

Ukraine's Offensive Operations

Shifting the Offense-Defense Balance

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THE ISSUE

Russian fortifications in Ukraine are the most extensive defensive works in Europe since World War II, according to new CSIS analysis. The Russian military has constructed trenches, minefields, dragon's teeth, and other barriers to slow Ukrainian forces during offensive operations. But as a review of previous wars shows, fortifications and other measures do not guarantee that the defender has the advantage. The Ukrainian military could effectively use a combination of strategy, technology, geography, and other factors to retake territory illegally seized by Russia.

INTRODUCTION

Russia has constructed formidable defensive fortifications in eastern and southern Ukraine. These defenses consist of an extensive network of trenches, antipersonnel and anti-vehicle mines, razor wire, earthen berms, and dragon's teeth—truncated pyramids made of reinforced concrete used to impede the mobility of main battle tanks and mechanized infantry. As one UK defense intelligence report concluded, "Russia has constructed some of the most extensive systems of military defensive works seen anywhere in the world for many decades. These defences are not just near the current front lines but have also been dug deep inside areas Russia currently controls."¹

Russia's goals in building these defenses are to solidify its territorial gains in Ukraine and to prevent Ukrainian forces from liberating additional territory. Despite Russian efforts, however, it is unclear whether the defender has the advantage in Ukraine (as the Russians hope) or the Ukrainians can shift the advantage to the offense.

To assess the impact of Russia's fortifications, this analysis asks several questions. How is the Russian military attempting to strengthen its defenses in Ukraine? How are these efforts likely to impact the offense-defense balance? What are Ukrainian options to shift the advantage to the offense? To answer these questions, this analysis utilizes several sources of information. It analyzes open-source data on Russian fortifications and assesses satellite imagery of Russian fortifications in eastern and southern Ukraine. It is also informed by extensive interviews with senior Ukrainian, U.S., and European military officials in Eastern Europe in May 2023. Finally, this analysis leverages an extensive literature on the offense-defense balance, including lessons from previous wars.

The rest of this assessment is divided into four sections. The first provides an overview of the offense-defense balance. The second section examines Russian defensive efforts in eastern and southern Ukraine based on CSIS analysis of open-source data and satellite imagery. The third explores the obstacles a Ukrainian offensive could

face. The fourth section examines implications for Ukraine and its Western supporters.

THE OFFENSE-DEFENSE BALANCE

The offense-defense balance is the relative strength between the offense and the defense in warfare. The core idea behind the offense-defense balance is that there are several factors, such as technology and geography, that can influence the relative benefits and costs of attacking versus defending.² These factors impact whether the offense or defense has the advantage.³ As political scientist Robert Jervis wrote in one of the most influential works on the topic: “When we say that the offense has the advantage, we simply mean that it is easier to destroy the other’s army and take its territory than it is to defend one’s own. When the defense has the advantage, it is easier to protect and to hold than it is to move forward, destroy, and take.”⁴ The offense has the advantage if the expected benefits of attacking outweigh its costs by more than the expected benefits of defending outweigh its costs.

Several factors relevant to the current war in Ukraine impact the offense-defense balance. The first is technology. Innovations that can help a military to conduct maneuver warfare and swiftly advance into enemy-controlled territory may favor the offense. For example, advances in military mobility—such as tanks, fighter aircraft, chariots, horse cavalry, or even earlier critical components (such as the stirrup)—have sometimes favored the offense.⁵ These technologies—and how militaries employ them—have increased the possibility that forces can punch through opponents’ lines and exploit their breakthroughs.

Conversely, advances that decrease mobility—such as moats, land mines, trenches, and barbed wire—have sometimes favored the defense. Firepower such as machine guns, fast-firing rifles, infantry anti-tank weapons, and air defense systems have also favored the defense.⁶ The high lethality of these weapons increases the need for cover and concealment, allowing the defender to fight from prepared positions while the attacker must advance over relatively open ground.⁷

A second factor that impacts the offense-defense balance is geography. Terrain that includes flat plains, open fields, and deserts can favor the offense because these

features offer good visibility, ample room for maneuver, and fewer natural obstacles. Open terrain generally allows for easier mobility, flanking maneuvers, and the potential to rapidly concentrate forces at critical points.

Terrain that slows movement or makes it difficult to provide logistics—such as thick forests, dense jungles, swamps, mountainous terrain with few passes, and rivers and other bodies of water with few or no bridges—often strengthens the defense. Such geographic barriers can force attacks into the few roads, bridges, or passes that are available, thus reducing the defender’s intelligence difficulties as well as shortening the length of the front requiring defense. During the Cold War, for instance, the North Atlantic Treaty Organization’s plans for defending West Germany focused on the North German plain and the Fulda Gap, a pair of lowland corridors near the border between East and West Germany, because these were two places where major mechanized offensives against West Germany seemed feasible.

Distance also often favors the defense. If the attacker must travel a considerable distance just to reach the defender’s territory, the amount of force it can project is reduced by the costs of transporting and supplying the projected force, as well as the costs of defending long lines of communication.⁸ In addition, the offense-defense balance depends, in part, on how much territory the attacker is trying to take. More ambitious offensive missions, including those designed to take more territory, tend to be more difficult than less ambitious ones.⁹

Weather can further impact the offense-defense balance.¹⁰ In cold weather climates, frozen ground can support the offensive movement of mechanized forces in winter. As the Soviet army discovered during its invasion of Finland in November 1939, however, winter fighting can also mean operating in conditions of biting cold and deep snow. In the spring in some parts of the world, including Ukraine, mechanized forces have to deal with the *Rasputitsa*, or thaw, during which the ground turns to mud and the advantage may shift to the defense. During the summer in Ukraine, however, the steppes dry out and allow for better movement of tracked and wheeled vehicles.

There are other factors that can impact the offense-defense balance, such as clever strategies, force employment, leadership, and combat motivation.¹¹

Today, the challenge for the Ukrainian military and its Western supporters is to leverage technology, geography, strategy, force employment, leadership, combat motivation, and other factors to increase the relative benefits and reduce the costs of offensive operations. Conversely, the task for Russia is to build strong enough defenses (such as trenches and berms), layer these defenses with sufficient weapons systems (such as surface-to-air missiles and artillery), and utilize favorable terrain to blunt successful Ukrainian counterattacks.

HOW ARE RUSSIA'S DEFENSES ORGANIZED?

To shift the offense-defense balance in its favor, Russia has designed one of the largest defensive systems in Europe since World War II. It has constructed a line of fortifications roughly 2,000 kilometers long, running from Russia's border with Belarus to the Dnipro Delta.¹² Approximately 1,000 kilometers of these defenses are located in Ukraine itself, where essentially all conventional warfare between Russia and Ukraine has taken place. Russia's fieldworks include four semi-independent defensive systems, each of which roughly corresponds to a Ukrainian oblast.

