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Game Changers in the Sky: Drones as Force Multiplier in the Russia – Ukraine War

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Abstract

The Russia–Ukraine war, ongoing since 2014 and escalating dramatically in 2022, has redefined the battlefield through the extensive employment of drones by both nations. This issue brief analyses the use of unmanned aerial systems (UAS) from tactical to strategic levels, examining how Ukraine and Russia have adapted drone technology to serve military objectives across a diverse geographical theatre. The document covers drone evolution, operational integration, battles influenced by drone warfare and electronic countermeasures, offering insight into the future of asymmetric warfare and implications for global military doctrine.

Keywords: Russia, Ukraine, Drones, Asymmetric Warfare, FPV (First Person View), Shahed-136, Loitering Munitions, Electronic Warfare

Introduction

Geographical Extent and Context of the Conflict

The Russia–Ukraine conflict escalated significantly on 24 February 2022 when Russia launched a full-scale invasion of Ukraine. Russian forces advanced from multiple directions, including from Belarus toward Kyiv, from Russia into northeastern regions such as Kharkiv and Sumy, and from Crimea into southern regions like Kherson and Zaporizhzhia. The Donbas region, comprising Donetsk and Luhansk Oblasts, which had been a focal point since 2014, witnessed intensified fighting in 2022. Kyiv, although threatened in February and March 2022, never fell. Kharkiv, Ukraine's second-largest city, endured heavy shelling but remained under Ukrainian control. Mariupol faced a devastating three-month siege, while Kherson became the first provincial capital to be captured by Russia, only to be retaken in November 2022. Other southern cities, such as Zaporizhzhia and Mykolaiv, were also repeatedly targeted.

The Dnipro River served as a significant operational barrier throughout the war. Ukrainian forces worked to disrupt Russian crossings and protect the west bank of Kherson, while Russia aimed to secure and expand its bridgeheads. The conflict has created Europe's largest refugee crisis since World War II, with more than six million Ukrainians seeking refuge

in countries like Poland, Romania, Moldova, Slovakia, and Hungary. As of April 2025, Russia controlled approximately 20% of Ukraine, including Crimea and parts of Donetsk, Luhansk, Kherson, and Zaporizhzhia, spanning a frontline of approximately 1,000 kilometers. The conflict's geographical scale reflects its far-reaching impact, stretching across varied terrains and international borders (Walker, 2025).

Forces Involved

At the beginning of the invasion in February 2022, Russia's armed forces consisted of roughly 900,000 active-duty personnel, while Ukraine had about 200,000 to 250,000. Over time, both sides expanded their forces significantly. By early 2025, Ukraine's military had grown to an estimated 880,000 personnel (Mazurenko, 2025)**, while Russia increased its troop levels toward a target of 1.5 million, with approximately 700,000 deployed in Ukraine by 2025**(Safronova, 2025)**. Russia's military included a mix of Ground Forces, Aerospace Forces, Navy, Strategic Rocket Forces, and Airborne Forces, supported by paramilitary groups such as the Wagner Private Military Company and Chechen units. Ukraine, meanwhile, expanded its Ground Forces, Air Force, Navy, Territorial Defence Forces, and National Guard, incorporating foreign volunteers into the International Legion.**

Initially, both sides relied heavily on Soviet-era armaments, but the protracted conflict and international aid transformed their arsenals. Russia, facing heavy losses, resorted to older and refurbished systems. Ukraine, receiving significant Western aid, introduced advanced weaponry including tanks and modern air defence systems. Ukrainian air defences transitioned to NATO-supplied platforms, effectively countering Russian air and missile threats. At sea, Ukrainian drone boat tactics limited Russian naval operations in the Black Sea. **Both nations employed drones extensively for reconnaissance, attacks, loitering munitions, and electronic warfare, reshaping battlefield tactics and outcomes.**

Major Battles of the Russo–Ukrainian War (2014–2025)

The war has seen numerous key battles across various stages. Notable engagements include the 2014 annexation of Crimea, where Russian forces secured a swift victory. Battles like the Siege of Sloviansk and Ilovaisk followed, with mixed outcomes. Intense fighting at Donetsk Airport and Debaltseve in 2015 saw significant Russian and separatist gains. The 2022 invasion brought the Battle of Kyiv, a major Ukrainian victory that repelled Russian advances. Mariupol suffered a long siege ending in Russian control, while Ukraine succeeded in

counteroffensives in Kharkiv and Kherson. The Battle of Bakhmut, dominated by Wagner forces, ended in a costly Russian victory. Continued fighting in Avdiivka and the 2023 southern offensive led to a prolonged stalemate, with entrenched defences and heavy casualties on both sides (Davis Jr. & Fitzgerald, 2025).

