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Combat Helicopters and Drones in the Russian–Ukrainian Conflict – Challenges and Transformations

Abstract

Combat helicopters, once a dominant force on the battlefield, are facing an existential crisis in the wake of the Ukraine war. Their vulnerability to advanced air defence systems and proliferation of cheap, effective drones has led to significant losses and a re-evaluation of their role in modern warfare. The article explores this changing landscape, detailing the historical significance of helicopters and the challenges they face in Ukraine. It analyses the rise of drones and their growing importance in modern conflicts. Finally, the article discusses the future of helicopter warfare, potential adaptations, and the ethical and strategic considerations surrounding drone technology.

Keywords: combat helicopters, drones (UAVs), Ukraine war, air defence systems, future of warfare, strategical implications, ethical considerations

Introduction

Combat helicopters have played a key role in warfare for several decades, and their capabilities were tested in various armed conflicts. These assets are capable of providing direct air support to ground troops, performing reconnaissance and surveillance missions and conducting attacks against enemy targets. However, in recent years, they have faced a number of challenges – such as the proliferation of UAVs – that call into question their future role in modern warfare. We trace this issue and its implications and transformations for a short analysis.

Serious losses, low efficiency. This is how the helicopters' performance could be summed up for the time being in light of the Russian–Ukrainian conflict. There

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are few more dangerous deployments in the world right now than flying over hostile territory in Ukraine as a combat helicopter pilot or crew. A kind of loss of confidence is beginning to take hold in the face of machines that were previously considered terrifying. But what was seen in Ukraine really marks the end of an era?

In reality, we see a much more nuanced picture on the battlefields, however, the events of the Ukrainian war seem to confirm that a person is actually safer almost anywhere on a battlefield than in the cockpit of a helicopter. In the first days of the war, we could still see the footage of Russian helicopters buzzing over Ukrainian towns and villages, then they were quickly replaced by videos of helicopters being fired with various weapons. But are helicopters really doing that badly in the Ukrainian war? And if so, does this mean that the age of combat helicopters is fading? Do these weapons no longer have a place on a 21st century battlefield, and is the future absolutely for drones? We investigate these questions in our analysis.

Failed operations

Combat helicopters made their debut during WWII, but it was the Vietnam War that marked their first large-scale deployment. Since then, they have played a crucial role in every major armed conflict and have become an integral part of every significant military force, commanding a significant portion of the funds allocated for development, procurement and maintenance.

Of course, this was also the case with the Russian armed forces. According to data of 2023,[2] Russia possessed over 559 combat helicopters in service, ranking second only to the United States with its fleet of approximately 1000 pieces. Notably, this inventory included around 120 Kamov-52 (KA-52) "Alligator" combat helicopters, considered among the world's most advanced machines. Compared to the similar but older American Apache (AH-64) helicopters, which have been in service since the 1980s, the KA-52s were developed in the 1990s and have been in mass production since 2008. This makes them truly modern aircraft, theoretically capable of meeting any requirement. If these helicopters cannot handle a situation, it is reasonable to assume that it would pose a serious challenge to every combat helicopter in the world's air forces.

At the outbreak of the Russian–Ukrainian conflict, the general consensus was that these helicopters would play a decisive role, living up to their reputation and capabilities. On the first day of the Russian invasion, a fleet consisting of transport helicopters packed with paratroopers and KA-52s providing air cover attacked the Hostomel Ukrainian airfield near Kyiv. The aim was to capture the airfield and establish a forward bridgehead for the attack on the Ukrainian capital. While the Russians managed to seize the airfield for a time, the Ukrainian counterattack was swift and successful. In the operation, several Russian helicopters were lost, including at least two KA-52s,[3] along with numerous members of the Special Forces units.

[2] See: www.globalfirepower.com/countries-listing.php
[3] Oryx 2023.

Despite this, in the following weeks, the Russian helicopters still flew a lot of missions in the Ukrainian airspace, and the Ukrainians also used their own helicopters very aggressively, for example, they brought supplies into the besieged Mariupol in this way. However, as the shoulder-launched anti-aircraft missiles from the West overwhelmed the Ukrainian troops, and after the initial confusion, the Russians also organised their lines and air defence equipment, helicopters faced increasing dangers on both sides of the front. By now, their missions are largely concentrated on carrying out rocket attacks using the "spray and pray" tactic.[4] (Admittedly, this involves no less risk during the mission, but you still don't have to approach the designated target within a few hundred metres.)