The area that has been most extensively fortified since the 2022 invasion is Zaporizhzhia Oblast, followed by Kherson, Donetsk, and Luhansk oblasts, as highlighted in Figure 1.¹³ Although the defensive systems in each oblast are generally built from the same components—ditches, dragon's teeth, trenches, and artillery positions—each

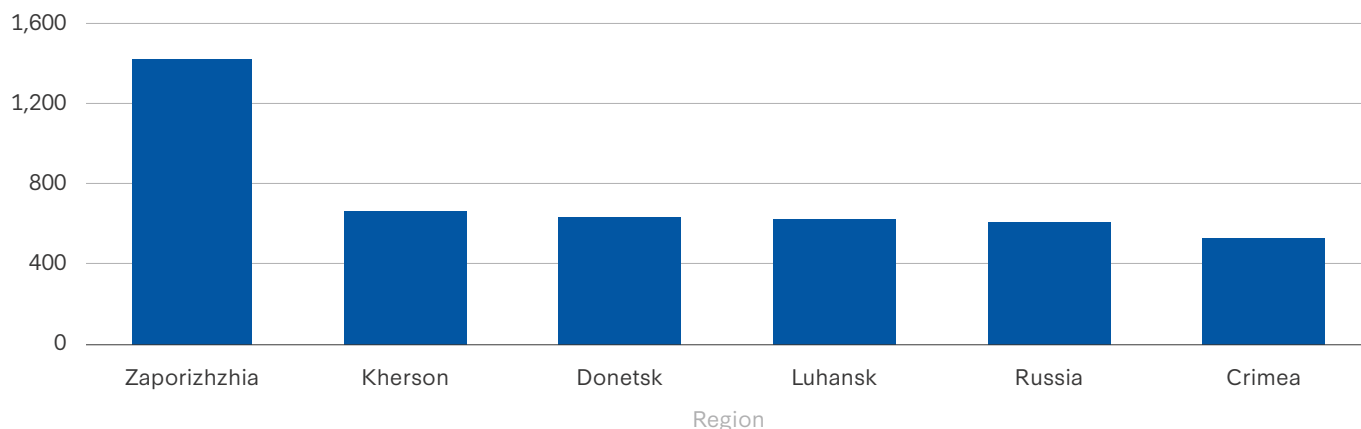
has unique characteristics that represent particular challenges to a Ukrainian offensive.

Overall, Russian defenses are designed to slow a Ukrainian offensive and to channel it into areas advantageous to Russian forces. The Russian fortifications visible in satellite imagery confront Ukrainian military planners with difficult trade-offs. The first dilemma is whether to commit forces against the densely defended approaches to Crimea, the urban areas that dominate Donetsk Oblast, or the more sparsely fortified but less strategically important areas in Luhansk. A Ukrainian offensive against the oblasts bordering Crimea carries further hard choices, forcing commanders to fight through layers of defensive positions more than 10 kilometers deep in Zaporizhzhia or to cross the Dnipro River, a difficult operation that carries the subsequent challenge of defending a beachhead from a counterattack. No matter what their commanders choose, Ukrainian forces will also be subject to repeated counterattacks from multiple directions seeking to isolate combat units from the support they need to sustain the offensive.

ZAPORIZHZHIA: A SYSTEM OF SYSTEMS

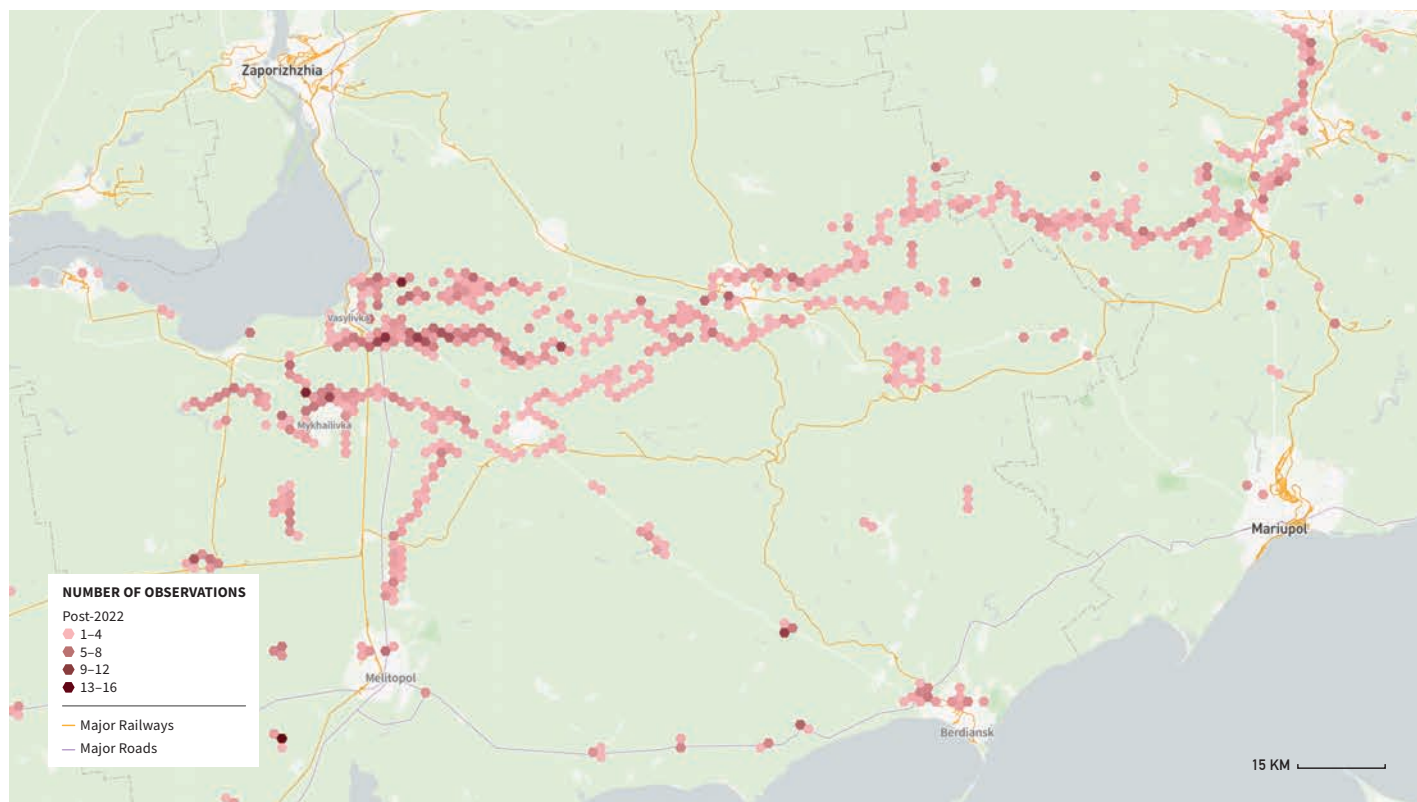
The Zaporizhzhia defensive system consists of roughly three subsystems, as illustrated in Figure 2. The first is an approximately 150-kilometer frontline system that stretches from the town of Vasylivka on the southeastern edge of the Kakhovka Reservoir to the town of Novopetrykivka on the Zaporizhzhia-Donetsk border. This system consists of

Figure 1: Observed Russian Defensive Fortifications Constructed since 2022



Source: Brady Africk, "Pre-2022 Field Fortifications in Russian-Occupied Ukraine," bradyafrick.com, May 27, 2023, https://read.bradyafrick.com/p/pre-2022-field-fortifications-in?utm_medium=reader2.