Ukrainian Use of Drones

Ukraine has employed drones innovatively and extensively. Small drones equipped with molten thermite munitions were used to destroy damaged Russian tanks, ensuring they could not be repaired or reused. **These drones also targeted hidden enemy positions, proving cost-effective and efficient. With over 96% of Ukraine's drone fleet domestically produced, a decentralized manufacturing ecosystem has emerged.** This allows rapid innovation but also presents logistical challenges due to the diversity of drone types. In 2025, Ukraine planned to procure around 4.5 million FPV (first-person view) drones, reflecting its prioritization of drone warfare (Nabukhotny, 2025).

Russian Use of Drones

Russia has used drones extensively for offensive operations, particularly targeting Ukrainian cities such as Odesa. **These attacks involved waves of long-range drones causing civilian casualties and infrastructure damage, including blackouts. Russia also used loitering munitions and kamikaze drones to degrade Ukrainian defences and target logistics.**

Ukraine’s Strategic Shifts

From the outset, Ukraine adopted asymmetric warfare strategies, including decentralized command and small-unit tactics. It increasingly relied on special forces and drones, employing guerrilla-style tactics and maritime drones to challenge Russian assets, particularly in the Black Sea. Training from NATO countries and integration of advanced Western systems like HIMARS, Leopard tanks, and Patriot missile systems necessitated adjustments in command and logistics. **Ukraine also focused on targeting Russian logistics and command centres through drones, artillery, cyber operations, and electronic warfare.** Domestic defence production scaled rapidly to offset unreliable foreign supplies.

Russia’s Strategic Shifts

After failing to capture Kyiv early in the war, Russia shifted to attrition tactics, emphasizing artillery and manpower. The use of Wagner mercenaries was pivotal in campaigns

like Bakhmut. Russia improved counter-drone and electronic warfare capabilities, deployed its own FPV drones, and built extensive trench systems and defences, especially in Zaporizhzhia and Kherson. **Missile and drone strikes on infrastructure, including Ukraine's power grid, became a regular feature of Russian strategy.** By 2023, defensive measures such as minefields and anti-drone systems became widespread.

Key Mutual Developments

Both sides engaged in information warfare and propaganda, leveraging social media to influence perceptions and morale. **Technological escalation led to a "military innovation race," particularly in drones, electronic warfare, and AI-assisted targeting.** Ukraine grew increasingly dependent on Western aid, while Russia sought assistance from Iran, North Korea, and China (Zafra et al., 2024).

Drone and Missile Strikes

Russia launched several major missile and drone campaigns, particularly in the winters of 2022 and 2023, targeting Ukraine's energy infrastructure and major cities like Kyiv. Iranian-made Shahed drones were used in swarms, while ballistic missiles like the Kinzhal targeted hardened bunkers. Ukraine retaliated with long-range drone strikes on Russian air bases, naval assets in the Black Sea, and symbolic targets in Moscow. Notable was Operation Spider's Web in June 2025, involving coordinated drone strikes on four Russian airbases.

Lessons Learnt in Drone and Missile Warfare

The war demonstrated the value of asymmetric tools like kamikaze drones, which imposed high costs on air defence systems. Swarm tactics overwhelmed layered defenses, highlighting the need for integrated electronic, radar, and missile systems. Real-time surveillance via ISR drones improved strike accuracy. Both nations rapidly developed and localized drone production, using commercial tech and 3D printing. **Electronic warfare proved vital, as jamming and spoofing disrupted drone operations.** Strikes in cities had strategic psychological effects, influencing civilian morale and political dynamics.

Scale of Drone Usage

Scale of Drone Usage by Russia and Ukraine

Unmanned Aerial Vehicles (UAVs) and Drones The war in Ukraine has seen an unprecedented scale of drone usage by both Russia and Ukraine, across reconnaissance, attack,

and loitering roles. This includes everything from small commercial quadcopters to large military-specific UAVs.

Surveillance and Recce Drones Russia has extensively used drones like the Orlan-10 (a small fixed-wing reconnaissance UAV) to direct artillery fire. Orlans became ubiquitous over the front – so much so that Russian artillery units struggled when electronic warfare grounded many Orlans in early 2022. Russia also deploys larger reconnaissance UAVs such as the Forpost (Israeli Searcher II clone) and Outpost and uses specialized drones (e.g. Zala models) for artillery spotting and electronic warfare (one system, Leer-3, uses Orlan-10s to spoof cell networks). Ukraine initially had a limited drone fleet: a few indigenous models and commercial drones. However, the famed Bayraktar TB2 armed drone provided by Turkey gave Ukraine a high-profile success early on – TB2s destroyed Russian armour and even sank naval vessels (the Moskva cruiser's targeting support and multiple patrol boat hits were aided by TB2s). By mid-2022, Russian air defences and jamming had made TB2 operations difficult, but Ukraine had already shifted to fielding hundreds of smaller UAVs. Both sides now rely on quadcopters and small fixed-wing drones (such as DJI Mavic, Autel, Leleka-100, Furia, etc.) for short-range reconnaissance, artillery correction, and even dropping grenades on enemy trenches. **This has turned the front line into a highly surveyed space – virtually every platoon has drone eyes in the sky.**

