through forested areas, in foggy, drizzly, or rainy weather, as well as at night, utilizing the cover provided by small settlements to reposition and fortify themselves in suitable locations. These groups are predominantly supported by drones.

In a typical frontal assault, several battalions are utilized in the attack echelon, in line with traditional combat tactics. Currently, around six mobile groups are forming from the fighting units, although their activities are easily detected. For the first time since the onset of the war, in March 2026, the Russian army has been unable to seize any territory or positions, resulting in a stalemate on the front. Military experts aptly compare the pace of the Russian army's offensive with that of a "snail."

Despite the lack of significant changes or progress along the front, both parties continue to engage in warfare utilizing "attrition" tactics. This includes strikes on energy and logistics centers, oil refineries, and military production facilities at strategic depths using ballistic missiles, missile drones, and strike UAVs, all while maintaining pressure along the contact line.

Ukrainian forces have gained dominance in the Black Sea by using naval unmanned aerial vehicles and strike-type UAVs. Russian Black Sea Fleet warships have been restricted from accessing the open sea. On March 2, 2026, Ukrainian forces hit five Russian warships in the port of Novorossiysk. The hit ships included the Yeysk, Kasimov, and Valentin Pikul minesweepers [6]. In the Mediterranean, cargo ships carrying Russian oil and gas have been hit

by UAVs. Tensions between the parties have spread from the front line to the strategic depth of defense and to the countries of the region. The main forces and means of this confrontation are ballistic missiles, missile drones, UAVs deployed at the strategic, operational, and tactical levels, as well as FPV drones and quadcopters deployed on the front line. The course of the war and the outcome of operations on land are now determined more by what happens in the airspace. The blocking of Starlink satellite communications in Ukraine since February 5, 2026 has created serious problems within the Russian army, which has clearly manifested itself on the front lines [7]. The management and support of the units fighting on the contact line became more difficult, and some units were exposed to friendly fire. The units became alarmed by the situation and suspended their offensive operations for a certain period of time. The work of UAVs operating in the “gray zone” along the entire contact line became more difficult. It was not possible to detect targets in real time and control artillery fire. After the access to “Starlink” was blocked, the pace of the Russian army’s attack weakened. According to experts, the “Starlink” packet communication plays a crucial role in terms of real-time communication on the battlefield, control of UAVs, and synchronization of operations. The disruption of communication created serious difficulties in planning and executing the attack. After the access to “Starlink” was blocked, it became clear that the information and communication superiority on the front directly affected the course of the battles. Taking advantage of the alarm and favorable conditions that arose among the Russian army on the contact line, the Ukrainian army was able to counterattack in several directions. Taking advantage of this, the Ukrainian army launched a counterattack in the southern direction of the front and was able to liberate 201 km² of territory from occupation. This is the most successful counterattack since the operation in June 2023, and is equal to the 244 km² occupied by the Russian army in December 2025 [8].

The blocking of Starlink has forced not only the control of drones, but also the weakening of attacks on the logistics of the Ukrainian army. This is clearly felt by Russian units in the direction of the city of Pokrovsk.

The exhausting and destructive effects of the war are increasingly evident on both sides. This is reflected in the significant portion of budget expenditures being allocated to the war, set against the backdrop of a weakening economy. The expansion of sanctions against major players in the Russian oil and gas sector, including Rosneft, Gazprom, and Lukoil, alongside measures to prevent income from the “shadow fleet,” has led to a reduction in budget revenues. Additionally, the detention of ships transporting oil products in international waters and the strikes conducted by Ukrainian security forces against vessels of the “shadow fleet” in the Black Sea and Mediterranean are aimed at curbing these budgetary revenues.

The introduction of modern weapons in the Russian-Ukrainian war, which has now been ongoing for more than four years, necessitates a reevaluation of strategies for planning and conducting military operations, as well as a revision of military doctrine. At the outset of the conflict, the Russian army possessed 6 to 10 times more tanks, armored combat vehicles, artillery pieces, combat aircraft, and helicopters than the Ukrainian forces. Under these circumstances, Ukraine was required to repel Russian attacks along a wide front and compel the enemy to adopt defensive positions in unfavorable conditions.

Those who believed that the Russian army's numerical superiority and strength, fueled by exaggerated propaganda, would guarantee an easy victory found that this was not the case. Currently, in the context of modern warfare, those possessing qualitative rather than purely quantitative advantages—particularly technological ones—emerge as the more formidable opponents. A theoretical analysis of the balance of power between the two sides reveals that traditional notions of quantity and quality no longer align with the realities of contemporary

conflicts. The Ukrainian army, by waging an asymmetric war, effectively demonstrates this to the world, thereby dismantling the myth surrounding the Russian military.

