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## **From drones to doctrine: Why Russia's air war in Ukraine is a warning for Europe**

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### **ABSTRACT**

This article examines the transformation of Russia's use of drones in the war against Ukraine from improvised tactical employment into a formalised military doctrine. Drawing on primary and secondary open sources, including defense and think tank reports, and media investigations, the study analyzes the growth of Russia's industrial production capacity, tactical innovations, and integration of unmanned aerial vehicles (UAVs) into hybrid warfare doctrine.

This article identifies five key features of Russia's drone doctrine. First, industrial-scale production and distributed supply chains. Second, layered saturation tactics that combine decoys, kamikaze drones, and AI-enabled swarms. Third, tactical adaptations such as jet-powered UAVs and fiber-optic control systems. Fourth, integration of drone operations into hybrid campaigns targeting civilian resilience. Fifth, the Russian systematic use of Ukraine as a testing ground for concepts that could later be used in NATO's eastern flank.

The conclusions indicate that Russia's approach creates substantial vulnerabilities for NATO and EU member states. First, it is the cost asymmetries between inexpensive drones and expensive interceptors that risk eroding Western deterrence. Second, fragmented procurement patterns hinder the development of a unified counter-UAV doctrine. And finally, civil infrastructure remains vulnerable to hybrid pressure.

NATO and EU countries should urgently adopt counter-drone doctrines, stockpile affordable interceptors, expand their electronic warfare capacity, and strengthen civil defense systems. Ukraine's experience offers a unique opportunity for joint learning, but Europe's window to prepare is narrowing.

**KEYWORDS:** drones, hybrid warfare, Russia , civilian resilience

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**Introduction.** Since May 2025, Russia's drone war intensity has reached an intensity and scale that poses severe threats to European security, which European defense planners cannot afford to ignore. On 9 July 2025, just hours after the US administration announced a new package of military aid to Ukraine, Russia launched its most severe and well-coordinated drone attack since the full-scale invasion started (Harvey, 2025). In one single night, over 700 drones combined with rockets were involved in an attack across the country. Some of these were kamikaze Shaheds carrying explosive payloads, others were radar decoys to trigger Ukraine, using costly interceptor launches. Moreover, an increasing proportion were AI-enabled swarms capable of adjusting flight paths and choosing targets without real-time operator control. These recent attacks have not been just destructive to critical infrastructure (e.g., power and transportation) but have also demonstrated a strategic shift in Russia's capabilities to organize complex air campaigns around unmanned aerial vehicles (UAVs) as the pivotal operational component, not merely a secondary element to rocket attacks (Beznosiuk, 2025d). These latest developments indicate an emergence of deliberate doctrine in which drones form the backbone of strike planning that not just merely targets critical infrastructure but aims to undermine social cohesion as part of broader hybrid warfare measures (Beznosiuk, 2025a).

Since the start of the full-scale invasion of Ukraine, Russia has demonstrated a shift from ad hoc Iranian-supplied Shahed attacks to an industrially sustained, tactically diverse, and doctrinally embedded capability. This approach serves as a direct warning that warfare innovations taking place in Ukraine today might be applied elsewhere in Europe in the foreseeable future, and it is essential to examine them and prepare accordingly (Beznosiuk, 2025c). This evolution fits a broader historical pattern where innovations in one war, such as Germany's early combined-arms tactics in 1939 or the US use of precision-guided munitions in Operation Desert Storm in 1991, later became standard features of warfare elsewhere.

**The Purpose of the Article .** The purpose of this article is to trace how Russia's use of drones in Ukraine has shifted from tactical battlefield tools to a fully structured operational doctrine supported by industrial capacity and tactical innovation. This article examines the key drivers of this transition, assesses how drones are now embedded in Russia's broader hybrid warfare strategy, and analyses the resulting vulnerabilities for Ukraine, NATO, and the EU. By bringing together industrial, tactical, and hybrid-warfare dynamics, this article intends to provide a coherent framework for understanding Russia's drone-centric approach and its implications for European security planning.

