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Abstract

### **Key Points**

The key lesson to date from the Russian-Ukraine war is the absolute necessity of air superiority to achieve a decisive advantage.

Limitations on Ukraine to employ U.S.-provided weapons in Russia have ceded a sanctuary for Russian forces to operate and have yielded them a significant advantage. As a result, Russia possesses air superiority over its own territory and some portions of the battlespace in Ukraine.

To secure air superiority in the times and places of its choosing, Ukraine must modify its historical doctrine and design and conduct an integrated air-ground campaign. Only with the kind of integration that creates a synergy between surface and air operations can Ukraine further its military's momentum on the battlefield.

Uninhabited aerial vehicles have emerged as a significant capability in the battlespace and present the opportunity for new concepts of operation, one of which is to contribute to achieving air superiority.

Air superiority can provide Ukrainian ground forces the freedom from attack and the freedom to attack that is necessary for them to achieve advantages relative to the larger and stronger Russian forces.

Ukraine requires weapon systems and munitions in numbers sufficient to achieve strategic gains in the battlespace—inhabited, uninhabited aircraft, precision surface-to-surface weapons, cyber operations, electronic warfare, intelligence, and special operations can all play a significant role if coordinated in an integrated campaign.

## The Significance of Air Superiority: The Ukraine-Russia War

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The conduct of the war in Ukraine to date has been a lesson in two distinct parts on the importance of air superiority. The first is the failure of the Russian Air Force to establish air superiority and overwhelm Ukrainian forces to achieve a decisive victory at the start of the conflict. The second part concerns the difficulty of establishing air superiority with insufficient resources and capabilities—a situation the Ukrainian Air Force has lived with for over three years as Ukraine has endured costly attacks on its territory. The lethal air defenses on both sides are denying each air force the ability to penetrate the opposing battlespace—a condition in which no force has control of the air. Unfortunately, without the advantages that air superiority ensures—namely freedom from attack and freedom to attack—this attrition-based conflict will be won by the side with the most warfighting personnel and materiel—Russia.

This paper focuses on how Ukraine could conduct an integrated air-ground campaign to secure air superiority in the times and places of its choosing, and thus further its military's momentum on the battlefield and begin reversing the territorial gains the Russian army has achieved up to this point. This approach has high potential to overcome the size disadvantage that Ukraine has relative to the Russian military, and it requires Ukraine to plan and execute operations that integrate their long-range surface-to-surface weapons with combat aircraft, drones, cyber operations, electronic warfare, and special operations. Achieving air superiority could provide Ukraine with the edge it needs to gain an advantage over the Russians, break through their front lines, and change the course of the war.



Figure 1: The Danish Air Force training Ukrainian fighter pilots to fly the F-16 at an airbase in Denmark.

Source: NATO courtesy video

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### Introduction \_

F-16s are about to enter Ukrainian service in the ongoing conflict between Ukraine and Russia. The effect that they could have in the evolution of the conflict depends on many factors: the number of F-16s and F-16 pilots available for combat operations; the level and type of pilot training and pilot proficiency and experience; the capability or block of the F-16s provided; the weapons provided; the numbers, level of training, and proficiency of F-16 maintenance personnel; and the ability of the aircraft to survive and operate under Russian attack, among others. This paper focuses on fighter operations at the

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operational level of war to optimize the use of the relatively small number of F-16s and pilots Ukraine will have to operate in the near term. By conducting integrated air-ground an campaign to secure air superiority in the times and places of its choosing, Ukraine can further its military's momentum on the battlefield and begin

reversing the territorial gains the Russian army has achieved up to this point. This proposed approach has high potential to overcome the size disadvantage that Ukraine has with both its air and ground forces relative to the Russian military. It requires Ukraine to plan and execute operations that integrate their long-range surface-to-surface weapons with combat aircraft, drones, cyber operations, electronic warfare, and special operations in a combined campaign. Air superiority can provide Ukrainian forces the freedom from attack and the freedom to attack that is necessary for them to achieve advantages relative to the larger and stronger Russian forces, ultimately leading to the ejecting of Russian forces from Ukraine.

Currently, neither the Russian nor Ukrainian forces are using combat aircraft to conduct deep strikes, relying instead on missiles and drones. The lethal air defenses on both sides are denying each air force the ability to penetrate the opposing battlespace-defined as a state of air parity-a condition in which no force has control of the air.<sup>1</sup> Ukrainian air defenses, combined with innovative indications and warning practices, have also successfully reduced the damage caused by Russian air attacks. This is important, given that Russia enjoys a dominant air position with a large number of Russian Aerospace Forces (VKS) aircraft that pose a significant threat.