The results achieved through the use of artificial intelligence in the development of modern weapons and their application in combat significantly surpass those obtained with conventional weapons. For instance, in the summer of 2025, a ground robot deployed by the Ukrainian army in a forested area along the front line near Kharkov, in coordination with UAVs, successfully repelled an attack by approximately one division of the Russian army. This event marked a historic milestone in military history, demonstrating the pivotal role of artificial intelligence and modern technology in tactical combat scenarios. At that time, as a result of the presence of ground robots on the battlefield, two soldiers surrendered to a robot, while reconnaissance UAVs directed them towards Ukrainian positions.

The dances performed by robots on the same stage as a dance group during the “New Year” celebrations in the People’s Republic of China on February 17, 2026 are very thought-provoking. The development of robots is developing in two directions: an independent brain equipped with motion control and artificial intelligence. The main goal here is a brilliant mind combined with a flexible body. These robots have been able to demonstrate skills and endurance in dynamic environments such as precise martial arts and running on stage. Currently, robots seem ready to replace living humans on the battlefield with their existing capabilities. It is not surprising that thousands of such ground robots will soon appear on the battlefield in synchrony with UAVs [10].

As the Russia-Ukraine war continues, the confrontation is evolving into a high-tech conflict. Military experts observe that UAVs have “filled” the skies over Ukraine, while unmanned naval vehicles have effectively paralyzed the Russian fleet in the Black Sea. The role of armed unmanned ground vehicles is also increasing throughout the course of the war. UAVs are likely to be employed not only for independent strike missions but also as part of a “UAV swarm” controlled by artificial intelligence.

The trajectory of warfare and the rapid advancement of technology indicate that we can expect increasingly intelligent and simultaneous attacks from UAVs and ground robots from multiple directions and elevations—air, land, and sea—on the battlefield. This approach suggests that a confrontation between Russian and Ukrainian robots on the battlefield is merely a matter of time.

Although conventional weapons predominated in the initial phase of the war, the course of the conflict changed significantly with the introduction of modern high-technology weaponry over time. The use of high-precision weapons and UAVs has resulted in increased accuracy of target engagement and combat losses, while the pace of attacks has, conversely, weakened. Currently, neither side on the front line can achieve a clear advantage and must settle for localized tactical gains.

A 30 km wide “gray zone” has emerged between the opposing sides along the front line, where the use of UAVs is predominant. In this zone, employing heavy combat equipment, artillery, and mortars, as well as deploying radio-electronic warfare (REW) and air defense systems, has become increasingly complicated due to survivability challenges. However, during adverse weather conditions such as heavy snow, rain, and fog—when UAV operations are unfeasible—and amid REW confrontations, the use of artillery and mortars remains preferred. Consequently, the depth of positions captured over the course of a month is, at best, limited to 3 km, reflecting heavy casualties sustained during these engagements.

Conclusion

The Russian-Ukrainian war, which began four years ago, has undergone significant transformations in its tactical landscape, particularly in the past two years. Initially rooted in conventional warfare, characterized by heavy reliance on traditional military assets such as rocket and artillery units, aircraft, and armored vehicles, the conflict evolved rapidly in response to mounting losses and logistical challenges, including ammunition shortages. Faced with these challenges, both sides adapted their strategies, beginning with the introduction of quadcopters for reconnaissance and targeting purposes. Over time, the capabilities of these unmanned aerial vehicles (UAVs) expanded, giving way to the widespread deployment of first-person view (FPV) drones, which offered enhanced situational awareness and precision in strikes. The war has been significantly influenced by technological advancements and Western military support, which have helped accelerate the development and production of modern weaponry. Specifically, the integration of high-precision weapons.

The widespread use of high-precision weapons and UAVs for various purposes necessitates the creation of a new type of troops, and this practice is spreading rapidly. In the armies of developed countries, attention is paid to the production of weapons models and the creation of types of troops that meet the requirements of modern wars.

In the course of the Russian-Ukrainian war, a massive and harmonious use of ground robots and UAVs for various purposes simultaneously from the air, land and sea is expected. In the 21st century, artificial intelligence has turned the confrontation between Russian and Ukrainian robots on the battlefield into a reality today.

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