**Analysis of the Recent Research and Publications.** Open-source analysis of Russia's drone program has expanded rapidly since 2022, but most assessments research only isolated elements rather than the

wider strategic logic behind Russian use of UAVs. Early reporting focused on Russia's dependence on Iranian-produced Shahed drones and its initially hindered ability to scale domestic production (Beznosiuk, 2025a; Hinz, 2025). Subsequent work by Ukrainian and international defense outlets has highlighted the rapid industrial expansion across Tatarstan, Udmurtia, and Bashkortostan, along with the emergence of sanctions-evasion networks supplying key electronics and components (Axe, 2025; Denisova, 2024; Beznosiuk, 2025c; GTRKRB, 2025; Global Initiative Against Transnational Organized Crime, 2025).

Technical and tactical reporting documents Russia's shift from basic kamikaze UAVs to a diversified portfolio that includes jet-powered drones, fiber-optic-guided platforms resilient to electronic warfare, airborne relay systems, and AI-enabled swarm coordination (Maksymiv, 2025; MKRU, 2025; RGRU, 2025; Interfax, 2025; TASS, 2025a; Pryhodko, 2025; TopWar, 2025a). Jointly, this analysis demonstrates a pattern of continuous battlefield adaptation, in which battlefield feedback loops facilitate rapid iterations across design, range, survivability, and operational use. Also, new research examines the Russian integration of UAVs into hybrid strike campaigns targeting Ukraine's energy system, logistics, psychological resilience, and mobilisation infrastructure (Beznosiuk, 2025). It sheds light on a shift from episodic strikes to a more systematic pressure intended to degrade both material capacity and civilian morale.

Despite the breadth of available reporting, existing literature generally treats industrial scale, tactical innovation, and hybrid effects as separate domains. Currently, there is no research examining how these components interplay to form an emerging Russian drone doctrine that incorporates mass production, multi-layered strike tactics, and hybrid objectives into a coherent operational model. This article addresses that gap by synthesising these dimensions and analyzing how Russia's drone-centric warfare approach reshapes the threat landscape for Ukraine, NATO, and the EU.

**Methodology** . This article draws on both primary and secondary open sources from 2024 to 2025. Primary sources include defense industry reports, production data, and official statements from the Russian and Ukrainian governments and industry players. Secondary sources include think-tank publications, media reports, and technical analyses that interpret this information. These sources were selected for their timeliness and relevance to Russian drone production, tactical employment, and the integration of hybrid warfare. The applied method is comparative and interpretive. The article traces Russia's evolution from ad hoc drone use to doctrinal integration, synthesises technical and strategic evidence, and identifies implications for NATO and the EU. While it does not engage in a formal theoretical literature review, the article contributes as an applied, evidence-based policy analysis aimed at informing debates in security and defense policy.

## **From Tactical Accessory to Core Operational Doctrine**

Initially, Ukraine had the edge in drone development and usage, with Russian drone usage relying mostly on conducting reconnaissance and conducting limited attacks against critical infrastructure and in frontline areas (Beznosiuk, 2025c). However, Russia started to catch up in 2023 with a substantial acceleration in drone production in late 2023 and 2024. In 2024, production increased tenfold from 2023 to reach 1.4 million drones (Denisova, 2024), and plans for the 2025 project anticipate a nearly 3-fold increase (Axe, 2025). This production base enabled Russia to integrate drone production into the heart of its operational planning, with drones like Shaheds being increasingly used to probe air defenses and map radar coverage, leading to the subsequent targeting of critical assets. Gerbera-style decoys force defenders to expend high-value air defense munitions (Beznosiuk, 2025a). FPV-guided “mini-Shaheds” conduct precision strikes on armour and logistics, while AI-enabled variants coordinate swarms that penetrate defense lines efficiently with minimal losses.

