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Tomáš Iliev

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Author
Tomáš Iliev
Adapt Institute Junior Research Fellow

Editor
Matúš Jevčák
Editor-in-Chief at Adapt Institute

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Tomáš Iliev

SUMMARY

- Conflict in Ukraine has been marked by the deployment of various types of drones. Both sides of the conflict constantly develop their capacities to produce drones, as in Ukraine, they have become a crucial tool for waging the war.

- Drone technology has been widely employed in the armed conflicts of the twenty-first century. However, the Russia-Ukraine war is witnessing advancements in autonomous warfare that outstrip those seen in other battle arenas.

- The ongoing conflict has demonstrated the evolving battlefield advantages of drones, which have become increasingly compact, deadlier, simpler to operate, and accessible to almost anyone.

- Despite their abundance, numerous small drones still cannot rival the power or sheer volume of artillery fire, making them inadequate substitutes for howitzers.

INTRODUCTION

Drones, or UAVs, were often considered weapons of the future. Before the two world wars in the 20th century, the Austrian forces used the predecessors of drones when the exploding balloons were used to attack Venice in 1849. In the First and Second World Wars, drones never played a role so significant that they would be regarded as the game changers. We can trace their first more extensive deployment back to the Vietnam War, followed by the conflicts in Kosovo, Iraq, and Afghanistan. After the war in Vietnam, Britain and the United States intensified their development of drones. At the beginning of the twenty-first century, after 9/11 primarily, their usage increased significantly as their technical, operational, and combat abilities developed immensely. Without drones, much valuable information on a battlefield would never be known. UAVs can operate in areas where the deployment of regular troops would be too risky. Their importance for military reconnaissance is indispensable (Carr and Keane 2013).

Moreover, without drones, many valuable targets would never be eliminated. Although drones are considered the weapons of modern warfare, their history is longer than one would expect. Their development goes back to the First World War. Now, more than one hundred years later, drones and their progress have come a long way. Since the beginning of the Russian aggression in Ukraine, the role of drones has grown significantly to the point where drones and the efficiency of their usage decide the success on the battlefields of eastern Ukraine. How many drones have already been used in the war? How have UAVs been used since the start of the war? Have there been any significant adjustments in the usage of drones since the beginning of the war? Are Ukrainian drones more efficient? This paper tries to answer these

questions and prove that without drones, neither Ukrainians nor Russians could lead the ongoing war.

WAR IN UKRAINE – WAR OF DRONES

During the first months of the Russian aggression, Ukraine intensively used the larger types of attacking drones. Despite their large size, they could strike Russian ground targets efficiently, and even Russian air defence could not intercept them and protect heavy ground military equipment. Such loss of technique and the army personnel forced the Russian military to learn how to challenge larger Ukrainian UAVs. It is essential to highlight that Russians are currently able to detect and destroy these types of drones, and therefore, Ukrainians stopped using them for destroying Russian heavy ground targets. Despite this, Bayraktars are still used thanks to their capacity to collect valuable intelligence. As the war progressed, events took a completely different course than many experts had predicted before the war.

Military drones and their usage were declining, and, on the contrary, the usage of commercial drones started to rise. It is not a secret that before the Russian aggression, only a few could imagine such a significant reverse from the military technology. Ukrainians found that smaller commercial drones are more efficient in breaching Russian air defence. Smaller types of drones possess various advantages over larger drones of a military nature.

In particular, smaller drones are less detectable, adjustable to multiple tasks and can bear different types of explosives, which can vary based on the nature of a target. Moreover, when destroyed, their cost is relatively low, which is not valid in the case of military drones. The cost of production and relatively low technical knowledge required to construct them resulted in the fact that today, more than 80 Ukrainian producers are delivering small commercial drones for the Ukrainian Armed Forces (Franke 2023).

Today, various types of drones are used in the war in Ukraine. Their purpose varies, but they all help Ukraine repel Russian forces' aggression. However, Russia has also adjusted to the trend and has started to use drones, causing damage to the civilian and military infrastructure of Ukraine.

