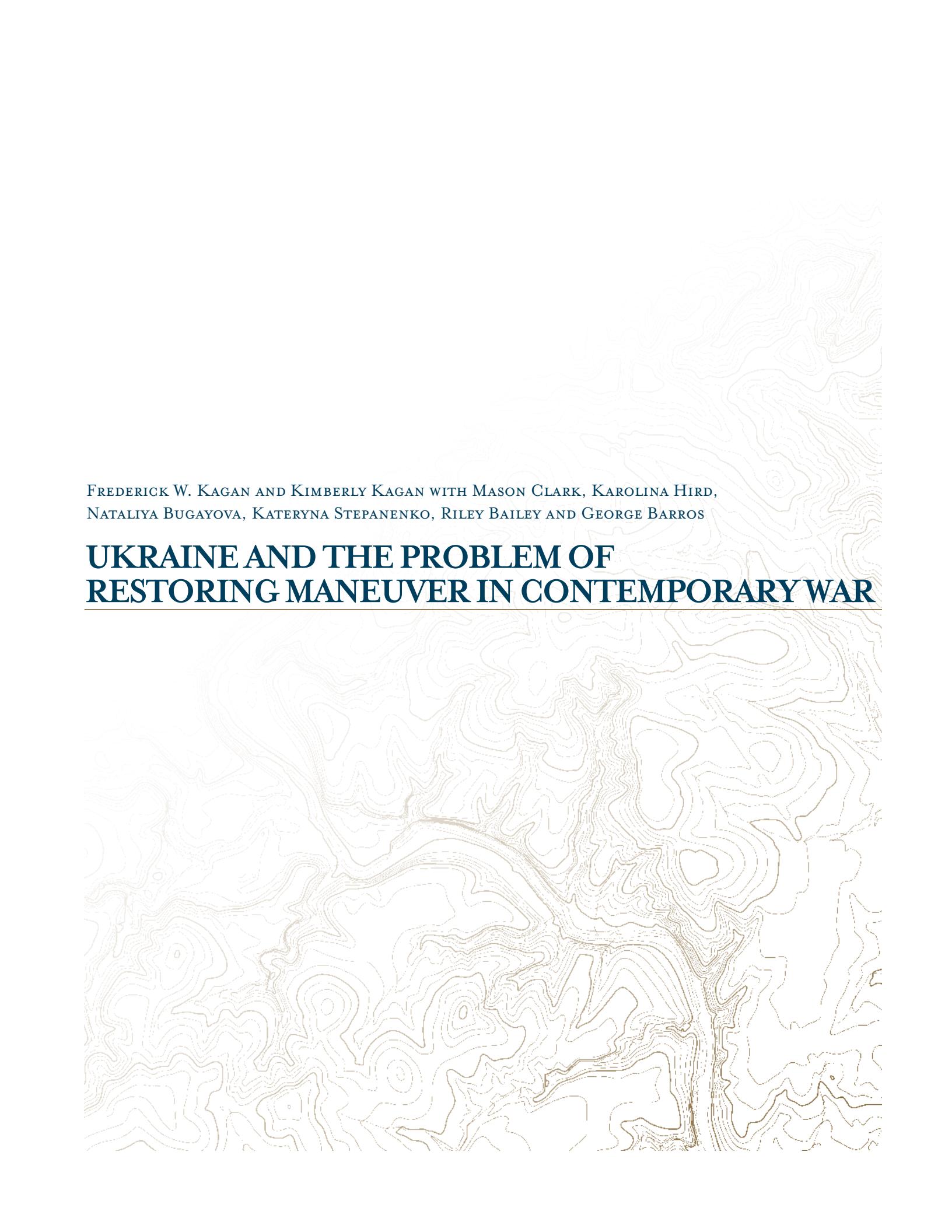


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FREDERICK W. KAGAN AND KIMBERLY KAGAN WITH MASON CLARK, KAROLINA HIRD,
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UKRAINE AND THE PROBLEM OF RESTORING MANEUVER IN CONTEMPORARY WAR





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The purpose of this paper is to evaluate the causes of the current positional character of the war in Ukraine, to offer recommendations for improving Ukraine's ability to restore maneuver to this war, and to identify key innovations in this war that will likely shape future conflict involving the US and its allies and partners. This paper does not evaluate current or likely future Ukrainian capabilities. Still less does it forecast future Ukrainian operations. Its purpose is to help Ukrainian and Western leaders think about how best to prepare for future counter-offensive operations and identify some of the adaptations Ukraine and its supporters would have to make in order to be able to execute such ideas. This paper was completed before Ukrainian forces began their August 2024 operations into Kursk Oblast in Russia.

Cover: DJI Matrice 300 reconnaissance drones, bought in the frame of program 'The Army of Drones' are seen during test flights in the Kyiv region on August 2, 2022, prior to being sent to the front line. - 'The Army of Drones' is a project initiated by the General Staff of the Armed Forces and the Ministry of Digital Transformation which is a comprehensive program in which organisation purchases drones, repair them, and train operators. (Photo by Sergei SUPINSKY / AFP) (Photo by SERGEI SUPINSKY/AFP via Getty Images)

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The ISW Russia Team and the ISW Geospatial Intelligence Team publish daily to inform the world about the full-scale Russian invasion of Ukraine. Their insights into contemporary warfare have emerged in our daily “sync” analytic conversations about battlefield events derived from open-source intelligence.

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– Frederick W. Kagan and Kimberly Kagan

ABOUT THE INSTITUTE

ISW is a non-partisan and non-profit public policy research organization. It advances an informed understanding of military affairs through reliable research, trusted analysis, and innovative education. It is committed to improving the nation’s ability to execute military operations and respond to emerging threats in order to achieve the strategic objectives of the United States around the globe.

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ISW believes that superior strategic insight derives from a fusion of traditional social science research and innovative technological methods. ISW and CTP recognize that the analyst of the future must process a wide variety of information ranging from interviews and historical artifacts to high-volume structured data. ISW and CTP thank their technology partners for their support in this innovative endeavor.



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Executive Summary

The war in Ukraine is transforming the character of war in ways that will affect all future wars. The United States and its allies and partners must understand and internalize the lessons of this war and rapidly adapt themselves in order to address the fundamental problems of contemporary warfare that the war in Ukraine is exposing. These fundamental problems are not confined to the combatants in this conflict, to the specific theater in which they are fighting, or to their particular capabilities and limitations. The more advanced technologies and systems that the United States, NATO, and China, among others, can field neither automatically resolve these problems nor render them obsolete. The path to successful military adaptation runs through Ukraine.

The Ukraine war is to the next great power war as the Spanish Civil War was to World War II. The Spanish Civil War, fought from 1936 to 1939, pitted Republican forces aided by the Soviet Union against Nationalist forces supported by Nazi Germany and fascist Italy among others. The great power backers provided advanced weapons including tanks and aircraft to both sides, and the war became the first live testing ground of the modern weapons and techniques that would be used on a vast scale in World War II. Astute observers in Berlin, Moscow, and elsewhere watched militaries at much lower levels of technology and capability than their own use these new weapons and drew valuable lessons that they implemented in their own more advanced forces.