Assessing losses and the changing dynamics

In terms of losses, it is very difficult to find reliable sources of real numbers. Current estimates put the number of Russian helicopters destroyed, damaged or captured between 90 and 137 (Ukrainian sources report more than 300 losses), and at least 60 of these were KA-52s.[5] The losses of the Ukrainians may be similar or even more serious in terms of proportions, since they had significantly fewer helicopters at the beginning of the war (approximately 112 of which only 34 were combat),[6] so they were much more sensitively affected by the loss of a single helicopter. In addition, most of the above-mentioned losses occurred in the first two or three months of the war, so the Russian Air Force lost approximately one-tenth of its deployable helicopters during this time. It's easy to see that this was not sustainable, and commanders on both sides recognised this, leading to a reduction in the number of deployments and changes in tactics.

These developments have sparked opinions in the global media that the Ukraine war has proven the end of the era of combat helicopters. These vehicles are said to be facing the same fate as battleships during the WWII, which became hopelessly obsolete with the rise of aircraft carriers, and gradually worn out from the ranks of the navies. Would shoulder-launched missiles and drones bring helicopters to the same fate? Is it expected that the development of new combat helicopters will begin to be stopped worldwide, and existing orders will be cancelled? The situation is not quite that simple.

Unequal combat situation

The NATO has provided Ukraine with thousands of MANPADS (Man-Portable Air-Defense Systems), including at least 2,557 FIM-92 Stingers and an unknown number of Piorun, Sungur, Strela-2, Igla and RBS-70 missile systems. The British have also

[4] Historic Wings 2022.
[5] Trimble 2023; Januvsky et al. 2022.
[6] Armstrong 2022; VOA News 2022.

provided the AFU with thousands of Starstreaks.[7] These are easy-to-use and highly accurate missile systems that have been responsible for numerous successful high-profile attacks on Russian fixed-wing and rotary-wing aircraft.[8]

Shoulder-launched anti-aircraft missiles (MANPADs) are indeed frighteningly effective against helicopters, but they are not at all new to the battlefield. Of course, a modern top-of-the-line MANPAD, such as the British Starstreak, is far more advanced than developments of the 1970s or 1980s, but helicopters have also changed a lot in the recent decades.

The iconic American helicopter of the Vietnam War, the Bell UH-1 "Huey", was essentially a civilian aircraft equipped with weapons, with little protection and electronic equipment – and of course, with a price tag to match. In comparison, a KA-52 is at least as much space technology as a modern fighter jet is compared to its predecessor from the '70s.

As with any other weapon, there is a constant arms race between helicopters and the means to counter them, but in this race, rotary-wing aircraft are at a serious disadvantage. While, for example, a WWII anti-tank gun would hardly cause any damage to a modern tank equipped with reactive armour, a helicopter can be critically damaged with almost any weapon, and in fact, a modern combat helicopter could even be shot down with an ancient catapult if it could be hit in the right place. This has simple physical reasons: helicopters cannot be equipped with armour that can withstand anything, because they would not be able to take off, and in addition, the rotor blades can practically be effectively protected by nothing. These machines therefore rely on their speed, agility and active defence systems (such as infrared chaff or lasers to disrupt heat-seeking missiles) to avoid trouble. However, these can only provide limited protection, especially when faced with an enemy well-equipped with shoulder-launched or other air defence assets.

In addition, air defence missiles can miss their targets multiple times, but a single mistake by a helicopter pilot or defence system can mean the end of the machine (and usually the pilot and crew). If we add to this the cost of the opposing weapon systems, we get an even more unequal situation. A KA-52 costs about 15-16 million US dollars' worth of rubles, while an advanced air defence missile is only a matter of a few hundred thousand USD.[9] Therefore, even if only one in ten or twenty MANPAD shots hits a helicopter, it is still very cost-effective for the defender and very costly for the attacker. And that's not even to mention the threat posed by unmanned aerial vehicles (UAVs), which can autonomously seek out enemy forces and attack helicopters with missiles or bombs. These are also relatively cheap and easy to operate, and their development is exploding, but more on that later.

