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Issue Brief

# Drones for Surveillance to Strikes: Assessing the Impact through the Lens of Russia-Ukraine War

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## Summary

New and disruptive technologies are making wars extremely complex. Drones play a crucial role in ISR operations, as well as in coordinating and directing punitive strikes. Russia and Ukraine have been using drone technology to gain an upper hand in a dynamic battlefield.

The Russia–Ukraine War has witnessed a significant surge in the use of drones for surveillance and strikes. The unmanned systems have also transcended the aerial domain and have witnessed operational employment in marine and land warfare. Russia inducted unmanned ground vehicles (UGVs) in January/February 2023 and Ukraine used uncrewed surface vehicles (USVs), marine drones, for launching attack on Sevastopol harbour in October 2022.

The United States and Israel are the pioneers in the development and employment of unmanned aerial vehicles (UAVs), informally known as drones.[1] In addition, China, Iran, Russia, and Turkey have also contributed significantly in this field. UAVs were widely used in the Global War on Terror (GWOT) and are quickly becoming an important part of inventory of most armed forces.

The 2020 Nagorno-Karabakh War conclusively established the importance of UAVs in a conventional battlefield. In the first 15 minutes of the war, Azerbaijani drones destroyed close to 50 per cent of Armenian Air Defence (AD) systems and 40 per cent of its artillery. The Azerbaijani forces equipped with Israeli Harop and Orbiter Loitering Munitions (LMs) and Turkish Bayraktars, combined sensors with precision strikes, destroying even the active AD systems.[2] Having achieved near control of the sky, the Azerbaijani UAVs targeted Armenian ground forces with impunity.

The evolution of drone warfare is taking place literally on the fly and drones stand poised to shape the contours of all future wars. The Brief places in context the multifaceted role being played by drones in the Russia–Ukraine War and the impact of unmanned systems on the future of warfare.

## Firsts in Drone Warfare

The year 2022 saw several firsts in the employment of drones, among them was the first recorded 'unmanned' aerial combat and first known case of fighter jet going down to a kamikaze drone (Shahed-136).

Ukraine released a 16-second clip of two UAVs engaging each other in combat for the first time in the history of warfare. The footage shows Ukrainian UAV tasked for observation and control of artillery fire is approached by a Russian quadcopter that

[1] Samuel Bendett describes drone as a programmable unmanned device that can fly, move on surface and on/under water. It can manage its actions in the target environment using its payload or can be controlled using commands from a human operator, or from onboard artificial intelligence (AI) or AI located on another device. Bendett goes further to suggest "any guided projectile, a space satellite, and even a radio exchange simulator based on ChatGPT technology (although in this case all actions take place in the virtual reality) are sort of drones as well." See Samuel Bendett, **"THREAD on the Perception of Combat UAVs and FPV-type Drones…"**, X (formerly Twitter), 15 August 2023.

[2] Captain Karl Flynn, **"Make Every Marine a Drone Killer"**, US Naval Institute, November 2023, Vol. 149/11/1,449.

manoeuvres around it before deliberately crashing onto it. In the clip, the blades of the Russian quadcopter rupture and it crashes on the ground.[3]

The year 2022 also saw first recorded case of a loss of fighter jet because of hit by shrapnel from an exploding drone. It is reported that a Ukrainian MiG-29 shot down a Geran-2 (or Shahed-136) and when the drone exploded, apparently the MiG-29 was hit by the shrapnel from the exploding Geran-2 and crashed when the pilot lost control of the aircraft.[4]

Russia–Ukraine War does not have the distinction of use of Artificial Intelligence (AI) for the first time in combat. In 2021, the Israel Defence Forces (IDF) described the 11-day conflict in Gaza as the world's first "AI war", citing its use of AI to identify rocket launch pads and deploy drone swarms.[5] However, it has been reported that both Russia and Ukraine are making extensive use of AI for target identification, facial recognition, data fusion, and signal communication to enhance effectiveness of combat operations. AI is also being used in drone operations.

Mykhailo Fedorov, Ukraine's Vice Prime Minister and Minister of Digital Transformation on 26 July 2023 stated that the Ukrainian armed forces have deployed

> "1700 drones to the frontline to support Ukrainian counteroffensive. Among them are strike and reconnaissance copters. These drones are equipped with AI that will help to effectively recognize and then destroy Russian targets."[6]

The way in which Russian and Ukrainian forces have exploited AI to enhance operational capabilities of the drones is of interest to armed forces around the world; for the moment, there is limited information in this regard.

