POLICY BRIEF

Russian Drone Warfare: Destruction, Development, Defence, and Deterrence

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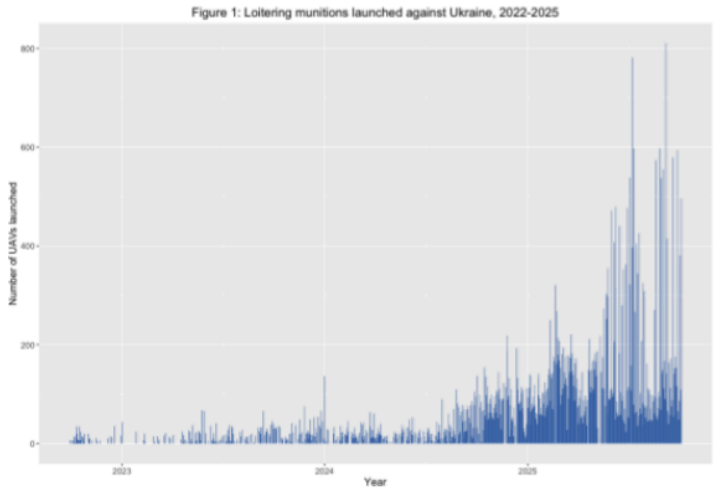
Drone warfare is one of the defining features of Russia's war against Ukraine. The war has seen the constant introduction of new technology and tactics, and in turn, new countermeasures to respond to these developments.

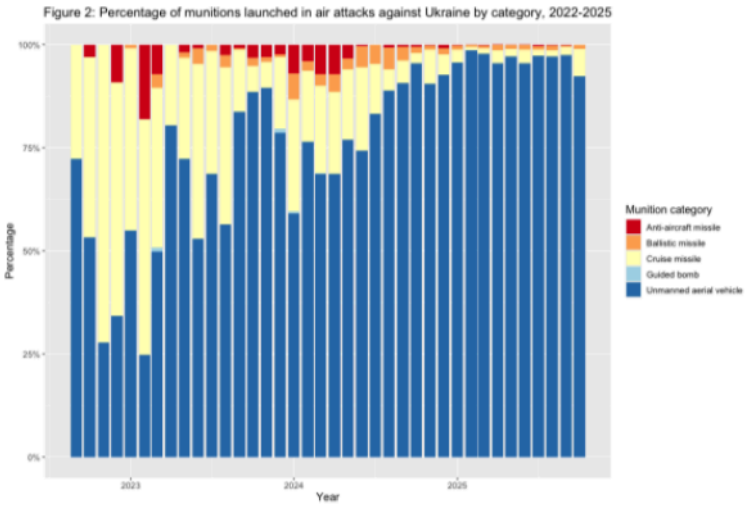
Since the beginning of the invasion, Ukraine has used both inexpensive commercially available first-person view (FPV) drones and purpose-built military unmanned aerial vehicles (UAV) to great effect in defensive and offensive operations against Russia (Naber, 2025). In response, Russia has adapted its use of drones against both Ukrainian forces and civilians. Beyond the frontline in Ukraine, Russian drones have recently violated NATO airspace (Lendon & Yee, 2025). Understanding how Russia's drone warfare has changed throughout the course of the war is critical to developing strategic responses to changing tactics.

Destruction: Drone warfare in Ukraine

Russia has drastically altered its use of drones since the start of the war in Ukraine. As illustrated in Figure 1, Russia has sharply increased the number of UAV loitering munitions launched in its air attacks against Ukrainian cities, industry, and infrastructure. Russia has primarily used these large-scale air attacks to overwhelm Ukraine's air defences, to destroy critical energy and military infrastructure, and to undermine the population's morale by launching UAVs at residential buildings and civilian infrastructure (Sonne et al., 2025).



The significant increase in the number of loitering munitions used in air attacks in proportion to other types of munitions has been driven largely by Geran-1 and Geran-2 UAVs, which are based on the Shahed-131 and Shahed-136 UAVs supplied by Iran in the early stages of the war and are currently produced domestically by Russia. In addition to increasing the sheer number of UAVs used in these air attacks, Russia has begun to change how they are used in order to avoid countermeasures; the UAVs are flown at higher altitudes to evade small arms and anti-aircraft fire from the ground (Wilson et al., 2025) and are also accompanied by "Gerbera" drones, which resemble the Geran-2 model but are made of cheap materials and often used as decoys (Hunder, 2025). The critical effect of these tactical changes is to force Ukraine to exhaust costly air defence resources in repelling air attacks.



On the frontline in eastern Ukraine, Russia has innovated on one of the war's most infamous weapons – FPV drones. Russia was the first to use FPV drones guided by fibre optic cables (Farrell, 2025), which are resistant to jamming through electronic warfare (EW), unlike those that utilize radio frequencies. Although wire-guided munitions are not new, the adaptation of this technology to drone warfare has negatively impacted the ability of Ukrainian forces to defend their lines of communication near the front (Stepanenko, 2025, p. 8). Beyond this, newer technological and software developments like artificial intelligence (AI) and machine learning (ML) are in the early stages of augmenting the capabilities of both Ukrainian and Russian drone operators (Stepanenko, 2025, p. 7).

Development: Russia's industrial production of drones

Russia's shift in drone warfare tactics has relied on significant industrial and administrative developments. Most notably, Russia has begun producing the Geran-2 UAV domestically under a major production deal with Iran (Cotovio, 2025). It is reported that Russia originally imported the drones at the cost of $200,000 USD each (Cotovio, 2025) but has since been able to reduce the cost per unit of each Geran-2 drone to $35,000 by producing them domestically, according to the Center for Strategic and International Studies (Hollenbeck et al., 2025). Russia has also reportedly begun to produce the Geran-3, a variant of the Shahed-238, which uses a jet engine instead of the piston engine found in the Geran-2, thus allowing the Geran-3 to operate at significantly higher speeds to avoid countermeasures (Stewart, 2025a).