Russia possesses another advantagethe freedom to operate from a sanctuary, provided in part by the U.S. restrictions imposed on Ukraine that limit the employment of weapons provided by the U.S. to Ukrainian territory and airspace. They likewise have significant advantages in terms of the number of combat aircraft, stand-off weapons, and ground-based air defenses (GBAD), as well as the relative sanctuary from attack by long-range weapons from Ukraine. As a result, Russia possesses air superiority over its own territory and some portions of the battlespace in Ukraine. President Zelenskyy recently highlighted this condition as his military's number one concern.<sup>2</sup> Fortunately, the poor leadership, lack of training, and ground-centric doctrine of the VKS limit the potential of its forces. Russian airpower subsequently impacted the war much less than originally expected, but the VKS is learning from its earlier mistakes-and improving.

This report provides an overview of how Ukraine could now construct and execute an integrated campaign to gain air superiority—a necessary condition to change the course of the war. It describes the character of the opposing air forces and the conduct of the air war, explaining both Russia's and Ukraine's failure to establish air superiority in the opening phases of the conflict, as well as the conditions these opening phases created that present barriers to achieving air superiority today. It describes the increasing reliance on cheaper, uninhabited aerial vehicles (UAV) to conduct strike, which has helped Ukraine and Russia achieve some of their respective air warfare goals. However, UAVs could additionally be employed in ways that help enable Ukraine to instead establish windows of air dominance that can meaningfully change the tide of combat. Ukraine's F-16s can also play a key role in this integrated campaign.

If there is any lesson from the Russian-Ukraine war to date, it is the absolute necessity of air superiority to achieve a decisive advantage. Without it, the conflict has devolved into a

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son fromrelative stalemate resembling—<br/>literally—the trench warfare of<br/>World War I. And, without the<br/>advantages that air superiority<br/>ensures—namely freedom from<br/>attack and freedom to attack—<br/>an attrition-based conflict will<br/>be won by the side with the<br/>most warfighting personnel and<br/>materiel. Today that is Russia—a situation that

cannot be allowed to prevail.

#### The Theater Airpower Balance<sup>3</sup>

Ukraine fields the Ukrainian Air Force (UkAF), an independent service, which it reorganized in 2004 through the integration of aviation and the missiles, guns, and radar of its GBAD forces. The coordination of GBAD and combat aviation assets is critical not only to defend Ukrainian air space but also to enable the development of integrated air campaign plans to gain a military advantage.<sup>4</sup> As outlined in this report, these plans will require close coordination with the Ukrainian army for maximum effect.

Russia also maintains an independent air force, which was reorganized in 2015 to include the space forces, called the Russian Aerospace Forces or VKS. Like Ukraine, the VKS comprises aviation and GBAD units (though the Russian army also maintains separate air defense capabilities). That said, among the branches of the Russian military, the ground forces are more equal than others, and coordination of air operations is done by ground force commanders, not the VKS. As highlighted by a British analysis of the conflict, "Russian jointery functions as a hierarchy in which the Navy and VKS are subordinated to the Ground Force's needs."5 This inhibits Russian forces from exploiting the full potential of airpower. After the opening phase of the conflict, prioritizing demands of the Russian forces the fighting on the ground quickly compelled a significant shift in VKS strategy and objectives that constrained their ability to focus on air superiority.

In the buildup to war, the balance of airpower was strongly in favor of Russia, which fielded 350 combat aircraft in the region, capable of generating hundreds of sorties per day. These included some of Russia's most advanced combat aircraft, such as the Su-30, Su-34, and Su-35S. Besides a numerical advantage, VKS aircraft also enjoyed a significant qualitative edge, with better radars and longer-range missiles. For example, Russian fighters demonstrated the capability to gain a radar lock and execute "fire and forget" missile launches at 50 nautical miles in combat.<sup>6</sup> A Russian fighter also reportedly shot down a UkAF fighter at a range of 95 nm.<sup>7</sup> The VKS fielded significant and effective electronic warfare (EW) capabilities and a small fleet of AWACs aircraft, whose longrange radar provided early warning to Russian combat air patrols of approaching UkAF sorties. The vast majority of the VKS