The Spanish Civil War was but one of the countless instances of war driving military innovation. US thinking about the future of war has too often focused excessively on the changes peacetime technological innovation can bring. American military thinkers often imagine that future wars will be too short to generate much innovation during conflict or seek rather to develop in advance of war asymmetric advantages that will guarantee rapid and decisive success. But most large wars are both long enough and challenging enough

to both sides to drive intense innovation and adaptation cycles iterating much faster than such cycles run during peacetime. Such innovation cycles are at least as notable during positional wars such as World War I, where the pain of long, slow, costly operations creates an urgency for change that can drive significant innovation—just as we see in Ukraine today. The Spanish Civil War was also an example of the way in which smaller conflicts during lulls in great power war can generate change that in turn shapes the way that the next war between great powers is fought.

The Russian and Ukrainian militaries currently fighting in Ukraine are less technically sophisticated, more hastily trained, and much more poorly supplied than the militaries of the United States and its NATO and Asian allies on the one hand, or that of the People's Republic of China on the other. Dismissing the lessons of the Ukraine war on those grounds would be foolish in the extreme.¹ The Ukraine war has

become the first major conflict to see several technological phenomena that will certainly characterize future war:

- I. Air and missile defense systems used at scale against massive and repeated drone, cruise, and ballistic missile salvos;

The war in Ukraine is transforming the character of war in ways that will affect all future wars.

2. Mass use of reconnaissance and strike unmanned aerial systems (UAVs or drones), and first person view (FPV) loitering munitions by both sides;
3. Rapid, dynamic evolution of electronic warfare (EW) measures and counter-measures, including GPS jamming at scale and counter-drone EW;
4. Use of maritime drones to destroy major surface combatants in port and at sea; and
5. Use of drones and cruise missiles to destroy advanced layered air defense systems.

These technological phenomena are only the most salient features of the current conflict likely to be central to any future major war—there are many other examples of contemporary systems and techniques being used for the first time at scale against a peer adversary with similar capabilities.

This paper primarily aims to offer a new framework within which Ukrainian forces and their Western backers can break the current positional warfare and allow Ukraine to restore maneuver to the battlefield. But it is also meant to establish a basis for a discussion within the United States, NATO, and allied Pacific militaries about the implications of the current conflict for contemporary and future war.

Problems

The fundamental problems in contemporary war visible in Ukraine fall into two primary categories: 1) traditional problems that have re-emerged (and do re-emerge at intervals in the history of warfare as conditions change); and 2) new problems resulting from technological changes occurring now.

Traditional problems that have re-emerged include the following:

At the strategic level, large, modern states generally cannot be defeated in a single decisive campaign. The examples of France in 1940 and Iraq in 1991 are exceptions rather than the norm. Such states that survive initial attacks can usually force a protracted conflict, as Ukraine has done following the failure of the initial Russian invasion in 2022.

Beyond Ukraine, the United States and its allies and partners must internalize the reality that they must be prepared for a protracted war and cannot rely on achieving a rapid, decisive outcome at the start of any future conflict. Ongoing discussions about expanding the defense industrial bases of the United States and its allies and partners address part of this challenge. However, accepting the need to be prepared

to wage protracted war also requires fundamental changes to strategic and operational concepts and specifically to approaches to campaign design.

At the operational level, the Ukraine war has demonstrated the enduring nature of three major traditional challenges that can cause war to assume a positional form:

- I. Large, modern states can often generate enough combat power to man continuous defensive positions with no open flanks and can establish sufficient tactical depth at key points to force an attacker to conduct a costly and risky penetration battle¹;
2. Penetration battles have once again become so costly to the attacker that exploiting breakthroughs even when they can be made is not feasible; and
3. Even when a breakthrough is made and exploitation begins, large modern states can usually establish subsequent defensive positions at some distance in the rear to stop the exploitation and stabilize the line.

¹ This condition can even hold in a war that is primarily fought at sea. Japan and the United States both established roughly continuous lines in the various island chains through which they fought and were rarely able simple to sail past defensive island bastions held by the opposing to achieve any decisive effect.

Solutions to these problems have been found at various levels of technology and in various conditions, but those solutions have not permanently resolved the problems for all time. Neither do technological or other changes render these problems permanently insoluble. The United States and NATO have capabilities not available to Russia or Ukraine that would partially resolve some of these challenges in the current context, but those capabilities are not sufficient to render all these problems obsolete or irrelevant in contemporary war.

New Problems: Tactical Reconnaissance Strike Complex (TRSC)

The integration of new technologies with traditional weapons systems and approaches are the primary factors that have given renewed prominence to problems two and three above. The war in Ukraine has seen the most advanced use of offensive and defensive electronic warfare in history as well as the most extensive use of unmanned systems integrated with ground-based fires and attack drones. Pervasive reconnaissance drones have made the battlefield nearly transparent—except when the adversary has been able to blanket it with effective defensive EW. Masses of small first-person-view (FPV) attack drones have made the battlefield extraordinarily lethal because of their ability to destroy individual vehicles and small groups of personnel with precise strikes in a cost-effective manner. The integration of all these systems into what we call in this paper the “Tactical Reconnaissance Strike Complex” (TRSC) is the principal factor currently driving the positional character of the war.

The Soviets and Russians had concepts they called the “reconnaissance-strike complex” (RSC) and the “reconnaissance-fire complex” (RFC) that created a logical separation of fires systems (aircraft, artillery, rocket artillery, etc.) by range into the operational-level RSC and the tactical RFC. Both sides in the current war have merged operational and tactical systems together to achieve direct tactical effects. **We have therefore coined the expression “Tactical Reconnaissance Strike Complex,” or “TRSC,”**

to capture this phenomenon. The TRSC is the combination of pervasive tactical reconnaissance, primarily by drone; drone-corrected precision artillery fire; precision munitions delivered by fixed- and/or rotary-wing aircraft; drone-launched precision munitions; and large numbers of FPV loitering munitions. We have added “tactical” to the RSC because the TRSC combines long-range strike (drones, missiles, and long-range rockets) with short-range fires (tube artillery, tactical drones, and short-range rockets) to generate tactical effects with operational level implications. The RSC, by contrast, aims to generate operational effects directly.

Extensive offensive and defensive electronic warfare supports the TRSC, which also draws on operational and strategic reconnaissance assets. **Neither side has yet integrated long-range strike systems into efforts to conduct or defend against penetration or exploitation operations at scale,** although they could do so.

The TRSC is not like a set of integrated weapons systems such as NATO armies would field in which each major component has relatively fixed capabilities and fixed relationships with the other components. It is, rather, a conceptual system in which the characteristics and capabilities of critical components can change dramatically, often in a short period of time, and the relationships between major components can vary constantly. Change occurs at differential rates, moreover, in the platforms themselves, their critical electronics, and the software that runs them as well as the software that integrates the system. Changes thus also proliferate across the theater at differential rates—software changes are usually the most rapid followed by changes in electronics and then in platforms.

The TRSC thus constantly evolves on both sides in very rapid cycles, sometimes as short as two-to-three weeks driven largely by the competition between EW systems and their countermeasures. Both sides have shown the ability to neutralize at least portions of the adversary’s TRSC at moments planned to support ground operations, and both sides have shown the ability to respond rapidly to restore the functionality of their degraded TRSCs in such cases.

This phenomenon is unlikely to change soon for a number of factors we explore in more depth in the paper.

The TRSC also varies in capability and intensity across the front line. It relies in part on a limited number of advanced systems that neither side can field in quantities sufficient to cover the entire front. The adjustments that create temporary advantages are generally also difficult to proliferate across the entire theater rapidly. This unevenness of capabilities thus creates areas of greater vulnerability that an attacker could potentially exploit.