Since the spring of 2025, Ukrainian air officials have reported that Russia has increasingly used drones in layered sequences, where Shahed-type UAVs often serve as decoys, being flown into known radar arcs to trigger defensive fire, followed by other strike systems exploiting the revealed positions (Defence Express, 2025b). Such tactics have been observed in frontline areas like Kharkiv and, at times, during deeper strikes on cities including Dnipro. Russia's drone strategy has a two-fold approach. The first part involves wearing down both personnel and equipment while maintaining the Ukrainian air-defense staff in a state of permanent readiness (Beznosiuk, 2025b). The second element is a dual-purpose targeting logic of not just achieving conventional military objectives and degrading critical infrastructure, but also eroding civilian morale with the intent to undermine social cohesion within Ukraine. While the first part of this strategy has proven partially successful, as Ukrainian resources have been substantially depleted, the second part is also crucial, considering the extent of moral exhaustion and the limited capacities to shelter the civilian population and provide psychological support.

## **The Industrial and Supply Chain Backbone**

Russia's ability to transition from infrequent drone targeting to subsequent doctrinal incorporation in its military strategy rests on its increasing resilience and growing industrial base.

Alabuga Special Economic Zone in Tatarstan has become one of Russia's central drone manufacturing areas, growing by over 160 hectares since late 2024 and producing multiple classes of UAVs (Hinz, 2025; Kohanets, 2025). In this regard, Russia has actively sourced labour not just domestically but also internationally, with numerous workers often deceived and recruited from all across the globe (e.g., Africa, Latin America, and Asia) under contracts that frequently result in coercive

employment conditions (Global Initiative Against Transnational Organized Crime, 2025). The Russian government recently announced plans to bring in 25,000 North Korean workers to ramp up production further and address potential labour shortages (Defence Express, 2025a).

Overall, Russia employs a geographically distributed drone production model to maximize efficiency and minimize security risks. While Alabuga serves as a focus area for mass production, a network of drone factories in Udmurtia and Bashkortostan produces airframes and other components (GTRKRB, 2025). This dispersion makes the network significantly harder to neutralize and aligns with the doctrine's emphasis on redundancy and adaptability. Moreover, the Russian leadership has actively worked to secure its supply chains by overcoming all sanctions. It has methodically invested in building new facilities, domestically engineered lithium-ion battery production at the UAS "Samara" innovation centre in Tolyatti (Interfax, 2025), and high-quality composite propellers and rotor blades for drones of all sizes in Novosibirsk (TASS, 2025). The Russian government has also invested in the development of Rosel's satellite-independent navigation system for drones, designed to function in GPS-denied environments and withstand cyber and electronic warfare (Rostec, 2025). All of the above recent investments reduce reliance on foreign suppliers. Furthermore, Russia has also sourced numerous components via intermediaries in the Caucasus, Central Asia, and the Middle East, avoiding interdiction efforts (Center for Global Civic and Political Strategies, 2025). In this regard, Russian customs records indicate a steady flow of dual-use electronics arriving via Armenia and Kazakhstan, indicating how sanctions leakage aids drone assembly lines. Russian universities and regional tech hubs have also been actively driving domestic drone innovation that is often overlooked. The "Partizan" drone group, developed at Reshetnev University in Siberia, is optimised for harsh climates and low-connectivity environments and incorporates airborne relay UAVs that extend the range of strike and reconnaissance drones while concealing operator positions (Maksymiv, 2025).

In turn, Russia has also actively worked to facilitate the domestic production of drones by private enterprises. For instance, Frobotics's "Svarog" family of fiber-optic drones combines an extended range of up to 30 kilometers with night vision, thermal imaging, and multiple payload configurations (TopWar, 2025a). In contrast to radio-controlled drones, fiber-optic UAVs are immune to jamming, paving the way towards overcoming EW-saturated areas in the frontline. Additionally, Russian domestic fiber-optic cables used in these systems outperform their Chinese equivalents in terms of durability, thereby minimizing breakages during high-speed manoeuvres (Ukrinform, 2025). Another recent development comes from the "Kuklovod" control system at the Perm National Research Polytechnic University, which addresses a key vulnerability in tethered UAVs: cable breakage during unwinding (MKRU, 2025). By redesigning the reel system and utilising locally produced carbon-fiber composites, engineers extended

the operational range to 25 km, enabling stable, high-speed data transmission. The system's dual ground station formats (mobile and PC-based) make it adaptable for both field units and fixed installations.

