

BRIEF

IN A STATE OF DENIAL:
THE AIR WAR IN UKRAINE

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Ukraine's ability to repel one of the world's leading military powers has surprised the world. In the air domain, the skies over Ukraine have remained contested despite Russia's technological and numerical advantages. This brief describes Ukraine's defensive (air denial) and offensive air doctrines and considers the potential impact of introducing Western fighter aircraft to the battlefields in Ukraine.

AIR DENIAL

Western air forces adhere to an air domain strategy first laid out by military thinkers in the nineteenth and twentieth centuries that seeks to win and maintain 'air superiority'—the ability to conduct air operations "without prohibitive interference by the opposing force."¹ For many strategists, this is the single most critical factor in a large-scale military campaign, as operations on land or sea are virtually impossible for a force that cannot control the skies.²

Yet, since Russia's full-scale invasion of Ukraine in February 2022, neither Russia (despite its superiority in numbers and capabilities) nor Ukraine has been able to establish air superiority. With fewer and less capable air domain assets, Ukraine has instead been obliged to adopt the less costly objective of denying Russia's ability to obtain air superiority—essentially adopting the inherently defensive strategy of 'air denial.' By denying access to a limited portion of airspace and essentially enabling temporary or localised air superiority, a strategy of air denial limits an opponent's ability to conduct operations or operate to its fullest capacity.³

Ukraine's mobile and dispersed air defence units have thus denied Russia unfettered access to the skies over most of the country, keeping Russian aircraft at bay and under threat and limiting the effectiveness of Russian missile attacks.⁴ Russia, meanwhile, did not seriously attempt to establish air superiority in the opening days of the war and has still not committed most of its air force to operations in Ukraine. Instead, it has responded by introducing more Russian air defence batteries to keep Ukrainian pilots and assets from accessing Russian-occupied areas, such as the Donbas.⁵ Russia and Ukraine are thus locked into mutual air denial.

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This is a practical and relatively successful air strategy for Ukraine. However, for it to remain so will require Ukraine to sustain continuous air defence operations and the West to commit to a steady supply of military assistance. Mutual air denial is essentially an attritional form of warfare from which Russia is likely, ultimately, to draw greater benefits.

AIR DEFENCE TO AIR DENIAL

Ukraine's air denial operations have severely limited the effectiveness of certain Russian air assets, in particular combat aircraft. As a result, Russia has relied heavily on missile, artillery, and drone attacks, increasingly targeted at civilians, and earning the conflict the grim title of 'Putin's missile war.'⁶

Ukraine has been able to use a variety of air defence assets to defend against Russia's missile

and drone attacks. Anti-aircraft guns such as the German Gepard or US Avenger have been used to great effect against drones, however, the backbone of Ukraine's air defence is its surface-to-air missile (SAM) systems.⁷ At first, this force primarily consisted of mobile, ex-Soviet 9K33 Osa [SA-8 *Gecko*], S-300 [SA-10 *Grumble*], and 9K37 Buk [SA-11 *Gadfly*] units, deployed in short-, medium-, and long-range layers. Layering has remained a core tenet of Ukrainian SAM deployment as Western medium- to long-range systems, such as IRIS-T, NASAMS, SAMP/T, Aspide, and Patriot, have been introduced alongside legacy Soviet equipment.⁸ Regarding short- and very short-range SAM systems, Ukraine has employed portable air defence weapons such as Igla and Stinger, which have even been credited with taking down Russian cruise missiles.⁹

This layered system has proved remarkably effective. For instance, in May 2023, Ukraine reported downing around 90% of Russian cruise missiles and drones, nearly 80% of air- and ground-launched ballistic missiles nationwide, and 100% of ballistic missiles attacking areas where ballistic missile defences (Patriot) were present.¹⁰ However, since summer 2022, Russia's drone and missile attacks have been aimed at a broader and less predictable set of targets, including cities, civilian energy infrastructure, Western-supplied missile stocks, and dispersed aviation infrastructure such as airstrips and pilot training facilities.¹¹ This shift is likely a response to the success of Ukraine's air defence system but also underlines President Putin's commitment to a grinding war of attrition.

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A strategy of air denial forces Ukraine to make difficult choices regarding the targets it wants to deny to Russia, whether it be Ukrainian cities, critical defence and civilian infrastructure, or the front lines. There are thus significant risks to Ukraine's war aims if Russia's attacks become increasingly indiscriminate or if Western military assistance slows down.

COUNTERING AIR DENIAL

Russia's air denial has similarly constrained Ukraine's own air operations. Ukraine possesses a fleet of combat aircraft, mostly ageing ex-Soviet Mikoyan MiG-29, Sukhoi-25, and Sukhoi-24 fighters, and a small number of Sukhoi Su-24 tactical bombers.¹² The fleet is depleted, but some of these aircraft remain viable. However, like the Russian invaders, Ukrainian pilots are restricted to nimble operations over their own controlled territory. Infiltration of the air defence-saturated Russian-controlled airspace is possible only through stand-off attacks, in which munitions are launched from a distance, beyond the range of most of Russia's ground-based air defences.¹³ Western munitions such as the American-made Zuni rockets, or British Storm Shadow and French SCALP cruise missiles, have allowed Ukrainian aircraft to operate from a significantly greater range and to be relatively effective in striking Russian forces, assets, and infrastructure.¹⁴

Nevertheless, Ukraine's combat aircraft are valuable and mostly irreplaceable. Losing one bomber or fighter is a tremendous blow. For many air operations, Ukraine has thus turned to uninhabited aerial vehicles (UAV), which are able in some circumstances to penetrate air defences but are, in any event, cheap and expendable. Ukraine's tactical employment of UAVs for locating enemy positions, disrupting supply lines, and conducting offensive strikes (including on Russian territory) has attracted significant public attention throughout the war.¹⁵ Ukraine has mostly used smaller drones, including locally-sourced Punishers, and commercially made, Chinese DJI-inspired quadcopters.¹⁶ It has also received small UAVs from Western donors, such as the tiny Norwegian Black Hornet (with a wingspan of only 12 centimetres), and loitering UAVs such as the US-made Switchblade and Polish micro Warmate systems.¹⁷

Ukraine has used UAVs in two main ways in its offensive operations. First, the land forces have used smaller, user-friendly UAVs as platforms for gathering intelligence and targeting data, and to drop munitions on Russian forces and assets.¹⁸ Second, Ukraine has been able to extend its reach beyond the battlefield by using UAVs that