The novelty of the TRSC lies in part in its cyclic dynamism. Its components and their integrations and interactions with one another are constantly in flux, creating both opportunities and vulnerabilities for the attacker and defender. The challenge it poses to the restoration of maneuver to the battlefield is thus very different from the largely static problem that created trench warfare on the Western Front in World War I. The technologies that created that problem—the water-cooled, belt-fed machine gun; extensive trench systems covered by barbed wire; wired communications; and rapid-firing artillery—remained largely unchanged from 1915 to 1918. Both sides experimented with tactical adaptations and technological solutions and counter-measures, but all were aimed at overcoming the same basic technologically-caused dilemma. The technologies driving the current dilemma are themselves constantly changing, however, creating a punctuated equilibrium of development that can offer advantages and threats because of changes in the underlying technologies.

The nature of the TRSC itself thus generates windows of vulnerability and opportunity that a skillful attacker can hope to use, in principle, in order to make or exploit breakthroughs to achieve operationally-significant objectives. The war has not seen an example of such an operationally-significant breakthrough generated in this fashion, however, but rather tactically-significant advances that the attacker was then unable to exploit. The challenge

facing Ukraine is thus finding ways to convert tactically-significant undertakings into operationally-meaningful actions.

The TRSC is far from the only obstacle to Ukraine's efforts to restore operationally-significant maneuver, to be sure. Ukrainian forces have been starved of necessary materiel largely due to delays in and limitations on the provision and use of weapons and equipment supplied by Ukraine's partners. They have also suffered from increasing manpower shortages caused by a combination of casualties and mobilization policies. Ukraine's situation in both areas is now improving as US aid has begun to arrive and non-US Western aid is increasing and as Ukraine begins to address its mobilization challenges, but the improvement is slow and limited. Ukraine will need to accelerate the resolution of its mobilization problems and its supporters will need

to accelerate the arrival of essential materiel and reduce constraints on its use to set conditions for significant Ukrainian counter-offensive operations of any sort.

Addressing the mobilization and materiel challenges Ukraine faces is a necessary but not sufficient condition of Ukrainian success,

however. Ukraine and its supporters must also reconceive the design and execution of operational-level campaigns taking account not only of the challenges posed by the TRSC but also of those posed by the traditional problems in warfare that have reemerged that we have identified above.

The first and most important element of this reconceptualization lies in the recognition that **wars of this scale cannot be resolved in a single decisive campaign**. The ability of large states to establish deep defensive positions and reserves means that almost any campaign will culminate before achieving the war's strategic aims. Sound campaign design thus requires planning from the outset for multiple successive operations with each one setting conditions for the next. The ideal approach to such campaign design focuses on minimizing the operational pauses between campaigns in order to deprive the adversary of the ability to regain the initiative or establish

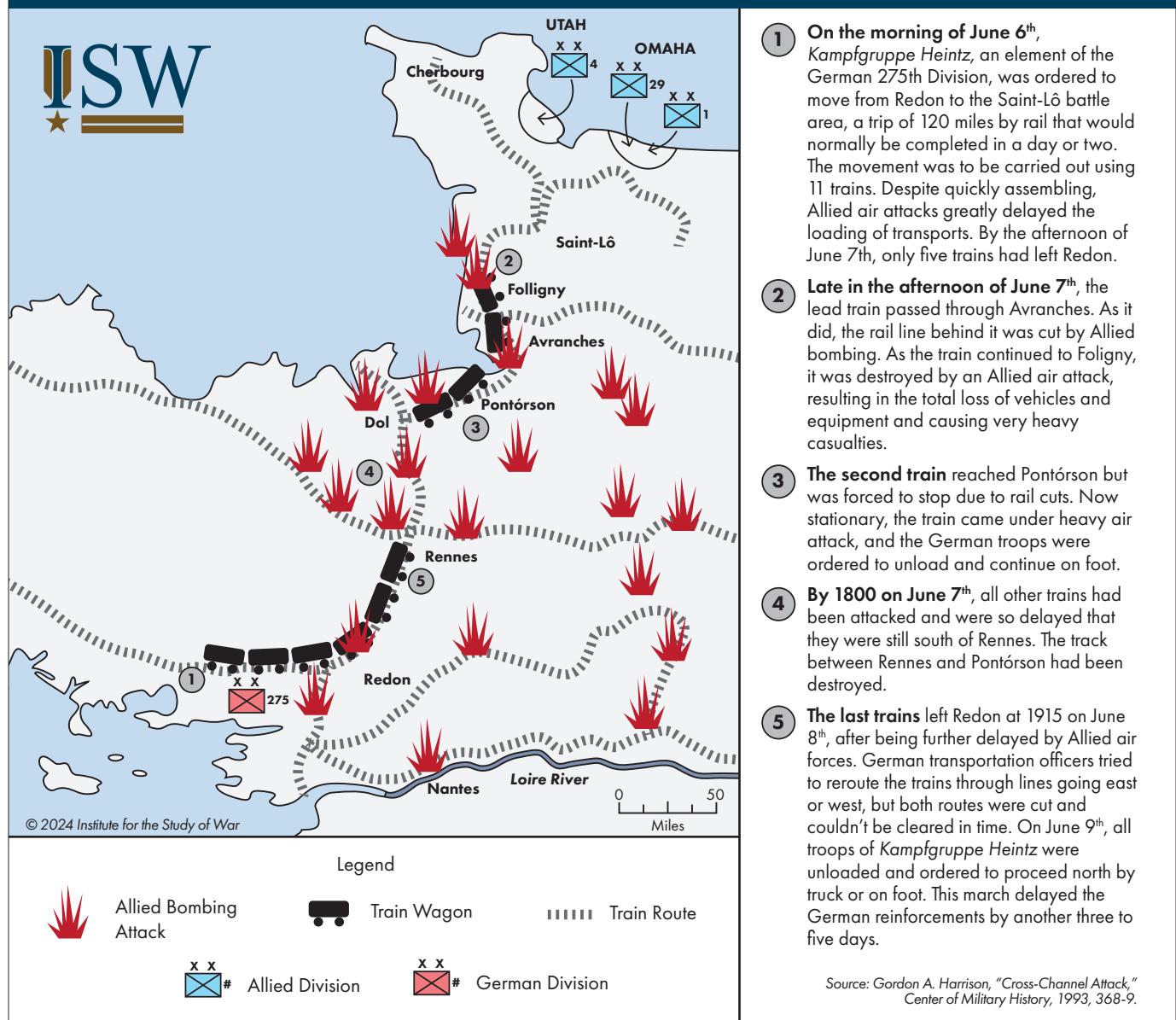
*Wars of this scale cannot
be resolved in a single
decisive campaign.*

defensive positions that would make subsequent operations too costly. The realities of this war likely preclude such an approach at least in the near term, as Ukrainian forces reconstitute their manpower and materiel. The Ukrainians and their supporters must thus accept that, until these conditions change, a successful operational penetration and exploitation will be followed by a Russian counter-attack and the need to conduct another risky and costly penetration

in the successive campaign. Helping Ukraine field the forces necessary to plan and conduct successive operations with limited pauses will reduce long-term costs and risks.