### **Tactical Innovation as Policy**

Russian drone tactics now follow a deliberate policy of redundancy, adaptability, and layered impacts aimed at exhausting Ukraine, undermining its social cohesion, and mentally exhausting its local population. Russia has made substantial progress in the tactical adaptation and development of UAVs. For instance, the recently introduced "Archangel" UAV delivers speeds of 280 km/h and modular payloads ranging from 700 grams to 7 kilograms, enabling precision strikes against bunkers, vehicles, and critical assets such as communication towers (TASS, 2025b). It offers several launch options, ground or aircraft, providing flexibility in deployment. It can fly at low altitudes and can avoid radar detection before accelerating to high speed for terminal strikes on air defense radars.

There was another recent addition: "Dan-M", a jet-powered platform capable of 750 km/h, derived from an aerial target drone (TopWar, 2025b). Its small radar profile and 3D-printed engine parts make it difficult to detect and intercept, forcing defenders to use their most capable and costly interceptors. A single "Dan-M" raid, even if intercepted, can absorb two to three interceptor missiles worth several hundred thousand dollars each, paying for itself in strategic terms. This approach is part of Russia's objective to overwhelm and wear down Ukrainian air defenses and subsequently inflict maximum damage on its critical infrastructure.

Russia has also achieved success with support platforms to expand its operational reach. With "Partizan" relay drones, the Russian army can establish ad hoc communication networks deep into contested zones, enabling FPV strikes far beyond line of sight. The "Svarog" UAVs and "Kuklovod" system enable sustained EW-resistant operations, essential for both resupply and targeting in heavily jammed environments. For instance, a "Svarog" could deliver ammunition to a forward position while simultaneously transmitting reconnaissance imagery back to a command post via a fiber-optic link, immune to jamming. Russia is also advancing counter-drone capabilities. At the "Archipelag 2025" forum, interceptors such as the AI-enabled "Skvorets PVO" and "Ovod-PVO," the manoeuvrable "Bolt" with radar integration, and the kinetic "Kinzhal" were presented (Pryhodko, 2025). These systems are designed to counter both individual UAVs and swarms. The "Krestnik-M" extends interception to maritime targets, reflecting Moscow's concern about unmanned surface threats. Supporting these is the "Tsifrovoy Dozor" acoustic network, which detects and classifies drones even under heavy jamming, and can integrate data from optical and radar systems (TASS, 2025c). A less visible but strategically important field is UAV-based exploitation. The "Uskuynik" project equips drones with a bionic arm capable of mid-air capture or ground retrieval of enemy UAVs (RGRU, 2025). The 3D-printed gripping system can be adapted for various models, allowing captured drones to be reverse-engineered,

stripped for parts, or redeployed. In an EW-heavy environment, this capability could be used not only for recovery but also to deny adversaries the opportunity to retrieve crash-site intelligence. The breadth of this portfolio demonstrates that Russian innovation encompasses the entire operational cycle, combining both offensive and defensive capabilities.

### **Drones in Hybrid Warfare**

Russia's integration of drones into hybrid campaigns mirrors its battlefield innovation. Civilian infrastructure remains a prime target. The Russian army targets power plants, hospitals, schools, and rail hubs, striking them to cause cascading economic damage, disrupt essential services, and undermine Ukraine's social cohesion (Beznosiuk, 2025a). The targeting of military recruitment centres in 2025 added a new dimension (Beznosiuk, 2025d). Strikes in Kharkiv, Zaporizhzhia, Poltava, Kryvyi Rih, and Kremenchuk destroyed undigitised conscription records and undermined mobilization efforts. Earlier incidents in Rivne, Pavlohrad, and Kamianets-Podilskiy point to a sustained strategy to degrade Ukraine's ability to replenish its forces. Such operations combine physical damage with a psychological impact, amplified by disinformation portraying the state as incapable of protecting its citizens. In a NATO context, the Russian army could seek to exploit similar tactics against mobilization hubs in the Baltic states or critical facilities in Poland, sowing instability before any open military engagement with Russia.