TYPES OF DRONES ON UKRAINE'S BATTLEFIELD

Reconnaissance Drones

Reconnaissance drones have become a vital part of modern warfare. They provide immediate information and intelligence about the enemy´s positions and activities. In the case of the current conflict in Ukraine, reconnaissance drones are irreplaceable for monitoring potential threats and movements on the front lines, as well as for the overall assessment and decision-making regarding the activities of both sides. Moreover, reconnaissance drones are usually equipped with cameras and infrared sensors, offering commanders crucial insight into the enemy´s activities and the ability to react to them. However, the same applies to the Russian side, which also uses reconnaissance drones. Consequently, both sides of the conflict know about their activities. It has become more difficult to catch an enemy by surprise, which often leads to the failure of each Ukrainian or Russian attempt to break the enemy lines.

Ukrainian forces have utilised reconnaissance drones extensively to gather intelligence on Russian military activities. The so-called "nano drones" allow the First Person to View (FPW) and can film enemy forces. Their size predetermines them for surveillance tasks, mainly when Russian forces must not spot that Ukrainian defenders are watching them. The Black Hornet type is currently used the most out of nano drones. Even though these drones pose an advantage of being often unspotted due to their size, they can fly up to 1.5km and stay operational for only 25 minutes. Despite this disadvantage, their usage proved crucial when Ukrainian forces needed to find information about Russian forces nearby.

Small Tactical Reconnaissance Drones are used in Ukraine as well. This type of drone is used in cases when Ukrainian forces need to conduct surveillance or gather intelligence about Russian forces further in the enemy territory. The most used small tactical drones are US-made AeroVironment RQ-20 – Puma. "Puma" can operate on land and in the maritime environment. Due to its highly developed manual or autonomous navigation program, "Puma" earned popularity among drone operators, who can conduct surveillance as far as 20km (for 2 hours) and efficiently hand-launch the drone. The "Puma" drones were part of a 300-million-dollar aid package from the United States in 2022, and ever since, the Ukrainian armed forces have used them.

Also, Ukraine is using more significant types of renaissance drones, such as Boeing ScanEagle, which is used for missions where long endurance of drones is necessary to find out about far enemy positions or activities. Insitu, a subsidiary of Boeing, built it. ScanEagle has a flight range of up to one hundred kilometres and can conduct missions for 20 hours without landing. Ukraine received ScanEagles as a part of the 775 million dollar aid package from the US military in August 2022. However, Ukraine uses other types of reconnaissance drones. "Leleka" drone, "UAV Shark or "DJI Mavic-3" are the reconnaissance drones used by the Ukrainian army. They proved highly effective in unveiling enemy positions and weaponry and pointing artillery to destroy them. Moreover, the "DJI Mavic-3" configuration Mavic-3 or Mavic-3T (with thermal imager) proved effective in dropping explosives on enemy positions (Brown and Chiu 2023).

Attack Drones

Attack drones, or combat UAVs with attacking capabilities, are also used in the Ukraine conflict. These types of UAVs are deployed to strike enemy positions and targets and cause losses in the workforce and military technique. In Ukraine, attack drones are crucial as they are capable of attacking enemy positions and reconnaissance tasks. However, Ukraine (and Russia) uses them to cause damage rather than reconnaissance missions, as they can damage enemy infrastructure, personnel, and positions.

In the case of Ukraine, Bayraktar TB2 is the most famous attack drone, which proved effective mainly at the beginning of the conflict when it struck Russian columns with lethal accuracy, causing fatalities in the ranks of the Russian army. In particular, Turkish-made Bayraktar TB2 and other weaponry were crucial for repelling the Russian forces from the Kyiv area in 2022. Bayraktars can be equipped with various air-to-surface missiles and can

stay in the air for 27 hours and attack anywhere 300km from the take-off area. These drones provide Ukrainian commanders with a means of conducting precision strikes against enemy positions, disrupting supply lines, and neutralising high-value targets. The use of attack drones by Ukrainian forces represents a significant advancement in their military capabilities, enabling them to project power beyond their traditional artillery and rocket systems. Similar to Ukraine, Russia also uses attack drones to engage the Ukrainian army. In particular, the Russian side has used the Russian equivalent of Bayraktar TB2, Kronshtadt Orion, for tasks similar to those of the "Bayraktars." Identical to its Ukrainian "counterparts," "Orions" were active at the beginning of the invasion, as they could fly for 24 hours and strike enemy targets as far as 250km-350km.

However, neither side uses large-sized attacking drones on the Ukrainian battlefield. The reason is that neither Ukrainian Bayraktars nor Russian "Orions" proved to be vulnerable to air defence systems deployed by the Ukrainian and Russian armies once the conflict became static. Both Ukrainian and Russian attack drones suffered losses in their ranks. As of 2023, they became less used and replaced by smaller types of combat UAVs, such as kamikaze drones, which are less expensive and can cause significant damage to the enemy workforce or weaponry (Pettyjohn 2024).