The second element of reconceptualizing campaign design is the need to determine experientially and iteratively the optimal planned depth of a penetration and exploitation in current conditions. The

A Case Study of Allied Battlefield Air Interdiction against German Reinforcements during Operation Overlord: The March of Kampfgruppe Heintz, June 1944



scale of the planned 2023 Ukrainian counter-offensive was clearly too large and the hoped-for exploitation was clearly too deep. It is currently impossible to determine the optimal depth or breadth of either undertaking. Ukrainian forces will have to experiment with operations on different scales and iterate based on their outcomes. Optimal depths and breadths of penetrations and exploitations will also likely change as technology and tactics evolved rapidly. But the **key to success will almost certainly lie in linking together a large number of relatively small but still operationally-significant advances to achieve strategic objectives.**

The third element of reconceptualization is the need to **improve the integration of long-range fires with ground maneuver.** A key element of the historical solution to the problem of making and exploiting operationally-significant penetrations was the use of airpower to isolate the battlefield and protect exploitation forces by keeping adversary reinforcements and, secondarily, supplies, from arriving in a timely fashion. This airpower function is known as battlefield air interdiction (BAI). Neither side in this war can conduct BAI using manned aircraft because of the density and sophistication of adversary air defenses (and, in Ukraine's case, the sheer paucity of such aircraft and pilots). Ukraine has, however, shown that it is possible to conduct at least partial BAI using ground-based systems in the admittedly exceptional case of the 2022 Kherson counteroffensive. Ukrainian forces used US-provided HIMARS to deprive the Russians of the use of the essential Antonivskyi Bridge and the roadway over the Kakhovka Dam in conjunction with Ukrainian ground offensive operations, forcing the Russians to withdraw from right-bank Kherson. The success of that effort rested, to be sure, on the fact that the lower Dnipro is a very wide river with a very few major crossings that could be disabled by the systems Ukraine had. It demonstrates, nevertheless, that **the skillful use of ground-based strike systems can reproduce some of the effects of traditional BAI.** Therefore, the challenge of isolating the battlefield

within the parameters of likely technological capabilities is one of campaign design.

Ukrainian failure to conduct BAI in support of the 2023 counteroffensive allowed the Russians to redeploy the bulk of two airborne divisions (five regiments) to the main counteroffensive sector in time to blunt the penetration and preclude a successful exploitation. Ukrainian BAI in support of the offensive in western Zaporizhia Oblast would have been very challenging because of the relatively flat terrain with no major chokepoints that could have been easily targeted. The Ukrainians would thus likely have had to focus on striking elements of the reinforcing units as they approached the front lines in order to delay them, force them to deploy into combat formations prematurely, and attrit them. The effect the Ukrainians could have generated in 2023 even with such an approach is far from clear, to be sure, given the limited number of long-range precision systems they had and the limited ranges of the systems available to them at that time. The point here is not to criticize Ukrainian performance in 2023 but rather to illustrate a specific problem that will likely recur in any future major Ukrainian counteroffensive operation if Ukrainian forces do not find ways to prevent or at least mitigate it. Ukraine now has many more long-range systems of various ranges, moreover, that make possible the development of at least limited BAI components of future ground operations.

The fourth element of reconceptualization derives from the fact that Russian forces are now on the offensive across virtually the entire front line and are not, therefore, currently focused on preparing deep and extensive defensive positions along most of it. Ukrainian forces will not necessarily have to be able to penetrate dozens of kilometers of minefields and trench systems manned by Russian troops that

Success in this war lies in developing multiple advantages that generate systemic effects.

have been rehearsing defensive tactics for months as they did in 2023. The Ukrainians can choose instead to attack areas of Russian vulnerability in two ways. First, there are likely sectors of the front

that the Russians are manning thinly as they prioritize their offensive operations, creating weak points propitious for Ukrainian attacks. Second, Russian forces on the offensive are not developing deep defensive positions behind themselves on the whole. **Ukrainian forces can therefore counter-attack into culminating Russian offensive operations, taking advantage both of the lack of deep defensive positions and of the relative disorganization of a force engaged in a culminating attack.** Ukraine must develop the ability, with the support of its partners, to penetrate prepared defensive positions, to be sure, but the next counteroffensive operation whenever it comes need not look like the 2023 effort in western Zaporizhia.

The final element of reconceptualization is the need to plan ground counter-offensive operations to **use fleeting technological advantages to disrupt the defender's TRSC in support of the initial penetration operation and to sustain the advantage long enough to create a moving envelope that protects exploitation forces through to their planned culmination and transition to the defensive having secured their objectives.** Such an approach is not novel in warfare. The British in World War I, for example, largely held back widespread use of the tank until they could field tanks at scale in support of the 1916 Somme Offensive—where the appearance of large numbers of British tanks surprised the German defenders and facilitated initial successful penetrations. But World War I approaches along these lines tended to focus on generating one advantage at a time and took insufficient account of the rapidity with which counter-measures would emerge. **Success in this war, and likely future wars, lies in developing multiple advantages that generate systemic effects, recognizing the likely short duration of those advantages, and planning ground operations within those constraints.** Deploying multiple advantages at once is important in order to complicate and delay the adversary's ability to negate them rapidly. **Success also lies in the recognition of the need to be creating such advantages constantly and**

dynamically in interaction with the adversary and changing technologies — there will not likely be a single jump in capabilities that will bring enduring rather than temporary advantages.

The need constantly to be generating multiple innovations in various kinds of systems emerges thus from the character of this war, but it is fortunately also a core advantage that Ukraine has over Russia. The Ukrainian innovation environment is robust, creative, well-integrated with the battlefield, and able to draw on Ukraine's intrinsic technological capabilities and human capital as well as on Ukraine's many advanced international partners. Russia is innovating as well, to be sure, and can draw on Chinese and Iranian innovation capabilities in addition to its own extensive technology economy and defense industrial base. But the Russian approach is generally more centralized, more focused on mass production of successful prototypes at scale, and less nimble than Ukraine's. This critical area is Ukraine's comparative advantage over Russia and can facilitate Ukrainian military success if the challenges of manpower and materiel as well as campaign design can be met.

Ukraine should seek every possible way of restoring maneuver to this war as soon as possible.

Ukraine faces enormous challenges today and in the months to come. Ukrainian forces are very unlikely to be able to initiate significant counteroffensive operations in 2024 and into 2025. Their ability to do so at all still rests on the accelerated and sustained provision of Western security assistance and the lifting of restrictions on the use of that assistance as well as on their ability to sustain an improved mobilization and training system.

It does not follow, however, that Ukrainian forces should plan simply to remain on the defensive for the indefinite future while trying to amass the resources needed for a counter-offensive. This should be a time of experimentation, on the contrary, that should increasingly let Ukraine challenge Russian forces for the initiative in parts of the theater while exploring opportunities for future, more substantial counter-offensive operations as conditions permit.

Neither can Ukraine resign itself to the supposed reality of permanent positional warfare. The persistence of positional warfare depends, in fact, on the unstable dynamic developments underlying the TRSC and cannot be taken for granted. The Russians may find a way to restore maneuver if the Ukrainians do not do so first. But positional warfare, more importantly, will not liberate the strategically

vital lands Ukraine must win back in order to be secure against future Russian aggression. It will also protract the war and dramatically increase its costs to Ukraine and to Ukraine's supporters. Ukraine should thus seek every possible way of restoring maneuver to this war as soon as possible, daunting though that task appears.

Introduction: The Future of War Runs through Ukraine

The Ukraine war is to the next great power war as the Spanish Civil War was to World War II. The Spanish Civil War, fought from 1936 to 1939, pitted Republican forces aided by the Soviet Union against Nationalist forces supported by Nazi Germany and fascist Italy among others. The great power backers provided advanced weapons including tanks and aircraft to both sides, and the war became the first live testing ground of the modern weapons and techniques that would be used on a vast scale in World War II. Astute observers in Berlin, Moscow, and elsewhere watched militaries at much lower levels of technology and capability than their own use these new weapons and drew valuable lessons that they implemented in their own more advanced forces.