Loitering Munitions and Kamikaze Drones Starting in 2022, Ukraine received some Western loitering munitions like the Switchblade 300/600 (small kamikaze drones) and later developed its own, but the scale was initially limited. Russia, in contrast, introduced the ZALA Lancet loitering munition in significant numbers by 2023. The Lancet is essentially a small kamikaze drone with a payload capable of destroying artillery and radar systems. Lancets have successfully struck dozens of Ukrainian howitzers, vehicles, and even at least one naval vessel in port. Russia's Lancet usage demonstrated the lethality of small, expendable drones against high-value equipment at the front. **By 2023, Ukraine also began manufacturing or acquiring similar first-person-view (FPV) attack drones – inexpensive kamikaze drones piloted via video goggles – to target Russian tanks and trenches.** This grassroots drone warfare has become so prevalent that by 2024 both sides might expend hundreds of small attack drones in a single week.

Long-Range Strike Drones One of the defining features of the war has been Russia's use of Iranian-made one-way attack drones. In the fall of 2022, Russia began importing Shahed-136 loitering drones from Iran (rebranded as Geran-2 by Russia). These delta-wing

drones, sometimes called "kamikaze drones," carry a 40kg warhead and have a range of ~2,000 km but fly slowly and noisily. Russia launched Shaheds in swarms at Ukrainian cities – especially targeting power infrastructure in late 2022 and early 2023. While many are shot down by air defences, some got through; their low cost lets Russia erode Ukraine's stocks of expensive SAM missiles. By 2025, Russia has even started producing a local version of the Shahed (with imported components) to sustain this campaign. In response, Ukraine innovated its own long-range drones: it has used repurposed Soviet recon drones (Tu-141 Strizh modified as a cruise missile) and developed new long-range UAVs (various prototypes with ranges of 500+ km). **Throughout 2023 and into 2024, Ukraine carried out drone strikes on Russian territory, hitting targets in Moscow (even the Kremlin roof in May 2023, allegedly) and remote airbases (like the destruction of strategic bombers at Engels and Soltsy in late 2022 and 2023).** Ukraine also introduced naval unmanned surface vessels (USVs) – essentially kamikaze drone boats – which attacked Russian naval assets (addressed in naval section). By 2025, both nations are engaged in a drone arms race, with Russia deploying new variants like a Shahed-136 lookalike produced domestically and Ukraine fielding a myriad of drones, often crowdfunded or 3D-printed, for both reconnaissance and strike(Zafra et al., 2024).

Electronic Warfare vs Drones The proliferation of drones led to intense electronic warfare efforts. Russian EW units use truck-mounted jammers (e.g. Pole-21, Krasukha-4) to disrupt GPS and radio links, often bringing down or "blinding" drones. Ukrainian troops have adapted by using anti-jamming tactics and deploying their own EW (with NATO-supplied systems and locally made drone jammers) to counter Russian UAVs. **Both sides even use anti-drone drones – small UAVs attempting to physically net or ram the opponent's quadcopters.** The sky over the battlefield is a contested domain of its own, as hundreds of unmanned systems operate under constant threat of electronic or kinetic interception(IISS, 2024).

Electronic Battlefield

In essence, the electronic battlefield is as contested as the physical one. Russian commanders have noted that in Ukraine, drones and communications can be knocked out in minutes by EW highlighting the sophistication of Ukrainian electronic countermeasures now. Conversely, Ukrainian drone operators often call it the "world's most jammed war", where flying a UAV for long is a challenge due to Russian EW. **Both sides continuously adapt e.g., switching frequencies, hardening GPS, using fibre-optic guidance for drones (Russia in 2024 started using tethered drones safe from jamming).** The struggle for the

electromagnetic spectrum has become a silent backdrop to every engagement, from a small skirmish (where soldiers try to use encrypted radios and avoid detection) to large strikes (where decoys and jammers are employed to enable a missile to hit its mark)(Stepanenko et al., 2025).

Conclusion

In conclusion, from 2022 to 2025 the Russia-Ukraine war has transformed from a fast-moving invasion with disparate Soviet-era forces to a gruelling war of attrition between two increasingly well-equipped armies. Russia's forces grew in size but are increasingly a mix of old and new – modern missiles and Soviet tanks, veteran units alongside hastily trained conscripts. Ukraine's forces dramatically expanded and modernized, transitioning onto NATO weapon systems and demonstrating remarkable ingenuity (like electronic warfare and drone innovation) to counter Russia's larger military. **The conflict's evolution shows both the resilience of the combatants and the significant impact of international support and military-industrial mobilization on sustaining a long war.** Each side's composition and armaments in April 2025 reflect a hard-fought equilibrium – one that could yet tilt with further breakthroughs in strategy or technology, or the exhaustion of one side's capacity to continue the fight.

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