Kamikaze drones

They can hover in the air a target for extended durations before swiftly executing attacks upon the operator's instruction. These drones are adept at executing predetermined combat missions outlined by their algorithmic protocols. The Ukrainian Armed Forces have deployed an American kamikaze drone, Switchblade 300, boasting a top speed of 160 km/h. Operating within a range of 600 meters, it sustains flight for up to 50 minutes. Notably, this type of drone is usually used by Ukrainian army officers to neutralise enemy heavy weaponry, such as anti-aircraft missile systems, along with three TOR-2Ms or tanks.

Pegas is another Ukrainian-made drone that operates at an airspeed ranging between 50-75 km/h, covering approximately 400 meters in distance while carrying payloads of up to 20 kg. These drones, essentially standard quadcopters assembled from essential components, are outfitted with explosives by specialists, effectively transforming them into kamikaze drones. Developed in collaboration with the Army of Drones, these FPV (First Person View) drones have been instrumental in various operations leading to damage or destroying Russian infantry or heavy weaponry. The volunteer headquarters "Ukrainian Team" coordinated a fundraising campaign for Pegas drones, amassing a total of UAH 3,200,000, which equates to 100 drones.

Ukrainian army also uses the Falcon Avenger, which is capable of a feature enabling real-time video transmission through a front-installed camera. However, details regarding its country of origin and specific features remain undisclosed by the media. Last but not least, derived from the Leleka reconnaissance UAV, a Ukrainian-produced strike drone RAM II boasts a battle radius of up to 30 km and a flight range extending to 60 km, with flight durations lasting up to 1 hour, and is most often used for attacks on enemy heavy weaponry.

However, it is also notable that the Russian army uses kamikaze drones in combat. The prevalent drones encountered in Ukraine include the Iranian-designed Shahed-136/Geran 2, primarily utilised by the Russian military for targeting infrastructure in Ukraine. Essentially, these drones are equipped with explosive warheads for destructive purposes and have caused a number of military personnel or civilian deaths.

Kamikaze drones exhibit enhanced capabilities in terms of flight dynamics, control mechanisms, warhead specifications, and target detection sensors. Kamikaze drones can function either semi-autonomously or under direct operator control, allowing for the identification and engagement of targets. A prime example is the Russian Lancet, operated remotely via real-time control facilitated by a communication system. Equipped with an electro-optical camera, the Lancet transmits visual data to the command-and-control station for precise targeting (BBC News 2023).

Maritime drones

Ukraine is also using maritime drones (unnamed boats) that can destroy Russian shipping and infrastructure in the Black Sea. Ukraine claims that usage of maritime drones helped to keep some portion of grain exports from Ukrainian ports, as well as reduce the Russian Black Sea fleet's capability to endanger coastal areas of Ukraine, as Kyiv states that at least 20% of Russian missile attacks are launched from the ships in the Black Sea.

As the Ukrainian Black Sea fleet lost 80% of its vessels due to the Russian occupation of Crimea, maritime drones offer at least some compensation for this loss. Ukraine has presented the world's first and most significant type of maritime drone, the "Sea Baby." It can carry 850kg of explosives, reach a speed of 90kph and attack as far as 1000km. However, the most used type of Ukrainian maritime drone is the MAGURA V5, produced by the Ukrainian state-owned foreign trade enterprise SpetsTechnoExport. It was developed by the Main Directorate of Intelligence of Ukraine (GUR). It can perform various tasks, including maritime security missions, combat missions, reconnaissance, surveillance, search and rescue, patrolling and mine countermeasures. With its length of 5,5 meters, ability to carry up to 320 kg of explosives, and range of operation of up to 800km, MAGURA V5 has become a lethal weapon that has already caused the Russian Black Sea fleet of three ships. MAGURA V5 is responsible for the latest attack on the Russian Black Sea patrol ship Sergei Kotov in early March. Also, Magura V5 drones destroyed the Russian Black Sea landing ship Tsezar Kunikov and Tarantul-class corvette R-334 Ivanovets, both in February 2024. The Ukrainian maritime drones are also responsible for the famous attack on the Kerch Bridge and a subsequent attack on Novorossiysk port, both in the summer of 2023 (Hatton 2024).