The Spanish Civil War was but one of the countless instances of war driving military innovation. US thinking about the future of war has too often come to focus on the changes peacetime technological innovation can bring. This US thinking results in part because American military thinkers often imagine that future wars will be too short to generate much innovation during conflict and in part because US military thinkers seek rather to develop in advance of war asymmetric advantages that will guarantee rapid and decisive success. But most large wars are both long enough and challenging enough to both sides to bring about intense innovation and adaptation cycles iterating much faster than such cycles run

Most large wars bring about intense innovation and adaptation cycles iterating much faster than such cycles run during peacetime.

during peacetime. Such innovation cycles are at least as notable during positional wars such as World War I, where the pain of long, slow, costly operations creates an urgency for change that can drive significant innovation—just as we see in Ukraine today. The Spanish Civil War was also an example of the way in which smaller conflicts during lulls in great power war can generate change that in turn shapes the way that the next war between great powers is fought.

The Russian and Ukrainian militaries currently fighting in Ukraine are less technically sophisticated, more hastily trained, and much more poorly supplied than the militaries of the United States and its NATO and Asian allies on the one hand, or that of the People's

Republic of China on the other. Dismissing the lessons of the Ukraine war on those grounds would be foolish in the extreme.² The Ukraine war has become the first major conflict to see several technological phenomena that will certainly characterize future war:

1. Air and missile defense systems used at scale against massive and repeated drone, cruise, and ballistic missile salvos;
2. Mass use of reconnaissance and strike unmanned aerial systems (UAVs or drones), and first-person view (FPV) loitering munitions by both sides;
3. Rapid, dynamic evolution of electronic warfare (EW) measures and counter-measures, including GPS jamming at scale and counter-drone EW;

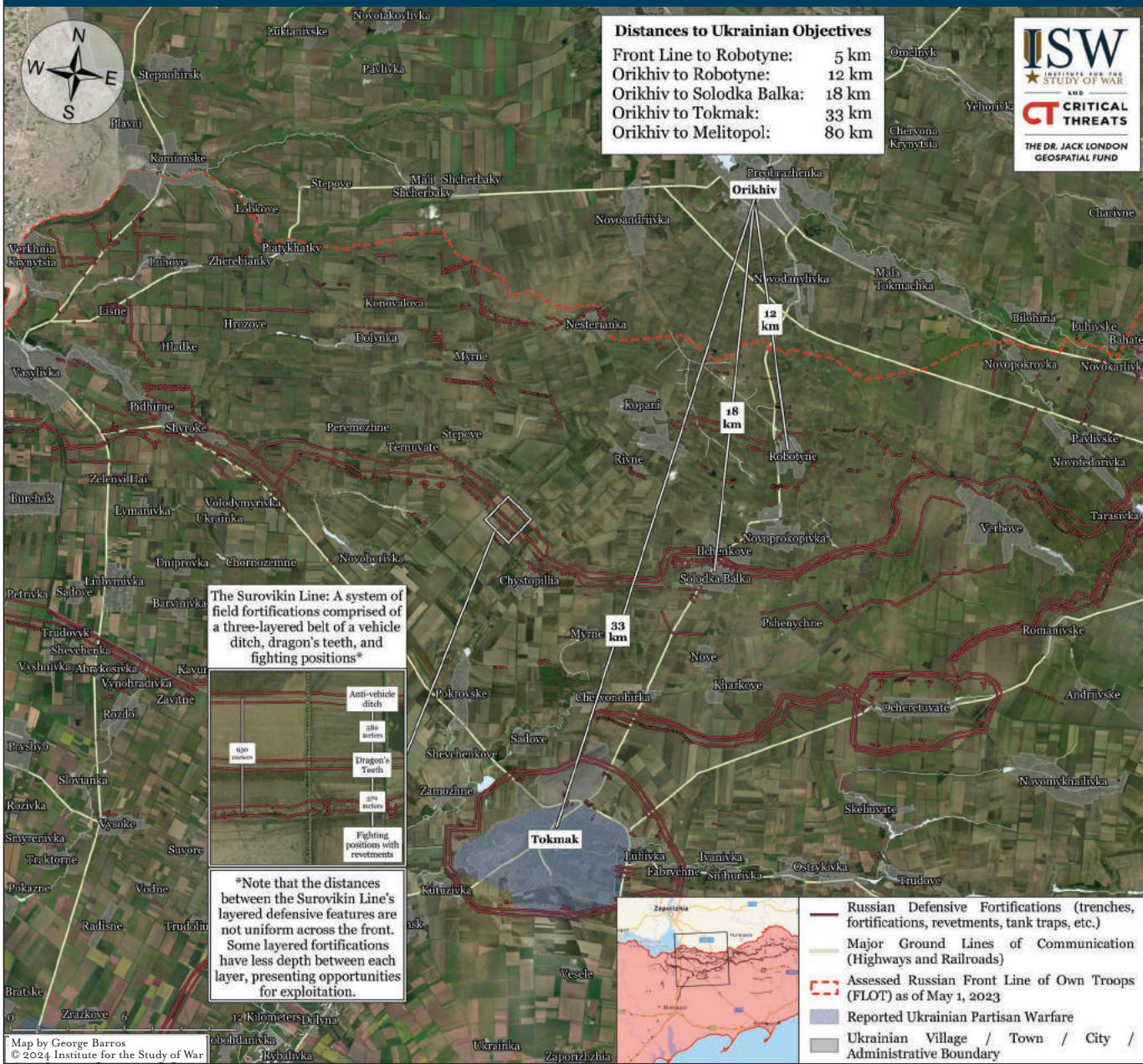
4. Use of maritime drones to destroy major surface combatants in port and at sea; and
5. Use of drones and cruise missiles to destroy advanced layered air defense systems.

These technological phenomena are only the most salient features of the current conflict likely to be central to any future major war — there are many other examples of contemporary systems and techniques

being used for the first time at scale against a peer adversary with similar capabilities.

The paper that follows primarily aims to offer a new framework within which Ukrainian forces and their Western backers can break the current positional warfare and allow Ukraine to restore maneuver to the battlefield. But it is also meant to establish a basis for a discussion within the United States, NATO, and allied

Assessment of the Frontline Situation for Ukraine's Main Effort Towards Melitopol as of May 1, 2023



Pacific militaries about the implications of the current conflict for contemporary and future war.

Restoring Operational Level Maneuver Remains the Central Problem in this War

The Ukraine war took on a positional form following the 2022 Ukrainian counteroffensives that liberated large parts of Kharkiv and Kherson oblasts. Positional warfare is the expression used by former Ukrainian Commander in Chief General Valery Zaluzhny, drawing on earlier military theory, to describe the character of the current war. It “is characterized by relatively static frontlines and regular combat that produces little movement, but the aim of such combat is generally either to create forward progress through steady if small advances or to create conditions to restore [operational] maneuver to the battlefield,” as we have explained elsewhere.³ Operational maneuver in this context refers to the ability of an attacking force to penetrate any prepared positions of the defender and exploit that penetration at the operational level of war (the realm of campaigns, not battles) through continued advances against defending forces that lack a coherent defensive line prepared to receive and defeat the attack.¹¹ Examples of such maneuver include the German defeats of Poland and France in

1939 and 1940 respectively, the campaign to break out of Normandy and liberate France in 1944, the US-led coalition’s operation to liberate Kuwait in 1991, and the US invasion of Iraq in 2003.¹¹¹

Neither Russia nor Ukraine has succeeded in penetrating the other side’s prepared defenses sufficiently to engage in such operational maneuver since autumn of 2022 even though both have made tactical advances. The Russians, for example, seized the city of Bakhmut in April 2023 but were unable to exploit that gain before Ukrainian forces were able to counterattack and re-establish coherently prepared defenses. The Russians seized the settlement of Avdiivka in February 2024 and have made additional localized tactical gains thereafter but have been unable to prevent the Ukrainians from re-establishing coherent defensive positions in that sector. The Ukrainians penetrated the initial Russian prepared defensive positions in Zaporizhia Oblast during their 2023 counteroffensive but were similarly unable to exploit that penetration before the Russians reformed coherent defensive positions and counterattacked. Even the Russian offensive into Kharkiv Oblast in May 2024 rapidly fell into a positional form as Ukrainian reinforcements established defenses. The challenge of restoring operational maneuver to war thus remains the central problem for both sides in this conflict at the operational level of war.