## Drones for ISR Operations and Targeting

Drones play a crucial role in intelligence, surveillance and reconnaissance (ISR) operations, providing armed forces and intelligence agencies with enhanced capabilities for information gathering, situational awareness and decision making. The unmanned systems can be equipped with high-resolution cameras and sensors

[3] Gareth Jennings, **"Ukraine Conflict: 'Drones' Engage in First Recorded Unmanned Aerial Combat"**, *Janes*, 14 October 2022.

[4] Tanmay Kadam, **"Ukraine Confirms 1st Known Case of Fighter Jet Going Down to a Kamikaze Drone; EurAsian Times' Assessment Hits Bulls Eye!"**, *The EurAsian Times*, 14 October 2022.

[5] **"Israel Quietly Embeds AI Systems in Deadly Military Operations"**, *The Economic Times*, 16 July 2023.

[6] Mykhailo Fedorov, **"Sending 1700 Drones to the Frontline…"**, X (formerly Twitter), 26 July 2023.

to generate real-time information of the target area. They can gather information about the activities and movement of the target and changes in terrain configuration. Drones can track targets over extended period and generate comprehensive and actionable intelligence. Drones equipped with special payloads can undertake electronic warfare (EW) and signal intelligence (SIGINT) tasks.

Both Russia and Ukraine are effectively using UAVs for ISR and targeting operations. By October 2022, on any typical day, Ukrainian forces would fly a UAV over Russian position, and by late evening, generate close to 3,500 photos, which would then be analysed after downloading on a computer. After target analysis and firming up on a target, which could be a Russian command and control centre or a vehicle, etc., a confirmatory recce would be undertaken to avoid waste of precious resource—artillery ammunition.

The UAV operator after confirming the presence of the target by undertaking a repeat flyover would then coordinate/direct the artillery fire using tablets and portable internet terminal of the Starlink system.[7] As early as October 2022, Ukrainian forces were successfully landing a direct hit on a target using three rounds of US supplied M777 howitzer.[8] Other weapon systems such as the Excalibur GPS-guided artillery shells and the US HIMARS rocket systems when guided by UAVs became even more potent in neutralising Russian targets.

## Drone Attacks at Sea

On 29 October 2022, seven uncrewed surface vessels (USVs) attacked Sevastopol harbour, hitting a frigate and a mine sweeper. The attack by canoe-sized marine drones was an innovative concept and the impact of the attack exceeded the physical destruction caused to the Russian navy.[9] Each of these boats mounted an electro-optical/infrared periscope and a Starlink satellite communications antenna which enabled transmission of multiple video feeds and helped in piloting over long distances.[10]

Some of the leading analysts have opined the attack as start of a new age in naval warfare, even though it is not the first time that USVs have been used to attack enemy ships in warlike situations.

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[7] Kurt Vinion, **"How Elon Musk's Starlink Became Invaluable to Ukraine's War Effort"**, *Radio Free Europe Radio Liberty*, 20 October 2022.

[8] Sam Skove, **"Near The Front, Ukraine's Drone Pilots Wage a Modern War on a Shoestring Budget"**, *Radio Free Europe Radio Liberty*, 31 October 2022.

[9] H I Sutton, **"Why Ukraine's Remarkable Attack on Sevastopol Will Go Down in History"**, *Naval News*, 17 November 2022.

[10] Sébastien Roblin, **"Robot Kamikaze Boats Blew Up Russia's Bridge to Crimea. Again."**, *Popular Mechanics*, 17 July 2023.

On 22 March 2023, Ukrainian forces raided the Sevastopol Harbour a second time. This time, USVs were used in conjunction with UAVs,[11] an ingenious employment of emerging and disruptive technology. The Russian Navy though was prepared and the raid did not produce the desired results. The Ukrainian USVs were destroyed by Russian defensive fire and at least one was caught in the harbour's floating boom defences. Despite failure of the raid, it had a major impact to induce caution in Russian Navy.