Off-the-shelf drones

In the ongoing conflict in Ukraine, a variety of off-the-shelf drones have found extensive use among Ukrainian forces and Russian army, and other entities involved in the conflict. These commercially available drones, easily obtainable from consumer markets, are frequently repurposed or adapted for military applications to fulfil various operational needs. There are various types of off-the-shelf drones used in the conflict.

The DJI Phantom drone stands out globally for its user-friendly interface, stability during flight, and high-quality camera capabilities. Widely recognised for their suitability in reconnaissance and surveillance missions, DJI Phantom drones have been deployed by both Ukrainian forces and the Russian army to gather crucial aerial intelligence within the conflict zone; evidence also confirms their use in attacking the ground forces and smaller military vehicles.
Another notable drone is the Parrot Bebop Series, which is popular among civilian drone enthusiasts and has also been used by the Russian and Ukrainian armies during the conflict. Featuring a lightweight design, built-in cameras, and smartphone-controlled operation, Parrot Bebop drones offer versatility for aerial surveillance and photography tasks.

Another drone used on the battlefields of Ukraine is the Xiaomi Mi Drone Series. It strikes a balance between affordability and advanced features, making it a common selection for reconnaissance missions in Ukraine. With stable flight performance, high-resolution cameras, and extended range capabilities, Xiaomi Mi drones are valued for their ability to provide valuable aerial reconnaissance in the conflict area by both Ukraine and Russia.

Also, the Syma X5 Series, though less sophisticated compared to other models, remains in use for basic reconnaissance due to its agility and compact size. Despite their limitations, Syma X5 drones contribute to intelligence-gathering efforts by providing aerial views of the battlefield.

Lastly, the Yuneec Typhoon Series is renowned for its professional-grade features, including superior camera resolutions and advanced flight modes. These drones are particularly suited for demanding surveillance missions, offering longer flight times and enhanced capabilities compared to entry-level models.

Off-the-shelf drones have fundamentally altered the dynamics of the conflict in Ukraine, offering cost-effective solutions for reconnaissance, intelligence gathering, and even limited offensive actions. However, their proliferation has also spurred the development of countermeasures, underscoring the ongoing technological competition in modern warfare. Therefore, there are limitations to the usage of commercial drones, possibly leading to relying more on the larger military types that are less vulnerable to the enemy´s countermeasures (Thompson 2024).

COUNTER-MEASURES AGAINST DRONES

In the ongoing conflict in Ukraine, both Ukrainian and Russian forces have deployed a variety of counter-drone systems to mitigate the threat posed by enemy unmanned aerial vehicles (UAVs). These systems range from electronic warfare (EW) devices to kinetic and non-kinetic methods designed to detect, track, and neutralise hostile drones.

Ukrainian forces have reportedly utilised a combination of domestically produced and imported counter-drone systems to safeguard their positions and assets against enemy UAVs. One such system is the "Leleka-100," developed by the Ukrainian company "Precision Systems." Leleka-100 is a mobile counter-drone system capable of detecting and jamming the radio signals used by hostile drones to communicate with their operators. By disrupting the

command and control link between the drone and its operator, Leleka-100 effectively neutralises the threat posed by enemy UAVs, preventing them from conducting reconnaissance or launching attacks.

In addition to electronic warfare solutions, Ukrainian forces have also employed kinetic counter-drone measures to intercept and destroy hostile UAVs. This includes the use of anti-aircraft artillery and man-portable air defence systems (MANPADS) to engage and shoot down enemy drones operating in Ukrainian airspace. These kinetic counter-drone systems provide a proactive means of neutralising aerial threats, particularly in scenarios where electronic jamming may be ineffective or impractical.

Furthermore, Ukrainian forces have reportedly utilised non-kinetic methods such as net guns and drone-catching drones to physically capture and disable enemy UAVs. These systems offer a more controlled approach to neutralising hostile drones, allowing for the capture and analysis of enemy payloads and providing valuable intelligence on adversary tactics and capabilities.

One of the primary counter-drone systems employed by Russia is electronic warfare (EW) equipment, designed to disrupt the control signals and navigation systems of enemy drones. These EW systems can effectively jam the radio frequencies used by UAVs to communicate with their operators, thereby neutralising their ability to receive commands or transmit data back to their controllers. By interfering with the drone's communication link, these EW systems can effectively prevent hostile UAVs from conducting reconnaissance or launching attacks.