*ISW defines the **tactical level of war** as including all activities related to the actions of soldiers in contact with the enemy in a defined space and time. The **operational level** goes beyond individual battles to address campaigns, which both set the terms of individual battles and aim to accomplish objectives vital to overall success in the war. Finally, the **strategic level** encompasses all activity above the operational level, including decisions by supreme commanders and heads of state coordinating multiple large formations. Or, as the seminal Soviet theorist Alexander Svechin put it, “tactics make the steps from which operational leaps are assembled; strategy points out the path.” The fundamental challenge faced by both sides in Ukraine is that their forces can take tactical steps (often at great cost) towards defined strategic paths, but the battlefield conditions discussed in the following section of this report preclude stringing multiple halting steps into effective and timely leaps.*

^{II} US Army doctrine defines penetration as follows: “A penetration is a form of maneuver where an attacking force seeks to rupture enemy defenses in a narrow front to disrupt the defensive system. Destroying the continuity of defense allows the enemy’s subsequent isolation and defeat in detail by exploiting friendly forces.” https://www.moore.army.mil/Infantry/DoctrineSupplement/ATP3-21.8/chapter_04/section_02/page_0040/index.html#:~:text=A%20penetration%20is%20a%20form,detail%20by%20exploiting%20friendly%20forces

^{III} This usage of maneuver refers to activities at the operational level of war rather than to the tactical doctrinal definition of the word that refers to the integration of movement and fires.

Consequences of the Suspension and Delayed Resumption of US Military Assistance

The failure of the US Congress to renew military assistance to Ukraine in the fall of 2023 generated an inflection in the war. Russian forces launched an offensive around Avdiivka, Donetsk Oblast in October 2023 intended to cause the Ukrainian counteroffensive to culminate and also to shape the US aid debate. As the US debate protracted into 2024 and Ukrainian supplies of particularly artillery shells and air defense interceptors dwindled, the Russians seized the theater-wide initiative with localized offensives launched along nearly the entire front line starting in January 2024.⁴ Ukrainian forces became focused almost exclusively on preventing the Russians from restoring operational maneuver by making and exploiting breakthroughs, a task at which they succeeded surprisingly well. The resumption of US military assistance in April 2024 and the arrival of this aid to frontline units has already begun to allow Ukrainian forces to stabilize their lines.⁵ Russian offensives continue into July 2024, particularly throughout Donetsk Oblast, but the Russians are extremely unlikely to be able to exploit the limited gains they are making to pursue operationally significant advances in the coming months.⁶ The Russians are also extremely unlikely at this time to make an operational breakthrough anywhere along the frontline, still less likely to restore operational maneuver.

The Russians concentrated forces to conduct another large-scale offensive in the summer of 2024 that Ukraine has been receiving and largely defeating so far. It is unclear if the Russians are still preparing for yet another discrete large-scale offensive operation or if they are funneling newly-concentrated forces into ongoing offensive operations. Russian forces launched a small-scale incursion into Kharkiv Oblast in May 2024 that rapidly descended back to positional warfare but they did so with only a small part of the forces they have been assembling to threaten Kharkiv City. It is unclear where any

The challenge of restoring operational maneuver to war remains the central problem for both sides in this conflict.

future large-scale Russian offensive would focus, but the Russians will likely try to complete the seizure of Chasiv Yar, continue to exploit their gains around Avdiivka, and drive toward the Donetsk Oblast border. They may also reinforce offensive operations on the Kupyansk-Svatove line that have generally stalled.

Ukrainian forces will in any case remain largely on the defensive throughout the summer of 2024 and very likely into the fall and winter, possibly making limited opportunistic counterattacks. The Ukrainian defensive efforts will likely prevent the Russians from making significant gains especially as Western military assistance continues to flow in and Ukrainian initiatives to increase manpower available to units in combat start to take effect.

Western policy discussions have understandably focused on improving Ukraine's ability to defend throughout this challenging time. Some Western commentators have, in fact, been seeking to make a virtue of necessity by arguing that Ukraine should simply focus on the defense and abandon thoughts of renewed counter-offensive operations.⁷ This approach would be extremely dangerous, as ISW has assessed.⁸ Russian President Vladimir Putin has apparently adjusted his expectations to include the assumption that Ukraine will never be able to regain land his forces can seize.⁹ This assumption is fueling his support for constant highly attritional but small Russian advances, presumably on the theory that enough small gains over time will decide the war in his favor and that the losses his forces take in making

those gains are acceptable since the gains themselves are permanent. This assumption encourages Putin to plan for a very protracted and bloody war, and he appears to be setting conditions to support such a war with his new appointments in the Ministry of Defense.¹⁰ Demonstrating that Ukrainian forces will be able to reverse Russian gains and liberate strategically important territory is a vital part of forcing Putin to recalibrate his aims and expectations once again.

Assessed Frontline Situation on the Seam Between Donetsk and Zaporizhia Oblasts as of May 1, 2023