### **Ukraine as NATO's Test Range**

The Russian leadership has used its war in Ukraine as a testing ground for its evolving drone doctrine. From AI swarm coordination to GPS-independent navigation, Russia collects performance data, identifies weaknesses, and refines its approach through repeated field trials. The Russian shift in drone strategy serves as both a warning and an opportunity for the West. NATO and EU countries should carefully examine Russian methods in real time, obtain key insights, and implement effective countermeasures. The warning is that NATO still lacks a unified doctrine for countering large-scale autonomous drone attacks. Procurement patterns remain fragmented, with some countries investing heavily in counter-drone systems while many fall behind. Ukraine's adaptation, which includes the use of interceptor drones, mobile electronic warfare units, and decentralised production of low-cost countermeasures, offers valuable lessons for the West. Ukrainian leadership develops these measures under constant attack and severe resource constraints. NATO has the advantage of preparation time and should work much closely with Ukraine to be able to prepare for potential military escalation with Russia and its application of drones.

## **Findings**

The article showcases that Russia has institutionalised a drone-first doctrine that integrates production, tactics, and hybrid objectives. Russia backs this doctrine by industrial expansion and sanctions-resistant supply chains, which ensure maintained pressure on the Ukrainian state and society. Tactical innovations, such as AI-enabled swarms, jet-powered UAVs, and fiber-optic control systems, have bolstered resilience against traditional air defenses. The integration of drones into hybrid campaigns has widened their impact, striking energy systems, logistics, and mobilization centres to erode civilian morale. Finally, Ukraine now serves as a live testing ground where Russian capabilities are refined, providing a model that could be replicated against NATO in the near future.

## **Policy Recommendations**

These findings have immediate implications for NATO and the EU. A unified counter-UAV doctrine is required to replace fragmented national approaches. NATO and EU procurement should prioritise affordable interceptors, counter-drone UAVs, and electronic warfare systems that can offset Russia's cost advantage. EU member states should integrate civil defense infrastructure, including shelters, repair units, and resilient communication systems, into their security planning and preparedness. NATO and the EU should institutionalise cooperation with Ukraine to enable real-time knowledge transfer and joint capability development. Additionally, EU leadership should consider stricter enforcement of sanctions on dual-use technologies, particularly those transiting through third countries, to limit Russia's production capabilities.

## **Strategic Implications for Europe**

Russia's drone doctrine is designed to exploit cost asymmetries. Forcing defenders to use expensive interceptors against inexpensive drones creates a war of attrition that favours Moscow. The integration of drones into hybrid operations ensures that civil defense becomes part of the battlespace. This makes shelters, rapid repair capacity, and resilient communications as vital to survival as air-defense missiles (Beznosiuk, 2025a). The distributed nature of Russia's drone-industrial network means it cannot be easily disabled through sanctions or strikes on a small number of facilities.

For NATO and the EU, the challenge is not only to field the right technology but also to develop the doctrine and training that will enable its practical use. Defending against mass drone incursions will require integrated air and missile defense networks, stockpiles of affordable interceptors, strong electronic warfare capabilities, and a civil defense system capable of operating under sustained pressure. In the absence of such measures, critical European infrastructure, from LNG terminals in the Baltic to major transport corridors through Eastern and Central Europe, could be exposed to the very saturation tactics now being refined over Ukraine.

**Conclusion.** The integration of drones into Russian operational doctrine marks one of the most significant shifts in modern warfare since the arrival of precision-guided munitions. It reflects sustained investment, diversified innovation, and iterative learning on the battlefield. By merging conventional and hybrid warfare into a seamless whole, Russia can project power, impose costs, and destabilise adversaries without triggering the escalation thresholds that would guarantee direct retaliation. Ukraine is already living in this future battlespace. The West still has time to prepare, but the window is narrowing at a much faster pace. The West faces a choice: either use Ukraine's experience as both a warning and a guide, or face the same doctrine with its accompanying implications later under far less favourable conditions.

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