Additionally, Russia has reportedly utilised anti-aircraft artillery and surface-to-air missile systems to engage and destroy Ukrainian drones operating in contested airspace. These kinetic counter-drone measures provide a means of intercepting and neutralising aerial threats by physically shooting them down. Anti-aircraft artillery platforms such as the ZU-23-2 or self-propelled air defence systems like the Pantsir-S1 may be among the systems deployed for this purpose. These systems are capable of engaging drones at various altitudes and ranges, providing a layered defence against aerial threats.

Furthermore, Russian forces may also deploy unmanned aerial vehicles (UAVs) equipped with electronic warfare payloads to counter enemy drones. These electronic warfare drones can disrupt the operation of hostile UAVs by jamming their control signals or interfering with their navigation systems. By deploying their own drones equipped with EW capabilities, Russian forces can actively suppress enemy drone activity and deny them access to critical areas or targets. These drones can also be used for reconnaissance and surveillance purposes to identify and locate enemy UAVs for engagement by other counter-drone systems.

In addition to these counter-drone measures, Russia also employs cyber warfare tactics to target and disable enemy UAVs. Cyber-attacks targeting the communication networks or control systems of hostile drones can disrupt their operation and render them ineffective. By exploiting vulnerabilities in the UAV's software or communication protocols, Russian cyber

operators can gain control of enemy drones or cause them to malfunction, preventing them from carrying out their intended missions.

The conflict in Ukraine has witnessed the proliferation of counter-drone systems on both sides, reflecting the evolving nature of modern warfare and the increasing threat posed by unmanned aerial vehicles in contested environments. As the conflict continues to unfold, the development and deployment of advanced counter-drone technologies are likely to play a crucial role in shaping the outcome of battles and influencing strategic decision-making on the battlefield. Despite the fact that counter-drone technologies play a vital part in the ongoing conflict in Ukraine, drones are still valued as irreplaceable tools for waging war between Ukraine and Russia. Therefore, in regard to the conflict in Ukraine, the drone production and acquisition capacities of both sides of the war are of crucial importance (Karner 2024).

DRONE PRODUCTION AND ACQUISITION

When considering the drone production capacities of Ukraine and Russia amid the conflict in Ukraine, several key elements emerge, including technological prowess, industrial infrastructure, and strategic objectives.

Ukraine's drone industry is emerging, with domestic entities like "Ukroboronprom" and "Antonov" focusing on UAV design, development, and manufacturing. Despite facing financial constraints and technological hurdles, Ukraine has shown potential in producing drones for various applications, both military and civilian. Currently, Ukraine has the capability to manufacture 150,000 drones monthly, and there's potential to reach a production capacity of 2 million drones by the year's end.

In contrast, Russia boasts a well-established and advanced drone manufacturing sector, supported by a robust defence industry and significant investment in research and development. Companies such as the "Kronshtadt Group" and "Russian Helicopters" have developed a range of sophisticated UAVs, including reconnaissance and combat drones. As of today, Russia produces or purchases 300,000 drones every month, each drone costing only a few hundred dollars.

In terms of quantity, Russia likely exceeds Ukraine in drone production due to its larger industrial base and greater financial resources. Russia's involvement in the conflict has also provided opportunities to deploy and test drones in combat settings, further enhancing its production capacity.

However, Ukraine has demonstrated flexibility and innovation in creating cost-effective and adaptable UAVs tailored to its specific needs. Drones like the "Bayraktar TB2" and "Aurea" series have gained recognition for their performance and reliability on the battlefield, indicating Ukraine's ability to compete despite resource limitations.

Moreover, Ukraine's strategic partnerships and collaborations with Western countries and defence contractors have facilitated access to advanced drone technologies and expertise, enabling the country to enhance its production capabilities and integrate cutting-edge features into its UAVs.

While Russia holds a quantitative advantage in drone production capacity compared to Ukraine, Ukraine's adaptability, innovation, and strategic collaborations position it as a significant player in the realm of drone warfare. Both nations continue to invest in advancing their capabilities, reflecting the growing importance of drones in contemporary conflicts like the one in Ukraine. Even though drones play a crucial role in the ongoing conflict, they have particular limitations that make them less effective due to weather conditions or other factors (Probasco, 2023).