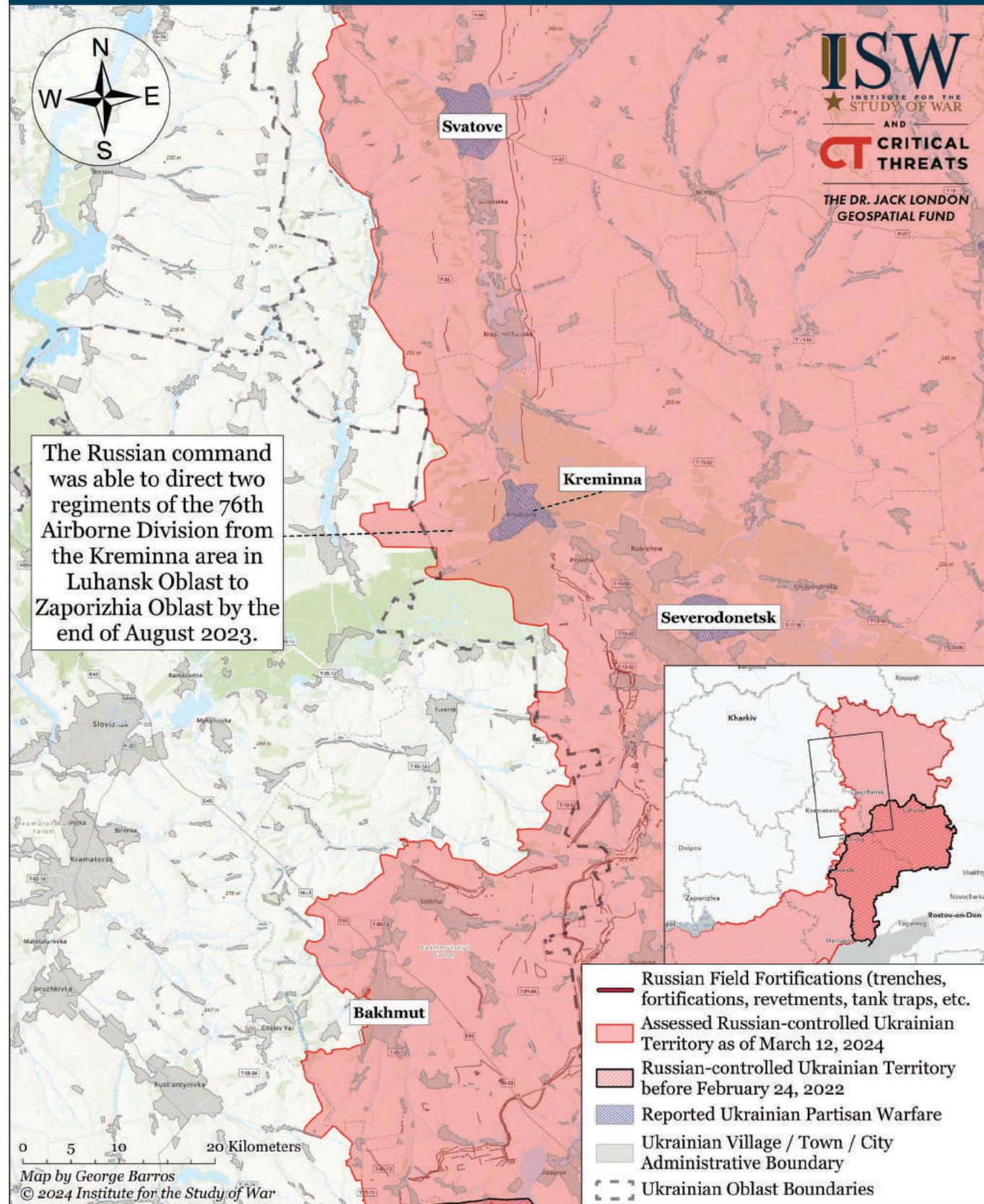
Ukraine will thus have to resume counter-offensive operations as soon as it can create the conditions to do so. Creating those conditions will take time and require overcoming significant but surmountable challenges as many have observed. Ukraine has suffered from shortages of military manpower resulting from a combination of losses and its own mobilization policies. Ukraine is also struggling to train incoming personnel to the necessary standards at scale. Shortages of materiel of all kinds hinder reconstitution and that training, as well as Ukrainian operations on the battlefield. For example, new units cannot train on vehicles they do not have. Ukraine has begun to address its manpower challenges through limited changes to its mobilization law and is working with Western partners to improve its training as supplies trickle in. However, Ukrainian forces are extremely unlikely to be able to undertake significant counteroffensive operations in 2024 and into 2025.

Overcoming Ukraine's manpower and materiel challenges is a necessary but not sufficient condition for Ukraine's success. The problem of designing and preparing for a successful counter-offensive—for restoring maneuver to the battlefield—remains

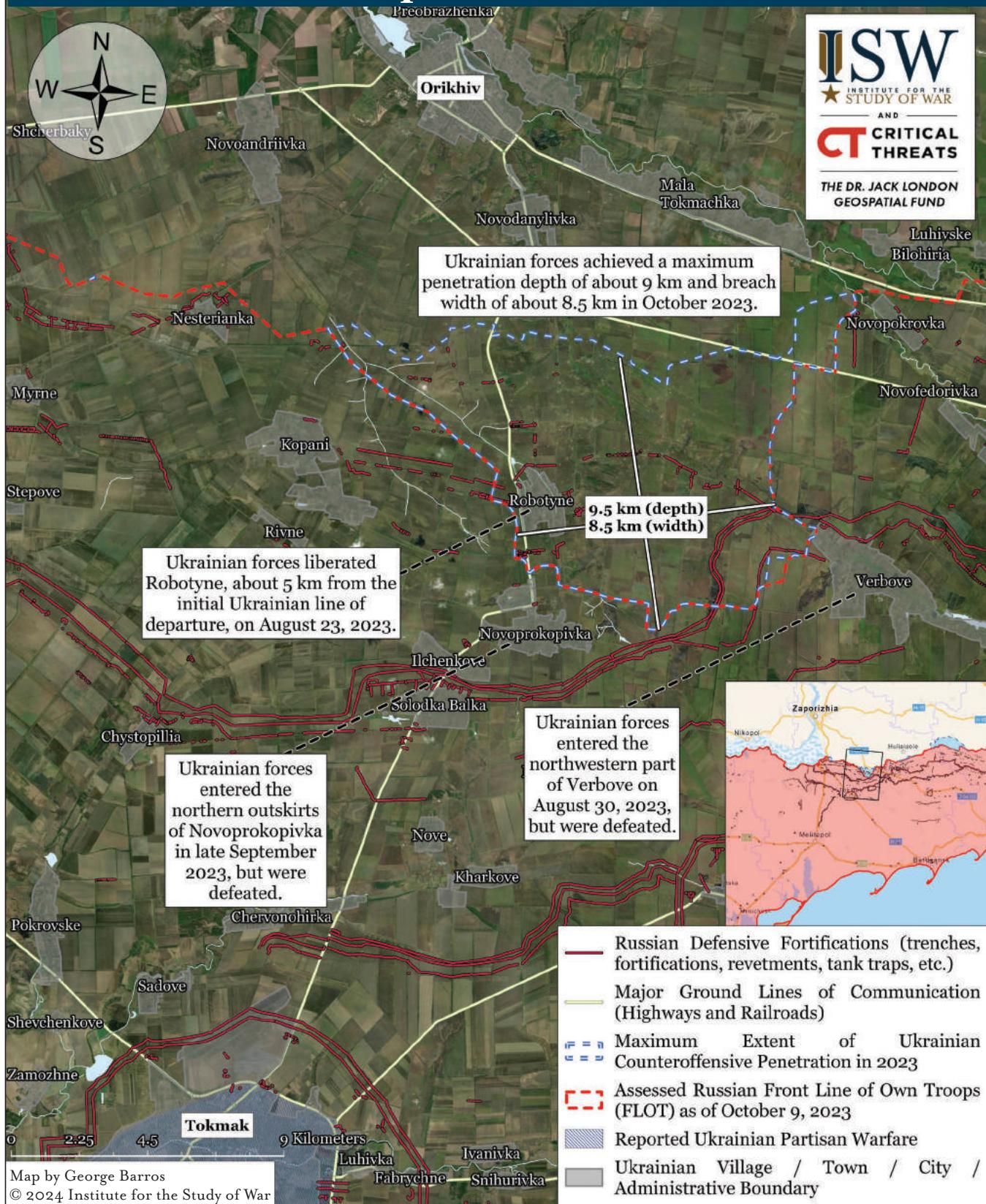
unsolved. A flurry of discussions about lessons to be learned from the 2023 counteroffensive and of tactical and technological innovations over the past six months has not coalesced into a coherent framework or concept for restoring maneuver to the battlefield. Some analysts have concluded that that task is impossible, indeed, and have advocated embracing attritional or, at least, positional warfare as the only feasible method of conducting operations in this war.¹¹

Such an approach would likely be strategically disastrous. It would effectively at best freeze the front lines roughly where they are, protract the war, and increase its cost to Ukraine and its supporters. It would encourage Putin to continue on his present course rather than forcing him to rethink his approach to Ukraine and the desirability of continuing the war. We offer no starry-eyed notion that restoring maneuver to this battlefield will be easy, and it may not prove feasible in the end. But we argue that doing so is so vital to Ukraine's long-term survival and to finding an end state to this war acceptable to Ukraine and the West that we must exhaust every possible avenue before abandoning

Assessed Frontline Situation in Kreminna, Luhansk Oblast, as of May 1, 2023



Limit of Advance of Ukraine's Counteroffensive Toward Melitopol as of October 9, 2023



the effort—and there are unexplored avenues, we believe, as considered in the rest of this essay.