On 17 July 2023, Ukrainian USVs targeted the Kerch Bridge, linking Crimean Peninsula to mainland Russia. One bridge segment was destroyed, and another was dislocated by more than 30 inches.[12] War-time destruction of bridges has always been difficult operation. Employment of UAVs and USVs perhaps may provide an answer to this vexed military problem.

The novelty of Ukrainian operations lies in the use of off-the-shelf, non-military grade equipment to maximum effect and bridge the asymmetry in the capabilities with the Russian forces. The attacks are also significant because they leverage modern communication system, viz. Starlink and are symbolic of a 'swarm' attack, even though they do not quite fulfil the nuances of the terminology.

H I Sutton, in his article of 31 August 2023 has charted the course of development of Ukrainian USVs, which has already witnessed two generations of development.[13] Sutton notes first generation of Ukrainian USVs were initially reported in September 2022 and were employed to spectacular use in raid on Sevastopol in October 2022. These USVs were of varying designs as they were manufactured by different agencies, viz. GUR (Defense Intelligence of Ukraine), Ukrainian Navy and even crowd-funded private enterprises.

Thereafter, there was rapid enhancement of capabilities with Magura, which stands for Maritime Autonomous Guard Unmanned Robotic Apparatus family of USVs reportedly having range of 450 nautical miles (833 kilometres), top speed of 42 knots and payload of 320 kilograms. The 'Sea Baby' family of USVs are equipped with 860 kilograms of explosives and were used to damage the Kerch Bridge on 17 August 2023.

On 24 August 2023, appreciating the importance of USVs, President Zelensky recognised the 385th Separate Brigade of the Ukrainian Navy which uses a range of 'Special-Purpose Naval Unmanned Systems', another first in terms of raising a special unit of USVs, in the annals of drone warfare.

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[11] H I Sutton, **"Ukraine's New Maritime Drone Revealed"**, *Covert Shores*, 22 March 2023.

[12] Marc Santora, Neil MacFarquhar and Haley Willis, **"Explosions Damage Crimea Bridge as Russia Blames Ukraine for Attack"**, *The New York Times*, 17 July 2023.

[13] H I Sutton, **"World's First Specialized Explosive Naval Drone Unit Formed in Ukraine"**, *Naval News*, 31 August 2023.

## Unmanned Ground Vehicles

The first half of 2023 saw interesting developments on the frontlines of the battlefields when both Russia and Ukraine began testing and deploying Unmanned Ground Vehicles (UGVs) in operations. Russian armed forces began by employing remotely controlled old tanks loaded with explosives against Ukrainian infantry and defences. Around the time they were also working on "higher-tech, self-driving options such as the Marker UGV, which has demonstrated AI and machine learning capabilities and has been able to traverse through controlled environments without an operator."[14] Four Russian Marker UGVs were reportedly deployed for operations in Eastern Donbas in January 2023.[15] Marker is a three-ton modular system which can mount grenade launchers, heavy machine guns, anti-tank guided missiles and electronic warfare equipment.[16]

Ukraine began receiving UGVs around the same time. Germany and Estonia promised delivery of 14 THeMIS UGVs configured for casualty evacuation.[17] Parallelly, many small-scale enterprises, innovators and engineers were working with experimental technologies to carry anti-tank mines, remotely operated machine guns and even 20 mm canons. These experimental technologies are relatively inexpensive and a prototype can cost less than US$ 1000.

## Drones Transforming Warfare

War has an enduring nature, but warfare or the 'way war is made' is dependent on number of factors, not the least on technology. New and disruptive technologies are making wars extremely complex and dynamic and will dominate all future battlefield. They help generate huge volumes of data, identify new threats and vulnerabilities and the latest generation of weapon systems and platforms are extremely precise and lethal. The new generation of sensors, satellites, and radars in conjunction with AI are shortening the decision-making cycle and increasing the operational tempo of wars in unimaginable ways.

Where do the drones fit in this changing character of warfare? Are they a revolutionary concept? The unmanned systems have been used in wars since centuries ago. USVs, packed with explosives or fire, have been used in the age of

[14] **"Ground Vehicles are the New Frontier in Ukraine's Drone War"**, *US News*, 13 July 2023.

[15] Ellie Cook, **"How Russia's 'Marker' Combat Robots Could Impact Ukraine War"**, *Newsweek*, 18 January 2023.