LIMITATIONS OF DRONES IN WAR

In the ongoing conflict in Ukraine, drones have emerged as indispensable assets for reconnaissance, surveillance, and precision strikes, providing vital advantages in gathering intelligence and executing tactical operations. However, their operational efficacy is significantly shaped by diverse weather conditions and the complexities associated with day and night operations.

Extreme weather conditions, particularly the severe winters prevalent in Ukraine, present substantial challenges to drone operations. During winter, low temperatures can have adverse effects on drone batteries, leading to decreased efficiency and shortened flight times. Lithium-ion batteries, commonly used in drones, are especially susceptible to cold weather, resulting in rapid power loss. Furthermore, freezing temperatures can impact the drone's internal components and sensors, potentially causing malfunctions or system failures. Snow and ice accumulation on the drone's body and rotor blades exacerbate these challenges, affecting aerodynamics and flight stability. Consequently, drones may struggle to operate effectively in extreme cold, thereby limiting their ability to provide real-time intelligence and surveillance during winter conditions.

Heavy rainfall and snowfall also pose formidable obstacles to drone operations in Ukraine. Precipitation can impair visibility and obstruct the drone's sensors and cameras, diminishing the quality of collected imagery and data. Additionally, wet and icy conditions can affect the drone's propulsion system, reducing manoeuvrability and control. In such adverse weather conditions, drones encounter difficulties maintaining stable flight and executing precise reconnaissance or surveillance missions, thereby diminishing their utility on the battlefield.

Fog, a common weather condition in Ukraine, significantly impacts drone operations by obscuring terrain features and reducing visibility. Dense fog makes it challenging for drones to navigate safely and identify targets, compromising situational awareness and mission effectiveness. Additionally, fog impairs the functionality of the drone's sensors and cameras, further hindering its ability to gather accurate intelligence. Strong winds also pose a significant risk to drone operations, particularly in regions with varied terrain and elevation. High winds destabilise drones, causing them to lose control or deviate from their intended flight path.

Therefore, the duration of drone flights in the Ukraine conflict fluctuates depending on various factors, weather conditions especially. At times, drones may remain airborne for extended periods, conducting persistent surveillance over specific regions or conducting reconnaissance

along the front lines. Conversely, flight durations may be shorter due to mission constraints or the necessity to conserve fuel and resources. In particular, off-the-shelf drones usually remain active for a maximum of two hours and must stay close to the operator. However, drones constructed by the military have the ability to stay active even for twenty hours, as they are designed to conduct operations for longer periods of time.

Regarding the lifespan of drones, commercial drones commonly used for reconnaissance typically have shorter service life (one to 7 days) due to their civilian-oriented design. These drones lack the durability needed for military operations and are vulnerable to damage from weather, mechanical failures, and enemy actions.

On the other hand, military-grade drones, purpose-built for combat, generally have longer lifespans and greater resilience (even one month or more). With reinforced structures and advanced systems, they endure the rigours of warfare better. Despite their higher costs, these drones are better suited for extended deployment. In Ukraine, military-grade drones are likely to outlast their commercial counterparts.

Regardless of the importance of drones, they face limitations compared to artillery in the Ukraine conflict. Artillery's long-range capabilities, high volume of fire, resilience to adverse weather, and psychological impact on the enemy make it a preferred choice. While drones excel in reconnaissance and precision strikes, artillery's versatility and effectiveness ensure its continued dominance on the battlefield. Thus, in the dynamic and challenging conditions of the Ukraine conflict, artillery remains the primary means of waging war. However, advancements in drone technology and strategies are continually being pursued to overcome weather-related constraints and enhance their operational capabilities in adverse conditions. These efforts aim to improve the contribution of drones to military operations and their ability to complement traditional artillery tactics on the battlefield, as drones will play a crucial role in future conflicts (Moyar 2024).

FUTURE OF DRONES IN ARMED CONFLICTS

The conflict in Ukraine has served as a crucial learning experience, shedding light on the evolving role of drones in warfare and offering valuable insights into their potential future applications and impacts on military strategies.

One key takeaway from the conflict is the increasing significance of drones in reconnaissance and surveillance. The use of drones for real-time intelligence gathering on enemy movements, positions, and defensive structures has become indispensable. With ongoing technological advancements enabling longer flight times, enhanced sensor capabilities, and autonomous operation, drones are poised to become even more integrated into military operations. In the future, they may emerge as the primary means of intelligence collection, providing commanders with comprehensive situational awareness and facilitating more informed decision-making.