Figure 2: Russian Fortifications in Zaporizhzhia Oblast, Ukraine



Note: Pre-2022 fortifications have been removed from this view of the map.

Source: Africk, "Pre-2022 Field Fortifications in Russian-Occupied Ukraine."

multiple layers of counter-mobility barriers and infantry trenches in the frontline area supported by prepared artillery positions less than 30 kilometers to the rear, just ahead of the second subsystem of prepared defenses. This longer line also contains another set of defenses around the town of Vasylivka, making the westernmost edge of the line particularly densely fortified.

The second subsystem stretches more than 130 kilometers from the town of Orlyanske to just north of Bilmak. Its makeup differs little from the frontline system, and it could serve Russia well were it to establish a new front line following a successful Ukrainian offensive. The withdrawal of Russian forces to this second line of defenses could also serve as a prelude to Russian counterattacks against the flanks of the Ukrainian advance.

The third subsystem is a constellation of disconnected fortifications surrounding larger towns close to the front line, most of which occupy commanding positions on major railways or roads, and smaller fieldworks along important roadways. None of these fortifications would be sufficient to rapidly establish a new front line in

the case of a Russian collapse, but they could slow a Ukrainian breakthrough, enable Russian counterattacks, and prevent the total collapse of the Russian front.

The distance between these subsystems varies, but the territory between them should not be seen as undefended space. Russian doctrine emphasizes both positional and mobile defenses.¹⁴ Russia would likely seek to engage Ukrainian vehicles in these areas using a combination of indirect fire—potentially including airstrikes—and its own fighting vehicles. A Ukrainian breakthrough would likely trigger a rush of Russian armored reserves to the area, where they would seek to engage Ukrainian forces in open terrain while the second and third subsystems underwent final preparations for combat.

The cumulative effect of these systems would be to array Russia's strongest resistance against Ukrainian efforts to break through to Melitopol or Berdiansk cities. These preparations reflect the high military and political value Russia attaches to control of Zaporizhzhia Oblast. A Russian collapse like the one seen in Kharkiv in 2022 that allowed Ukraine to approach or liberate these cities would

pose a serious threat to Russia’s operations in Ukraine. A Ukrainian push through the second defensive line would allow Ukraine to hold Russia’s supply lines in the country at risk, effectively splitting its military effort between two theaters. It would also threaten to reverse the forcible creation of a land bridge to occupied Crimea. Such a breakthrough approaches a worst-case scenario for Russia and therefore incentivizes the construction of a defensive system of the depth and density seen in Zaporizhzhia.

KHERSON: BEHIND A WALL OF WATER

Kherson’s defensive system is also arrayed around defending approaches to Crimea, but it is less dependent on multiple layers of fortifications because of the oblast’s terrain, which favors the defender. Russia has constructed a set of defenses along the Dnipro Delta across from the city of Kherson and at wide intervals along the Dnipro River. These spans of water are wide enough that they would require amphibious assaults, one of the most complex and demanding operations a military can attempt.

Any such assault would be contested by Russian forces in that first line of defenses, and even the most successful

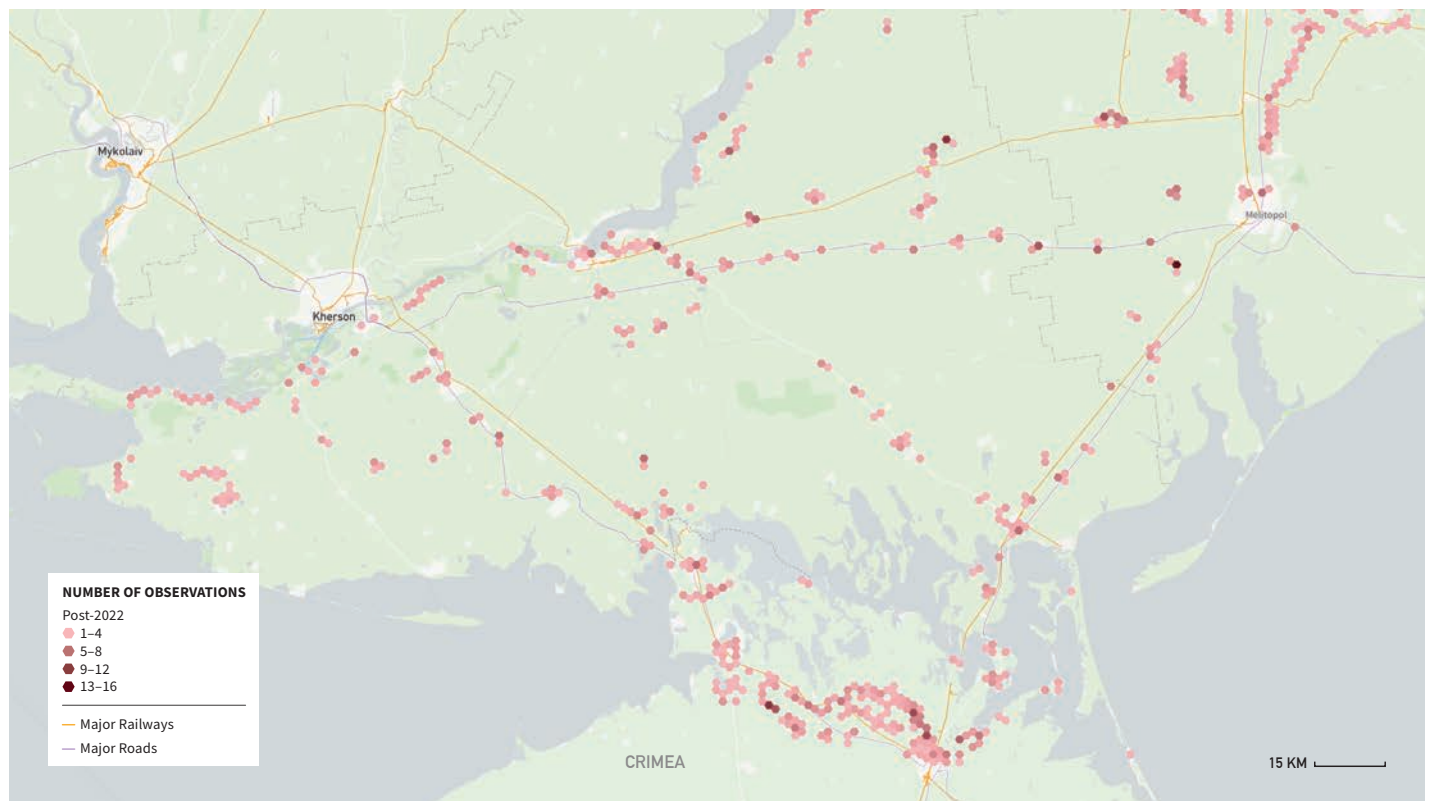
crossings of the river would not lead to a dramatic exploitation of Russian rear areas. The logistics involved in supporting such an exploitation across a large body of water are far more complicated than those involved in a ground offensive without such an obstacle. Russia has also constructed a large number of fieldworks to make such an advance even more difficult. Trenches stud the roads in Kherson every few kilometers, which would slow any effort to reach major logistics hubs and trigger the collapse of the Kherson front.