We must also take into account the astronomical costs of developing helicopters, maintaining them in combat readiness (an Apache's hour in the air costs about $5,000-6,000, and that's without even firing a single weapon),[10] and training pilots. Helicopters are also vulnerable not only in the air, but also on the ground. If the goal

[7] Gedeon 2022.
[8] Lubiejewsky 2023.
[9] Laskin 2021; Butowski–Newdick 2023; Vaniyan 2023.
[10] US Government Accountability Office 2022: 245.

is – as in the Russian strategic doctrine – for helicopters to provide primary support to ground-fighting units, then these machines must wait at airfields, ready to take off, close to the frontline. Such an airfield is easy to target and can be targeted by artillery with sufficient range. A good example of this is the Chornobayivka airfield near Kherson, where Ukrainian artillery has repeatedly shelled several Russian helicopters stored in the open air without any protection. But if these machines – as in the Russian strategic doctrine – have to be able to take off within three minutes of being called by ground troops and be in the relevant sector of the front within a quarter of an hour, then there is not much that helicopter unit commanders could do but hope that their own artillery and air defence assets would protect the machines on the ground – which is not what happened.

Taking everything into account, we can conclude that in Ukraine, under current conditions, there are far more risks associated with deploying combat helicopters than there are potential benefits to be hoped for.

This is why, in recent months, the Russians have also been using their helicopters much more cautiously, primarily using the aforementioned "spray and pray" tactic, which involves firing unguided rockets from behind the frontline. However, a multi-million dollar combat helicopter is a very expensive tool for this. Such rockets could be fired with similar or better accuracy and range from rocket launchers, or even from rocket launchers mounted on pickups.

Shrinking but important room for manoeuvre

So, has the combat helicopter as a weapon system really lost its meaning? It is important to note that the Ukrainian battlefield is very special and produces particularly disadvantageous conditions for helicopters. On the Ukrainian side, the mass-delivered MANPADs are now present even with small Ukrainian units, and the Russians have always placed a strong emphasis on providing their troops with ample ground air defence assets. It is almost impossible to sneak through the front lines unnoticed, neither side has been able to achieve complete air superiority, and for various reasons, neither side is able to effectively coordinate its helicopters, armour, artillery, and infantry.

But even so, helicopter losses are not exceptionally high: in Vietnam, the Americans lost over 5,600 helicopters (about half of their deployed rotary-wing aircraft!)[11] in the Afghan war, the Soviets lost over 300 helicopters,[12] but even after that, helicopter development did not stop in the world; on the contrary.

Combat helicopters, although vulnerable and expensive structures, are currently the best alternatives for performing certain tasks. For example, if it is necessary to quickly move troops and supplies over mountainous, difficult terrain, and then provide these troops with effective close fire support, then only transport helicopters and the accompanying attack helicopters can be considered. Helicopters also equip the attacker with invaluable capabilities during an amphibious operation and excel in

[11] Roush 2018.
[12] Nawroz–Grau 1996.

anti-submarine warfare. And if you don't have to worry about a modern MANPAD-equipped soldier or an S-300 Russian air defence battery behind every bush, they can still be excellent for escorting supply convoys through dangerous territory and for striking in enemy rear areas.

Their chances of survival against longer-range weapons and even more advanced defence systems can also be improved. What is certain, however, is that in such a war, much of their tasks will have to be taken over by other means. For reconnaissance and behind-the-lines missions, there are the increasingly sophisticated "drones", and it is very likely that in the near future the tasks of rapid supply transport will also be solved with unmanned aerial vehicles. However, this will not mean that military helicopters will disappear, but only that the range of capabilities that only these assets can provide for a military force will shrink. As long as there are such capabilities, helicopters will be there in wars. Even if – as we have seen – their history so far has also proven that where many helicopters are deployed, many will also be shot down. But the real question is still what they achieve before they are shot down and whether they help to achieve the set goals.