Another notable development is the growing deployment of armed drones for precision strikes. The conflict in Ukraine demonstrated the effectiveness of armed UAVs in targeting enemy assets while minimising risks to personnel. As drone technology continues to progress,

armed drones could become increasingly sophisticated, capable of conducting more precise and devastating attacks. This has the potential to reshape warfare by reducing the need for large-scale ground offensives and minimising collateral damage.

Additionally, the conflict highlighted the role of drones in asymmetric warfare. Both state and non-state actors leveraged drones for reconnaissance, surveillance, and limited strikes, challenging conventional military forces in unconventional ways. Looking ahead, drones may play an even larger role in asymmetric conflicts, empowering smaller and less technologically advanced adversaries to project power on the battlefield.

Moreover, the conflict spurred the development of counter-drone technologies as adversaries sought to neutralise the threat posed by hostile UAVs. This ongoing arms race between drones and counter-drone systems is expected to escalate, with both sides continuously innovating to gain the upper hand. Future conflicts may witness the widespread use of sophisticated counter-drone measures, including electronic jamming, kinetic interception, and directed energy weapons.

The experience of the war in Ukraine points towards a future where drones play a central role in military conflicts. From reconnaissance and surveillance to precision strikes and asymmetric warfare, drones offer military forces a versatile and potent tool for achieving their objectives on the battlefield. However, this reliance on drones also presents new challenges and risks, including the need to develop robust defences against hostile UAVs and address ethical and legal considerations surrounding their use in warfare. As technology continues to evolve, the future of drones in conflict will be shaped by ongoing advancements and the evolving nature of modern warfare (Borsari and Davis Jr. 2023).

CONCLUSION AND RECOMMENDATIONS

The ongoing war in Ukraine poses a severe threat to the stability and security of the European continent. Ukraine has been defending itself against Russian aggression for more than two years. That would not have been possible without Western support, which has faded in the previous months. Without Western aid, Ukraine will not be able to hold Russian forces. As drones have become a crucial component of waging war, Ukraine needs to be able to keep its drone fleet able to repel Russian attacks.

Therefore, to do so, western partners should persist in aiding Ukraine in enhancing its drone fleet while maintaining a pragmatic outlook on the extent of its impact. Ukraine can produce smaller types of drones, but without Western support, it cannot produce enough drones to match the Russian numbers. What is more, Ukraine will likely become a lead drone manufacturer after the war, using information and experience gained during the conflict, which NATO and other Western partners could use for building and developing their drone capacities as well.

Western partners and Ukraine should develop counter-drone defence systems that can protect Ukrainian cities and the military from Russian drone attacks. Ukraine urgently needs an even more efficient system against drone attacks, as Russia has intensified its pressure and is

targeting civil and military infrastructure all around the country. Therefore, Ukraine needs a system that will be produced on its territory and will not be too expensive to produce so that its loss would not be a financial burden for Ukraine.

Furthermore, fostering collaboration and information-sharing between military and civilian entities is paramount. Joint efforts can enhance early detection of drone activity and facilitate swift response measures to neutralise potential threats. Also, comprehensive training programs should be implemented to educate military personnel on drone tactics and effective countermeasures. Equipping soldiers with the necessary skills to identify and respond to drone threats is crucial for bolstering overall defence strategies.

Ukraine itself should continue to target drone factories on Russian territory. Even though protection against drones is crucial, destroying factories that produce drones in Russia has proved effective. Also, Ukraine should locate and attack the warehouses where drones provided to Russia by other states are stocked, as it could destroy them before their usage in Ukraine. Foreign supporters of Russia also have limited capacities and will not be able to produce drones enough drones for the needs of the Russian army.

Last but not least, western partners should deliver long-awaited artillery ammunition. Even though Ukraine is currently using drones as compensation for the lack of artillery ammunition, this tactic cannot hold Russian efforts for long. Western partners must realise that without artillery ammunition, it is just a matter of time before Russian forces will break the Ukrainian defences as a direct consequence of the lack of ammo. Drones have proven to be practical tools of war in Ukraine today, but it is also true that they cannot match the effectiveness of ammunition. However, it is necessary to mention that Russian gains could be more significant without drones. Today, drones are a crucial element in waging a war. Drones will become more advanced and used in conflicts worldwide as their development continues. If used with other types of weaponry, they could help Ukraine retake the battlefield's momentum and efficiently counter-fight the Russian forces.

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