On June 6, 2023, a major dam and power station on the Dnipro River in southern Ukraine were destroyed, causing a significant outflow of water. The flooding prompted evacuations in areas downriver from the Kakhovka dam, including in some parts of the city of Kherson.¹⁵

DONETSK: FIGHTING BLOCK BY BLOCK

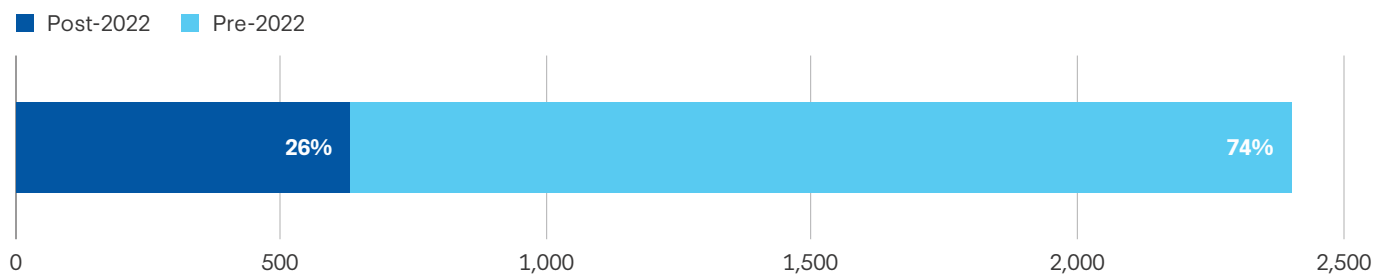
The Donetsk front is characterized by a combination of new and old defensive fortifications and complex urban terrain. These factors coupled with the front line’s proximity to Russia itself make a Ukrainian breakthrough in the region unlikely to result in significant exploitation.

Figure 3: Russian Fortifications in Kherson Oblast, Ukraine



Source: Africk, “Pre-2022 Field Fortifications in Russian-Occupied Ukraine.”

Figure 4: Observed Defensive Fortifications in Donetsk Oblast



Source: Africk, "Pre-2022 Field Fortifications in Russian-Occupied Ukraine."

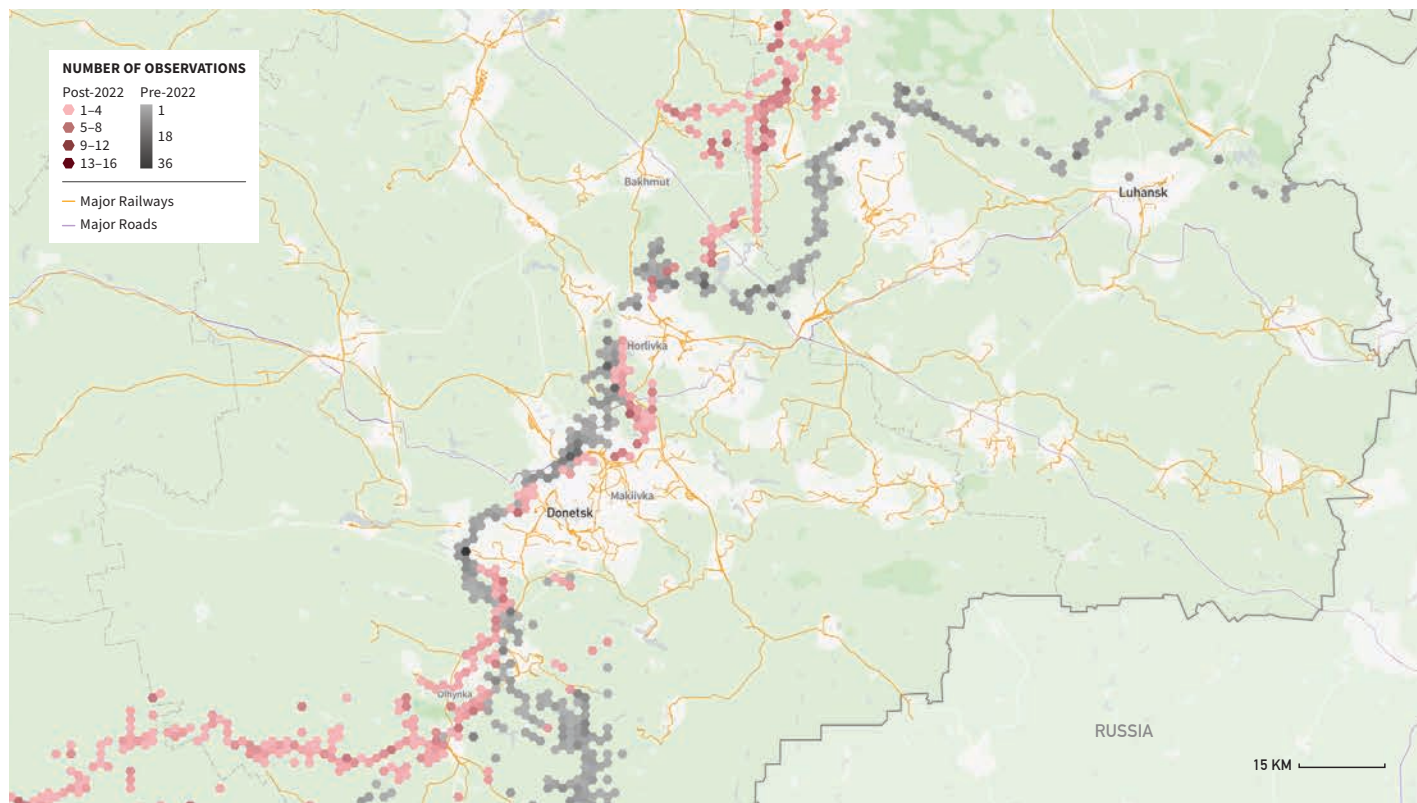
Russian units in Donetsk may be able to benefit from defensive positions dug before the 2022 invasion, unlike their counterparts in other parts of Ukraine. The oblast was the site of combat between Ukraine and Russian proxies for almost eight years before the 2022 invasion. As visible in Figure 4, pre-2022 fortifications outnumber post-2022 fortifications approximately three-to-one.