Battle of drones: a glimpse into the future of warfare

The Russia–Ukraine conflict has provided valuable insights into the use of unmanned aerial vehicles (UAVs), or commonly known as "drones", in warfare and has outlined certain future trends in the field.[13] Alex Kingsbury, a journalist at *The New York Times,* makes the straightforward statement in one of his articles: "All wars have their iconic weapons, from the AK-47 to the I.E.D. In Ukraine, it's the drone."[14]

Ukrainian kamikaze drones strike deep into Russia

On the night of 29 August 2023, Ukrainian kamikaze drones penetrated over 370 kilometres into Russia and attacked Russian airbases. In the attack, two of Russia's estimated hundred Il-76 heavy transport aircraft were destroyed, and two more were damaged.[15] Up to 20 drones may have been involved in the attack, which were allegedly launched from within Russia, with the knowledge or under the supervision of the Ukrainian Defence Intelligence Directorate.[16]

During the same week, Ukrainian forces employed affordable cardboard drones manufactured by the Australian company SYPAQ to target and destroy a MiG-29 and four Su-30 fighter jets in Russia's Kursk Oblast.[17] Approximately two weeks

[13] Franke–Söderström 2023.
[14] Kingsbury 2022.
[15] Reuters 2023; Al Jazeera 2023.
[16] Jacobsen 2023.
[17] Shashkova–York 2023.

later, Ukraine allegedly utilised drones in an operation aimed at neutralising Russian S-400 and S-300 air defence systems in Crimea.[18]

Inexpensive, DIY drones like SYPAQ's do not possess the explosive power of cannons, cruise missiles, or time-fused munitions ("loitering munitions"). However, these recent attacks demonstrate that small drones can still have an asymmetric strategic impact. Only a fraction of drone attacks need to be successful, and even small explosives can have a disproportionately large impact. As mentioned, parked aircraft are particularly vulnerable to such attacks.

The future of low-cost, long-range drone strikes

The ability to carry out low-cost, long-range drone strikes is not new. Drone technology, which allows drones to enter behind enemy lines cheaply, unnoticed, and with the element of surprise, avoid electronic and kinetic defences, and precisely strike military targets, has existed since around 2012. However, integrating and operating the technology has traditionally required a long and difficult learning process and development that involved gathering the necessary knowledge, solving the technical and engineering challenges that arose, and translating all of this knowledge and experience into an effective industrial environment. The Russian–Ukrainian conflict has greatly accelerated all three of these components, leading to a rapid reduction in the existing obstacles and the proliferation of the technology. Thus, it can be stated that such attacks are likely to become a routine part of warfare.

The future of innovation in Ukrainian drone warfare is developing along three main lines. First, the Ukrainians are intensively disseminating technical knowledge through both formal and informal channels. Government-led initiatives, such as the "Army of Drones",[19] have trained over 10,000 drone operators, and a large, decentralised network of engineers, operators and businessmen are working together in research, development, distribution, and application.

Second, Ukrainian engineers are developing special technologies to increase the combat effectiveness of drones. This includes modifying open-source flight control software to incorporate advanced algorithms for detecting GPS jamming and switching to alternative navigation methods. They are also developing artificial intelligence-based algorithms that are capable of tracking mobile targets without human intervention.

Third, Ukrainians and their foreign partners are establishing new ventures to provide affordable drone strike technology at scale. Over two hundred decentralised and often self-funded drone startups operate in Ukraine, managing their own international supply chains. Foreign suppliers seeking to support Ukrainians in their fight against Russian aggression are now providing turnkey solutions that reduce the barriers to drone adoption. The cardboard drones supplied by the Australian company SYPAQ are one example of this.

[18] Jankowicz 2023; Goksedef–Chervonenko 2023.
[19] See: www.ukrainianworldcongress.org/united24/

Another good example is One Way Aerospace, a Ukrainian company founded by British and Australian veterans and a Ukrainian engineer, now offers inexpensive kamikaze drones.[20] The Ukrainian newcomer has made waves with its low-cost, domestically produced kamikaze drones. These disposable drones, the AQ-400 and AQV-150, are designed for affordability and easy replacement, embodying a "quantity-over-complexity" strategy. The company is showcasing these systems to both the Ukrainian Ministry of Defence and an undisclosed European NATO partner, hoping to win contracts.