[16] Zachary Kallenbornand and Marcel Plichta, **"Release the Robot Hounds: Providing Unmanned Ground Vehicles to Ukraine"**, CSIS, 3 April 2023.

[17] **"Germany in Collaboration with Estonia to Deliver 14 THeMIS Robots to Ukraine"**, *Army Recognition*, 19 December 2022.

sailboats to target ships at sea and in harbour.[18] UAVs date back to World War I, even though they were never deployed in combat. The British pilots used drones for target practice during World War II and during Cold War the US Navy had helicopter drones to drop torpedoes on Russian submarines.[19]

In this context, the unmanned systems are neither new, nor a revolutionary concept. However, inexpensive platforms and their ability to harness the limitless possibilities of AI will enable drones to transform warfare. During the GWOT, the US Predator and Reaper drones entered the lexicon of common man. They are large military grade aircraft and very expensive. The ongoing Russia–Ukraine War is witnessing a different dimension of drones. There is a surge of small, inexpensive, off-the-shelf and even recreational drones in the battlefield, in all three domains—land, sea and air.

Fifth and fourth generation aircrafts cost millions of dollars and very few countries can maintain a fleet of these aircrafts. In comparison, drones are inexpensive and expendable, yet an extremely potent tool of warfare. They can perform a wide variety of tasks, from ISR, to directing artillery fire, chemical, biological, radiological, and nuclear (CBRN) operational tasks, and many more. In addition, the unmanned systems have an advantage of providing persistent presence and reducing risk to the crew.

Employment of small, inexpensive drones that are freely available has democratised warfare. They are no longer a monopoly of developed nations. The innovative use of unmanned systems, limited only by human imagination, is bridging asymmetry with advanced militaries and between state and non-state actors. UGSs for example may be employed as landmines or even 'suicide bombers'. Small UGVs packed with explosives can infiltrate enemy defences, crash into defences, explode under enemy tanks and guns.

In the aerial domain, 2022 was the year of quadcopters. Chinese DJI Mavic quadcopter was widely used by both the sides for ISR. Early 2023 saw the emergence of the first person view (FPV) drones and later in the year they were being employed in an unprecedented and astounding scale—with Russians reportedly employing *hundreds of thousands* every month.[20] According to some studies, the average life of

[18] Uncrewed surface vessels to strike a fleet, whether at sea or in the safety of a naval base or a sheltering inlet, are a long-established choice in naval warfare. In the age of sail boats small, uncrewed vessels packed with explosives—or fire—were released against surface combatants to damage, disable or, in the most successful case, sink them. See Alessio Patalano, **"Ukraine's Drone Raid on Russian Naval Base was Tactically Innovative But Not Revolutionary"**, *ASPI*, 10 November 2022.

[19] James Packard and Eli Kintisch, **"How Drones Are Transforming Warfare"**, *Scripps News*, 18 July 2022.

[20] There are reports to suggest that Ukraine manufactures 50,000 FPVs per month, while Russia potentially manufactures up to 300K FPVs monthly. See **"Ukrainian Claims that the Country Manufactures…"**, X (formerly Twitter), 30 November 2023.

drones in battlefield in August 2023 was three months and Ukraine was reportedly replacing them at the rate of five to ten thousand per month.[21]

The battlefields in Ukraine are flooded with UAVs constantly monitoring the evolving situation. The battlefield transparency when combined with AI-assisted targeting systems are resulting in near instantaneous destruction of targets. Russia and Ukraine have deployed UAV-fed and AI-backed integrated battlefield management systems which have increased transparency to a level wherein a column of tanks or troops on the move are being located in three to five minutes and hit in the next three minutes. The survivability on the move is less than ten minutes.[22] As AI technology matures and countries develop and acquire swarm drone capabilities, there are fears that drones have the potential to become weapons of mass destruction.[23]

[21] Scott Simon, **"How the Use of Drones in Ukraine Has Changed War As We Know It"**, *NPR*, 5 August 2023.

[22] Steven Feldstein, **"AI in War: Can Advanced Military Technologies be Tamed Before It's Too Late?"**, *Bulletin of the Atomic Scientists*, 11 January 2024.

[23] David Hambling, **"What Are Drone Swarms and Why Does Every Military Suddenly Want One?"**, *Forbes*, 1 March 2021.

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