The benefits of these fortifications to Russian fighters will likely be uneven. The quality and readiness of these fortifications are extremely difficult to assess.¹⁶ Some have likely been in disuse so long that they will not give

Russian soldiers the full benefits of a recently prepared defensive position, and some are Ukrainian defensive positions that are oriented to defend against an attack moving away from Russia rather than toward it.

The defensive system in Donetsk incorporates two layers of defenses around the town of Olhynka, where several roads meet, but otherwise appears to rely more on the three cities of Donetsk, Makiivka, and Horlivka, as illustrated in Figure 5. A Ukrainian attempt to push through either of these cities is extremely unlikely for an excellent reason: if Ukraine attempted to assault these

Figure 5: Fortifications in Donetsk Oblast, Ukraine



Source: Africk, "Pre-2022 Field Fortifications in Russian-Occupied Ukraine."

cities directly, its offensive would become bogged down in urban combat.

Bakhmut has recently become emblematic of the difficulty of fighting in built-up areas, but any combat in these cities would be on another order of magnitude. Horlivka, the smallest of the three frontline cities, had a pre-invasion population of about 240,000 and has an area of more than 400 square kilometers. In comparison, Bakhmut had a pre-war population of about 70,000 and an area of about 40 square kilometers. Any attempt to overrun either of these cities would make the battle of Bakhmut seem like a skirmish in comparison.

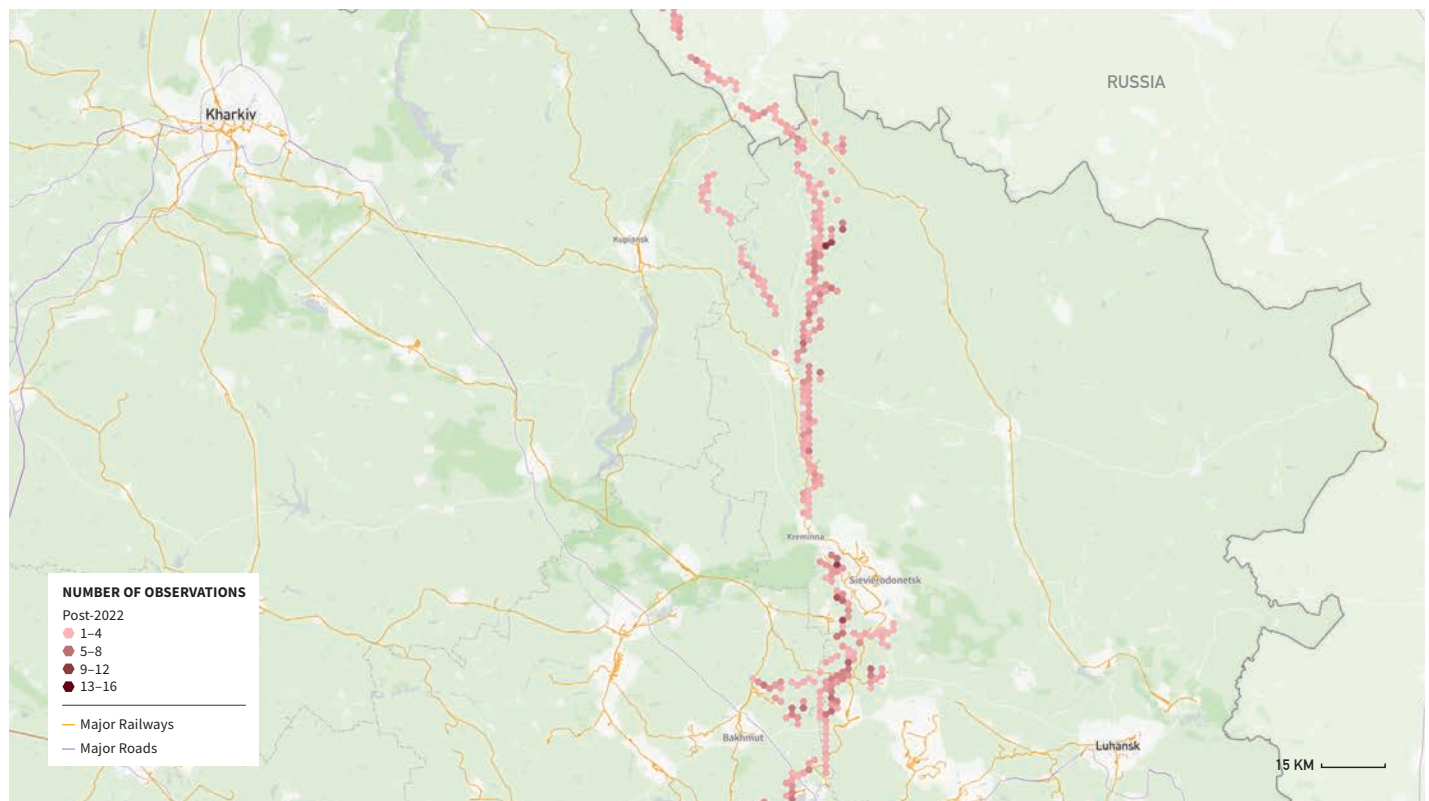
Ukraine could conceivably try to bypass either of the cities, but Russia has constructed fortifications between them. Where the cities are closest together, a single line of fieldworks may be sufficient, as a successful Ukrainian breakthrough passing close to either city would find its supply lines exposed to counterattack from city-based Russian forces. In areas further afield, Russia has constructed multiple layers of defenses somewhat comparable to those in Zaporizhzhia, but much closer together—about 5 kilometers in Donetsk

compared with 30 kilometers in Zaporizhzhia. This is unlikely to spell failure for Russia. The centrality of the cities and the proximity of the front line to Russia mean that Russian reserves will be able to move into position in Donetsk far more quickly than in Zaporizhzhia and that Ukrainian logistics will face a greater threat in the event of a breakthrough.