One of the main challenges Russia faces in producing these UAVs is securing electronic components that are largely produced in the West and subject to export bans (Bennett & Ilyushina, 2023). However, Ukrainian military intelligence has reported that at least one of these components in the Geran-2 has been replaced by alternatives sourced from China (Kyiv Post, 2025). In contrast, Russia's FPV drones rely primarily on Chinese-made components (The Insider, 2025). As a result of both factors, the Kremlin has made expanding the domestic drone industry a significant priority. In January 2025, President Vladimir Putin claimed that the production of civilian drones in Russia increased 2.5 times between 2023 and 2024. Without explicit reference to procurement challenges related to technology used in military drones, he also declared that Russian drone production must become self-sufficient (Putin, 2025a).

The increased production of drones for military use has also been accompanied by organizational changes in the Russian Armed Forces. In June 2025, Putin announced the creation of a separate "unmanned systems forces" branch of the armed forces (Putin, 2025b), which the Institute for the Study of War has described as an attempt by the Russian Ministry of Defence to enforce state control over both developers and operators of drones (Cafarella, 2024). One notable development is Russia's creation of the Rubicon Center for Advanced Unmanned Technologies, which procures new drone technology and trains drone operators for combat (Krutov et al., 2025). Rubicon has reportedly played a significant role in attacking targets in the rear to damage Ukraine's supply lines to the front (Melchior, 2025).

Defence and deterrence: NATO's response to Russian drone incursions

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Russia's use of drones has recently expanded beyond Ukraine's borders. In early September 2025, over a dozen Russian UAVs violated Polish airspace, several of which were destroyed by NATO forces (Lendon & Yee, 2025). Later in the month, the airspace of several European airports was closed due to the presence of drones, which many suspect to be of Russian origin (Brown, 2025). These incidents have underscored one of the major challenges faced by the alliance in countering Russia: how exactly to respond to Russia's actions and effectively deter future provocations. Certain member states have pushed for a more forceful response, whereas others have advocated a more cautious approach (Williams, 2025). The incident in Poland was further complicated by disputes over whether the drone incursion was intentional or accidental – President Donald Trump suggested that the incursion "could have been a mistake," while Polish Prime Minister Donald Tusk declared it to have been deliberate (Lillis et al., 2025). In the days that followed, further incursions of both Romanian and Estonian airspace, including by fighter jets in the case of the latter (Brown, 2025), indeed suggest that Russia was testing both NATO's political response and air defences when its drones originally violated Polish airspace.

The situation provided valuable intelligence to Russia about NATO's response at an operational level, including what types of resources – such as fighter jets – were used to respond and how long it took them to do so (Lillis et al., 2025). In the days that followed, NATO initiated Operation Eastern Sentry, which included the deployment of several fighter jets to the alliance's eastern flank (North Atlantic Treaty Organization, 2025). This response demonstrated a critical challenge faced by NATO: how to effectively counter Russian drone warfare. Although NATO could likely thwart an air attack akin to those launched against Ukraine, the cost of responding to a large-scale attack of this kind is likely unsustainable when repeated over the long-term (Cotovio & Sebastian, 2025).

NATO should look to Ukraine for ways to improve its drone and counter-drone capabilities: Ukraine uses a multilayered system that involves tracking UAVs and using EW systems to disable them or minimize their accuracy, machine guns to down drones flying at low enough altitudes, and interceptor drones to destroy those outside the range of ground fire (Jensen & Atalan, 2025; Kunyzkyj, 2025). In terms of technological developments, Ukraine has reportedly developed a directed energy weapon to disable UAVs, although it is unclear at present to what extent it has been used operationally and to what degree of success (Knight & Fox, 2024).

The September drone incursions and more recent drone sightings at airports and military bases in Europe (Stewart, 2025b) have demonstrated the need for NATO and the EU learn from Ukraine's experience and improve their capacity to safely track and intercept drones, particularly around critical infrastructure. Poland has already begun to do so, having initiated a joint training program with Ukraine to learn their counter-drone tactics (Hunder et al., 2025). The EU has proposed a "European Drone Defence Initiative," which explicitly intends to use information from Ukraine's experience with drone warfare to develop a "multi-layered, technologically advanced system with interoperable counter-drone capabilities for detection, tracking, and neutralisation" (European Commission, 2025). NATO, for its part, must establish a clear and unified strategic response with credible consequences in response to violations of its member states' sovereignty (Williams, 2025).

Policy insights

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1. One of the most notable characteristics of the war has been the continuous development of new technology and countermeasures in the realm of drone warfare. NATO and its member states must follow these developments closely and adapt their technological procurement accordingly.

2. The production of various types of UAVs is a state priority for Russia, and as the country looks for alternatives to Western-made components, either produced domestically or sourced from other countries such as China, interdicting the production and import of these components will become increasingly difficult.

3. The response to Russia's drone incursions demonstrated a need for NATO to ensure it is prepared to respond to Russian drone warfare, both in massive air attacks against civilian infrastructure and on the battlefield. To this end, NATO and its member states must:

- Develop a clear strategy for responding to Russia's violations of member states' airspace, with the aim of deterring future incursions and reducing the chance of strategic miscalculation (Williams, 2025);

- Collaborate with Ukraine to learn from their tactical experience with drone warfare, in both offensive and defensive operations; and,
- Be adequately equipped to respond to drone warfare, including through the development a multi-layered, interoperable system of detection and defence.

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