One Way Aerospace prioritises domestic production, sourcing components primarily from Western countries like Germany and the UK but aiming to localise manufacturing as much as possible. To achieve this, they're planning a new 1,000 square metres facility specifically for their long-range AQ-400 Scythe drone. This ambitious project aims to be a "$100,000 disposable cruise missile", boasting a 70-pound payload capacity, rapid assembly, mass production, and a 1,000 kilometres range. Their ultimate vision is a system capable of hitting 10 targets 150 kilometres away that makes One Way Aerospace a potential game-changer in drone warfare.

In addition to the trends above, Ukrainian drone warfare innovation faces other challenges and opportunities. The effectiveness of drone strikes, in addition to technological advancements, is closely linked to the adaptation of warfare strategies and tactics. The Ukrainians' ability to rapidly adapt and employ new solutions will be crucial to the effective use of drones.

Ethical aspects

Another important aspect is addressing the legal and ethical[21] issues surrounding drones. As drones become increasingly prevalent in modern conflicts, the international community needs to determine how to handle drone use in the context of international law and norms of war. Concerns about autonomous weapons systems, such as target selection and minimising collateral damage, will also be important factors.[22]

International humanitarian law applies, restricting certain weapons and demanding responsible use of legal ones to minimise civilian harm. Even lawful drone strikes require precautions. The core principle is following three key rules: distinction (separating civilians from combatants), proportionality (limiting civilian casualties compared to military gain), and military necessity (using force only for legitimate military objectives).[23]

But we come to the main ethical problem only after that. It is important to emphasise ethical principles in relation to computer-aided weapons. The responsibility cannot be passed to robots for a very long time – if ever. So even today, the so-called robot ethics can only be part of human ethics,[24] since unmanned vehicles

[20] Gosselin-Malo 2023.
[21] Koleszár 2010.
[22] Sotoudehfar–Sarkin 2023.
[23] Zając 2023.
[24] Koleszár 2010: 275.

and autonomous weapons cannot act ethically. That is why many scientists spoke in favour of their complete ban.[25]

Along with the proliferation of technology, the need for drone defence is also growing. State and non-state actors alike need to develop their drone defence capabilities, including drone detection, identification, and neutralisation. This may involve developing air defence systems, as well as employing electronic warfare techniques against drones.

Finally, the future of Ukrainian drone warfare innovation is influenced by the support and cooperation of the international community. Support from foreign suppliers and partners, such as technology transfer and expertise sharing, can further strengthen Ukraine's capabilities in this area. However, the international community must also be vigilant to ensure that drone technology used in conflicts does not spread irresponsibly or in a destabilising manner.

Overall, the future of Ukrainian drone warfare innovation hinges on the ability to adapt, address legal and ethical issues, develop defence strategies, and foster international cooperation and support. These factors will decisively influence how Ukrainian drone warfare innovation shapes the future of warfare.

Conclusions

The losses and lack of effectiveness described in the introduction highlight the problem of combat helicopters in modern warfare, particularly in the Russian–Ukrainian conflict. Helicopters, once considered as formidable weapons, have now lost significant effectiveness due to the proliferation of advanced air defence systems, MANPADS, and drones.

The history and development of the first military helicopters, as well as their widespread use in past conflicts, show that these machines have played an important role in military strategies for a long time. However, the high casualty rates and new types of threats experienced in the Ukrainian conflict raise the question of whether the era of combat helicopters is over and whether they should give way to newer technologies.

An analysis of the uneven battlefield situation, particularly the proliferation of MANPADS and drones, as well as the lack of defensive measures against them, shows that helicopters are becoming increasingly vulnerable and less effective in modern warfare. Although helicopters can still play an important role in certain situations, such as in difficult-to-access areas or special operations, the general trend is that the importance and effectiveness of combat helicopters is decreasing.

Looking to the future of warfare, the experience of the Ukrainian conflict shows that drones (UAVs) and other autonomous systems are becoming increasingly important. This reflects not only the evolution of combat technology, but also the need for military forces to adapt to new challenges and threats.

[25] Sharky 2013; Altmann 2014.

Overall, the decreasing effectiveness of combat helicopters and the growing role of drones and other autonomous systems signal significant changes in modern warfare. Military forces must adapt to these changes and develop new strategies and tactics to operate effectively in the changing environment.

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