LUHANSK: FORESTS AND FRONT LINES

The construction of Luhansk's defensive system is less clear from satellite imagery than those of the other three oblasts. It appears to be broken into a southern and a northern system, with the southern system arrayed primarily around the city of Severodonetsk, and the northern system consisting of a long line of defenses reaching toward the northern border with Russia, as highlighted in Figure 6. The southern system looks a great deal like the defenses around Donetsk Oblast's three cities and includes the front line in Bakhmut and the forests around Kreminna, where heavy fighting has been ongoing for months with few territorial gains for either side.

Figure 6: Russian Fortifications in Luhansk Oblast, Ukraine



Note: Pre-2022 fortifications have been removed from this view of the map.

Source: Africk, "Pre-2022 Field Fortifications in Russian-Occupied Ukraine."

The areas north of Kreminna look different. Russian fortifications north of the forest appear in satellite imagery as a defensive line running from Kreminna to the Russian border, split into forward and rear subsystems (as in Zaporizhzhia) in the northernmost parts of the oblast. Many of the fortifications visible in satellite imagery may actually represent a secondary system rather than an intended front line. These fortifications lie just a few kilometers behind a string of towns that hug the eastern bank of the Krasna River. The houses in these towns would provide ready-made fortifications from which the Russians could fight, while Ukraine would be slowed by the need to conduct bridging operations. As a result, Russia might place their first echelon of defenders in these towns, using the fortifications visible in satellite imagery to contain any Ukrainian units that break through beyond the towns.

North of Preobrazhenne, where the river passes to the east of the towns, Russia once again has constructed two major lines of field fortifications, although they appear less complete than other defensive lines. For example, there is an apparent gap between the towns of Pershotravneve, Mykolaivka, and Arapivka: a potential opening less than 30 kilometers by road from Kupiansk, a city in which Ukraine could conceivably mass forces. As is the case in Zaporizhzhia, areas without fieldworks are not necessarily undefended. Russia would still seek to conduct mobile warfare in these areas north of Preobrazhenne, which have already seen tank battles in the past year. A Ukrainian offensive this far north would also create novel vulnerabilities, extending Ukraine's flank along the Russian border, where political constraints give Russia a degree of safe haven from which to conduct a counteroffensive or strike Ukrainian forces, logistics, and civilians with standoff weapons.

WHAT OBSTACLES COULD A UKRAINIAN OFFENSIVE FACE?

The Russian defensive system consists of multiple types of anti-vehicle barriers, infantry trenches, and prepared firing positions for artillery and fighting vehicles. These fieldworks are arranged in layers to form defensive positions 1 to 2 kilometers deep. Russian doctrine suggests that these systems are intended to be held by motorized rifle battalions, which are assigned to defend areas 3

to 5 kilometers wide and 2 to 2.5 kilometers deep, and motorized rifle companies, which are assigned to defend areas up to 1.5 kilometers wide and 1 kilometer deep.¹⁷

A defensive system outside of the occupied town of Mykhailivka is representative. It consists of four layers of defenses. First, about 2 kilometers from the town itself, Russia has constructed a trench to disrupt the movement of Ukrainian vehicles toward the front line. Approximately 500 meters behind that ditch is a barrier of "dragon's teeth." These concrete barriers are densely packed into three rows and serve as a second barrier to any Ukrainian vehicles that cross the ditch to the north.

Roughly 250 meters behind the dragon's teeth is an infantry trench system. Soldiers in this trench would be able to engage vehicles attempting to approach or bypass the barriers with recoilless rifles, rocket propelled grenades, or anti-tank guided missiles; fire on accompanying infantry and engineers with small arms; and use indirect fire to target Ukrainians north of the ditch. Russian doctrine dictates that tactical commanders would have created integrated fire plans for their areas of responsibility.¹⁸ These plans would in theory increase the defensive advantage by maximizing the defenders' familiarity with the terrain, creating zones in which the defenders will concentrate fire, and allowing for planned maneuvers during combat including both withdrawals and counterattacks.

Behind the trench is a second set of counter-mobility barriers: an anti-vehicle ditch and another set of dragon's teeth. These are supported by a smaller set of trenches and vehicle emplacements located on the two roads leading into the town from the north. These smaller fieldworks can provide command positions from which the wider defensive effort would be led. These positions can also be used for direct and indirect fire on Ukrainian forces north of the first anti-vehicle ditch, as well as covering fire for any effort to withdraw into the town or further south.

These defenses are part of a longer defensive line that stretches from the town of Yasna to the Molochna River, covering a defensive front of approximately 30 kilometers. The northernmost line of dragon's teeth stretches for more than 6 kilometers to the east, where it meets another set of multilayered defenses near the town of Trudovyk. The southernmost line wraps around the town of Mykhailivka and measures approximately 45 kilometers.

Figure 7: Multilayered Defenses North of Mykhailivka, Ukraine



Figure 8: Dragon's Teeth, Trenches, and Anti-vehicle Ditches North of Mykhailivka, Ukraine



Figure 9: Vehicle Fighting Positions North of Mykhailivka, Ukraine



Similar layered defenses are visible across the span of the front line. Another example is visible near the town of Verbove. These fortifications are less extensive, although they have been the location of more recent construction. East of the road leading into the town, the defenses consist of three layers, as illustrated in Figure 10. An anti-vehicle ditch sits north of a set of dragon's teeth, which is itself north of a trench system with two layers. West of the road, the ditch has been extended since the initial image was taken, but satellite imagery available at the time of writing is not sufficiently clear to determine whether the line of dragon's teeth has been extended.

Farther west, Russian fieldworks serve as a reminder that these defenses are not intended to be static, but rather that they are part of a larger system incorporating mobile and positional defense. Figure 11 shows a trench leading to an opening in the dragon's teeth barrier. This construction is relatively unusual. Trenches are usually placed parallel to counter-mobility barriers in order to maximize firepower onto forces trying to cross or breach those barriers, something these trenches would not allow the soldiers manning them to do. What they could do, however, is provide cover to forces withdrawing through the gap in the dragon's teeth just north of the trench or provide interlocking fire onto an attempt to advance down the road less than 800 meters to the east. These trenches are therefore likely part of a tactical commander's prepared system of fire and maneuver.

Figure 10: Three Layers of Defenses outside Verbove, Ukraine

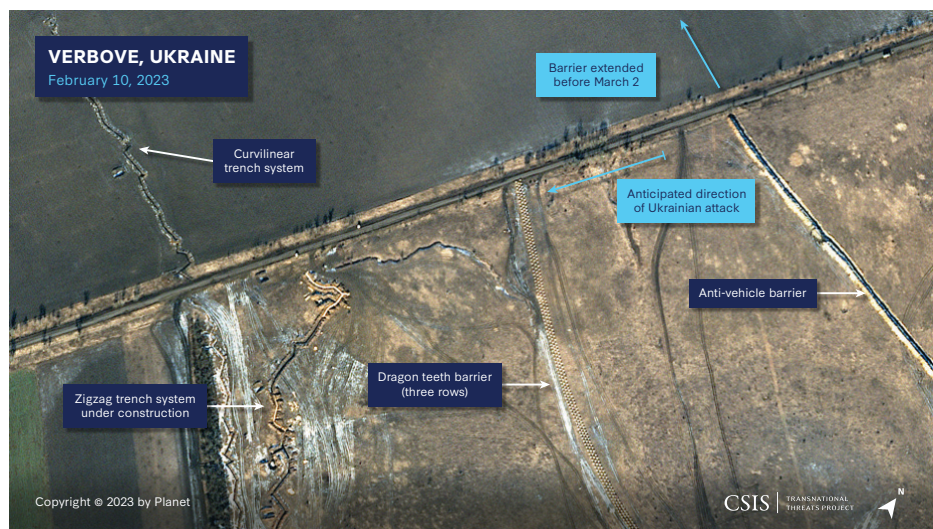


Figure 11: Trenches and Dragon’s Teeth outside Verbove, Ukraine



LESSONS FOR UKRAINE: SHIFTING THE ADVANTAGE TO THE OFFENSE

While Russia’s defensive fortifications are impressive in their size and scale—at least in some respects—they are likely insufficient to prevent Ukrainian forces from breaking through Russian lines and retaking territory illegally seized by Russia. In short, Russian defensive actions do not guarantee that the defense has the advantage. Several steps could shift the advantage to the offense.

WEAKNESS OF DEFENSIVE FORCES

Fortifications are only as good as the forces defending them. In the 1930s, France constructed the Maginot

Line, which included concrete fortifications, machine guns, anti-tank emplacements, and even underground railways. The Maginot Line had state-of-the-art living conditions for specialist units of infantry, artillery, and engineers—even including air conditioning. But the French military was relatively weak. It had a debilitated air force and a large army that was unprepared for offensive operations, though it had a reasonably strong navy.¹⁹ Germany exploited these French weaknesses during its invasion of France in 1940.

The Russian military—especially the army—has been battered over the past year. Following its February 2022 invasion, Russia failed to achieve many of its objectives in Ukraine because of poor combined arms operations; ineffective joint operations, such as close air support to Russian ground forces; problematic intelligence, including faulty Federal Security Service planning and analysis; significant logistical problems; and low morale. These factors were vital for Ukraine’s lightning

offensive in Kharkiv Oblast in 2022, where Ukrainian forces achieved operational surprise, broke through Russian lines, and captured a key logistical hub to trigger a collapse among Russian ground forces and the liberation of more than 12,000 square kilometers of territory.²⁰

The deployment of Wagner Group private military contractors to the front lines in eastern Ukraine in 2023 has further highlighted the poor performance of Russian ground forces, as well as the political risks of a full-scale Russian mobilization. Consequently, a partially bruised and demoralized Russian army sits behind the extensive fortifications, which may present opportunities for Ukraine.

Furthermore, the Russian military likely does not have enough high-quality forces to defend all parts of the line. The 70 combat regiments and brigades Russia has in Ukraine will likely not be sufficient to form a large mobile reserve, even if Russia commands enough soldiers to adequately staff its fortifications.²¹ The lack of a strong mobile reserve means that Russia will be hard-pressed to surge forces to fill gaps in its lines, station forces in second-echelon defensive positions, and conduct counterattacks according to its defensive doctrine.²²

EXPANSIVE FRONT LINE

Ukraine can use the extensive front line to its advantage. Territory can be important, particularly the size of a front and the territory an attacker is attempting to seize. While the Maginot Line in France covered approximately 450 kilometers, it did not cover every inch of French territory or key parts of France's border with Belgium and Luxembourg. Germany invaded the Netherlands and Belgium in May 1940. Later that month, German forces penetrated the Maginot Line at a weak part along the Belgian frontier, where France's defenses had few forces that were of relatively low quality. On May 15, 1940, Heinz Guderian's XIX Panzer Corps broke through the French line and headed west into open country, sealing France's fate.²³

One historical lesson for Ukraine and its Western supporters is to continue assessing weak spots in the Russian lines where there are opportunities for penetration, where Russian defenses are poorly constructed or of insufficient depth, and where Russian forces are understaffed or of particularly poor quality.²⁴ Ukrainian forces know this terrain well, since it is land many of their soldiers grew up on.

The formidable appearance of Russia's defensive fortifications may also obscure as much as it reveals. Russia has used contractors to dig trenches, many of whom likely lack significant military engineering experience.²⁵ There have also been reports of Russian mistreatment of these contractors.²⁶ Lack of expertise or low morale could lead to the fortifications being less effective than they appear in satellite imagery.

Variation in the quality of Russia's dragon's teeth is notable, despite the media attention they have generated as a symbol of Russia's defenses in Ukraine. These obstacles are most effective when connected to one

another by concrete linkages underground and partially buried. Some images appear to show dragon's teeth without underground connections. Other images appear to show dragon's teeth sitting on top of the earth rather than partially under it. One image posted on several Russian websites also appears to show that some of the dragon's teeth used by Russia are not entirely made of concrete and are already suffering environmental damage in Ukraine.²⁷ It is impossible to draw sweeping conclusions about the overall quality of Russia's defenses from these images, but they are enough to suggest that there are variations in the quality of defenses across the line that can be exploited by Ukraine with good intelligence.

The Ukrainian front covers roughly 1,000 kilometers—more than double the size of the Maginot Line—as it zigzags from the grassy slopes of the northeast, hugs the Dnipro River, and extends to the Black Sea.²⁸ This large front is likely a major vulnerability for the Russians. As one assessment of the offense-defense balance concludes, “If the attacker is faced with a defender who is protecting a narrow front, the probability that the blitzkrieg will succeed is much less than if the attacker can strike at a defender deployed across a broad front.”²⁹ This challenge is often called the force-to-space ratio.³⁰ Russia likely lacks the force-to-space ratio to defend such an expansive territory.

The May 2023 clashes between Russian security forces and fighters in Russia's Belgorod Oblast, near the Ukrainian border, likely worsened Russia's deployment problems by forcing the Russian military to move troops to its internationally recognized border with Ukraine.³¹ These types of attacks could increase Russia's force-to-space ratio problems by thinning out its defensive positions in some areas.

TECHNOLOGY AND MILITARY INNOVATION

Technology can impact the offense-defense balance. The offense generally requires mobility.³² The attacker must first achieve a breakthrough by defeating or destroying a section of the defender's front, and then it must exploit this breakthrough to advance into the defender's rear.³³ As noted earlier in this analysis, advances in military mobility have sometimes shifted the balance in favor of the offense.³⁴

The Ukrainian military has thus far been innovative in its development and use of technology.³⁵ Military innovation involves a change in the conduct of warfare intended

to improve the ability of a military to generate combat power. A change in the conduct of warfare does not necessarily require a change in military doctrine, but it does involve change at the operational level of war.³⁶

One example of Ukrainian innovation has been the use of unmanned aircraft systems (UASs) in combined arms warfare, which includes the blending of infantry, direct and indirect fire, aviation, and other joint capabilities to achieve political and military objectives.³⁷ Ukraine has utilized UASs to conduct several types of missions as part of combined arms warfare, such as target identification for artillery, strike, battlefield damage assessment, and information operations.³⁸

The challenge for Ukraine will be to innovatively utilize technology and adapt its conduct of warfare in ways that maximize mobility to exploit Russian vulnerabilities. For example, Ukrainian forces could use a combination of advanced technology and UASs or loitering munitions—including those supplied by the West—to conduct UAS “swarms” against Russian defensive positions. As interviews with Ukrainian military officials indicate, Ukraine is investing significant time and resources into innovations such as swarming tactics designed to maximize target saturation and overwhelm Russian defenses.³⁹ UASs could also be employed to probe for gaps in Russian lines, locate Russian reserves or artillery systems, or provide artillery-like effects in support of high-mobility units exploiting a breakthrough.

An important technological obstacle to Ukraine’s efforts is Russia’s electronic warfare capabilities. Russia has effectively used electronic warfare to combat Ukrainian UASs.⁴⁰ The ability of the Ukrainian military to find and destroy Russian electronic warfare systems, which are now organic to units at multiple levels, will be a key enabler of offensive success.

STRATEGY, FORCE EMPLOYMENT, WILL TO FIGHT, AND OTHER INTANGIBLES

Attackers can make up for a tough defense with clever strategies, effective force employment, leadership, nationalism, will to fight, combat motivation, morale, and other factors. Force employment, for example, includes how militaries use force on the battlefield—a combination of cover, concealment, dispersion, suppression, small-unit independent maneuver, and combined arms operations.⁴¹

Some also call this “military skill,” which describes a country’s ability to effectively employ military technology, including designing military strategy and assessing adversaries’ forces and strategy.⁴²

Will to fight and nationalism can influence the offense-defense balance, and neither have been in short supply among Ukrainians. To the extent that soldiers are motivated by nationalism, they frequently become willing to fight harder for territory that they understand to be part of their national homeland.⁴³ The Ukrainian military and civilians have shown an extraordinary will to fight since the start of the war.

The reverse is also true: soldiers who are not imbued with a nationalist consciousness may be less willing to fight for territory. Confederate soldiers deserted the Army of Northern Virginia at the Potomac in 1862 because “they felt that they were fighting to defend Virginia’s soil, not to invade the North.”⁴⁴ In addition, Hitler was unwilling to risk imposing full war mobilization on Germany until the failure of Operation Barbarossa opened the possibility that Germany’s own homeland security might be threatened.⁴⁵

Despite President Vladimir Putin’s insistence that Ukraine is part of the Russian empire, it is unclear how much this argument has convinced Russian soldiers and contractors. Recent research on absent without leave (AWOL) cases in Russian military courts suggests that an increasing number of Russian military personnel are not convinced. AWOL cases in the first four months of 2023 already surpassed the total number of cases in 2022.⁴⁶ It is impossible to say definitively that the rise indicates that Russians in Ukraine have a low will to fight, but it is hardly an indicator of a strongly motivated military.

A clever strategy is also important. Between 1919 and 1945, an evolving offensive doctrine (blitzkrieg) and motorized armor shifted the advantage to the offense and overrode machine guns, trenches, railroads, and barbed wire.⁴⁷ As B.H. Liddell Hart explained in analyzing German General Heinz Guderian’s blitzkrieg into France in May 1940:

It is clear that Guderian and his tankmen pulled the German Army along after them, and thereby produced the most sweeping victory in modern history.

The issue turned on the time factor at stage after stage. French countermovements were

repeatedly thrown out of gear because their timing was too slow to catch up with changing situations, and that was due to the fact that the German van kept on moving faster than the German high command had contemplated.⁴⁸

In the 1967 Six Day War, Israel Defense Forces heavily relied on armor and air forces to destroy significant components of the Egyptian and Syrian air forces. Within three days, the Israelis captured the Gaza Strip and all of the Sinai Peninsula up to the east bank of the Suez Canal. Israeli forces then drove Jordanian troops out of East Jerusalem and most of the West Bank and seized the Golan Heights from Syria. Israel developed an effective blitzkrieg strategy that relied on armor to inflict a decisive defeat against its Arab adversaries. As Moshe Dayan explained to Israel's Ministerial Defense Committee before the war, "If we opened the attack and effected an armored breakthrough into Sinai, the enemy would be forced to fight according to the moves we made."⁴⁹

For Ukraine today, maneuver warfare demands a flexible command structure with soldiers capable of exercising initiative in combat situations. It is not based on a rigid plan that commanders need to follow closely.⁵⁰ Ukrainian soldiers at the platoon, company, and battalion levels have already shown a proclivity to taking the initiative. In World War II, the German military developed a doctrine of *Auftragstaktik*, which dictated that commanders be given a battlefield objective rather than lengthy orders that micromanaged how they do it.⁵¹ This doctrine helped enable implementation of blitzkrieg, which requires lower-level commanders to act quickly and decisively in order to exploit breakthroughs and maintain the momentum required to avoid enemy counterattack.

A clever Ukrainian strategy that penetrates Russian lines could have significant follow-on effects. For example, a major breakthrough in Zaporizhzhia could severely threaten the viability of Russia's land bridge linking Russia's Rostov region with Crimea. Even a breakthrough in the less-densely defended Luhansk Oblast could provide significant

benefits by proving that Western support for Ukraine continues to bear fruit, removing Russian units from the battlefield, and sowing further dissent within Russia itself.

NEXT STEPS

The next phase of the war will hinge, in part, on the ability of Ukrainian forces to retake territory by moving from attrition to maneuver warfare and to shift the offense-defense balance in favor of the offense. As Napoleon wrote, "The strength of an army, like power in mechanics, is estimated by multiplying the mass by the velocity."⁵² A Ukrainian maneuver strategy places a premium on the second factor—velocity. Russian forces have attempted to shift the advantage to the defense and retain the territory they have conquered in Ukraine by constructing a formidable system of fortifications. But Russia faces several challenges in holding this territory, including weak ground forces that have not performed well on the battlefield, the need to defend a massive amount of territory, and variable construction of the fortifications.

This war is far from over. Western aid—including weapons systems, technology, training, intelligence, and financial support—will be critical over the long run to help Ukraine retake its territory and prevent Russia from invading again in the foreseeable future. The future trajectory of the war will also depend on whether Ukraine can exploit Russian vulnerabilities and effectively integrate technology, a clever strategy, force employment, nationalism, and other factors to turn the tide. ■

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