Discussions about future Ukrainian counteroffensives as continue in the West generally focus on preparing Ukraine for a counter-offensive in 2025 similar to the one Ukraine conducted in 2023 only with the mistakes of inadequate training, equipment, preparation, planning optimizations, and so forth corrected.¹² This approach is also flawed for a number of reasons we will consider in much more detail presently.

The necessity of seeking an escape from attritional and positional war is obvious, but the challenge of doing so transcends fixing the mistakes of 2023. The character of the war has changed in 2023 and 2024 in two ways. First, the evolution of the drone-electronic warfare (EW) complex and the very rapidly cycling offense-defense race between drones and EW has thus far favored the defender and greatly impeded the Russians' ability to make significant gains even despite Ukraine's critical shortages of artillery ammunition and other materiel. The Ukrainians will have to overcome this challenge, which was merely nascent during the 2023 counteroffensive, to restore maneuver of their own. The preponderant focus in ongoing lessons-learned discussions is rightly on the advent and widespread use of new technologies such

as tactical drones and EW systems, but older technologies such as tanks and both self-propelled and towed artillery remain essential battlefield systems and are integral to the emerging drone-based systems as we shall consider in more detail below.

Second, the Russians have gone over to the offensive along the entire line and appear intent on continuing offensive operations indefinitely. This fact, paradoxically, can facilitate Ukrainian counter-offensive operations. The relative success of the Russian defense against the 2023 counter-offensive rested on months-long Russian preparations of defensive positions in great depth and rehearsals of defensive tactics by units not otherwise engaged in serious combat operations. The Russians have not been observed to be constructing such defenses-in-depth in key sectors of the frontline since the end of the 2023 Ukrainian counteroffensive. As Russian offensive operations culminate, therefore, well-prepared Ukrainian counter-offsensives can hope to attack tired Russian units without the extensive minefields, reserves, and fighting positions that posed such problems in 2023. For these reasons and others, therefore, it is imperative to start thinking and preparing now for new approaches to future Ukrainian counter-offensive operations, long before conditions can be set actually to initiate them.

Part I: What Happened in the 2023 Counteroffensive?

Drawing the correct lessons from the Ukrainian 2023 counteroffensive requires beginning with the campaign designs and tactical approaches of both the Ukrainian Armed Forces (UAF) and the defending Russian forces at the outset of the campaign and then considering the evolution of tactics and techniques by both sides as the campaign continued.

Ukrainian Counteroffensive Campaign Design

The UAF began the major phase of the 2023 counteroffensive in early June. The counteroffensive consisted of a main effort and four supporting efforts.

Main Effort and Supporting Effort 1: Zaporizhia

The main effort consisted of two offensive drives: The primary Ukrainian axis of advance was from Orikhiv via Tokmak toward Melitopol in Zaporizhia Oblast. The secondary axis of advance ran from Velyka Novosilka south on the Zaporizhia-Donetsk oblast border. The Velyka Novosilka axis was likely meant from the outset to be Supporting Effort 1, although the Ukrainian command appears to have set conditions that would have allowed it to prioritize that axis as the main effort and have the drive on Tokmak become a supporting effort.

Supporting Effort 2: Bakhmut

UAF elements that had concentrated around Bakhmut to defend against the Russian offensive to seize that city, which the Russians took around May 20, 2023, went over to the counteroffensive at about the time that Russian forces completed the seizure of Bakhmut and the Wagner Group that had been spearheading the effort suddenly withdrew from the battlefield.¹³

Supporting Effort 3: Kherson

The UAF had apparently prepared an additional diversionary attack across the Dnipro River in Kherson Oblast, but the Russian destruction of the Kakhovka Dam on June 6 preempted it.¹⁴

Supporting Effort 4: Ukrainian Deep Strike Campaign

The UAF had been conducting targeted strikes with long-range precision weapons against Russian command and control and supply points in the lead-up to the counteroffensive but did not accompany the ground maneuver phase of the operation itself with a long-range strike effort that would generate effects directly supporting the ground operations.¹⁵ It is unclear if Ukraine could have conducted such an effort given the number and kind of long-range strike systems available to it, but it is clear that it did not try to do so.

Both the Bakhmut and the Velyka Novosilka axes were supporting efforts for the main Ukrainian



counteroffensive effort on the Melitopol axis, however, and the Ukrainian command did not attempt to exploit successes in either location. These Ukrainian operations appear mainly to have been intended to fix Russian frontline troops and reserves away from the primary planned breakthrough sector.¹⁶

Russian Defensive Campaign Design

The Russians had been preparing for the counteroffensive for many months, but the quality and readiness of their defenses varied considerably across the different axes of the Ukrainian attack. Russian forces around Bakhmut were in disarray as Ukrainian forces there counterattacked. The sudden and ill-coordinated withdrawal of Wagner fighters after the city's capture left a hole in the lines that the Russian high command rushed to fill first and primarily with airborne and Spetsnaz forces.¹⁷ The sudden transition from offense to defense prevented the Russians in this sector from establishing defensive positions, laying minefields, or otherwise preparing to receive the Ukrainian counterattack. Russian troops defending the Zaporizhia-Donetsk oblast seam were a hodgepodge of regular and irregular units and formations that had prepared their ground with minefields and trenches. Their command was not cohesive and their training for defensive operations was inconsistent.

The Russian forces facing Ukraine's main effort breakthrough sector were the best prepared of all Russian troops in the theater to receive an attack, by contrast. The Russian 58th Combined Arms Army (CAA) had responsibility for that sector and deployed the divisions, brigades, and battalions normally assigned to it in a cohesive and well-designed defense-in-depth.¹⁸ The 58th CAA conducted a relatively traditional, conventional defense with two important modern innovations.

Traditional Elastic Defense

Russian forces had prepared extensive defensive positions combining deep minefields, a main defensive line of anti-tank obstacles and trenches known as

the Surovkin Line, and a myriad of small, dispersed trenches and fighting positions dug into treelines.¹⁹ Russian artillery and rotary-wing attack aviation supported the ground forces.²⁰

The minefields have received extensive and perhaps excessive attention in the coverage of the operation. They were deeper and more skillfully laid than external observers had expected. Ukraine's Western partners had provided only limited armored mine clearing equipment, Ukrainian forces did not concentrate all that equipment on this primary breakthrough sector, and Ukrainian forces pushed forward the mine clearing equipment that did deploy to this sector without suppressing Russian anti-tank guided missiles (ATGMs). The Ukrainian forces did not appear to be proficient enough in combined arms tactics to conduct the complex tactical engagements that would likely have been necessary to suppress ATGMs and other Russian defenses while simultaneously clearing mines, as has been observed, but they also simply lacked enough armored mine clearing equipment to risk losing enough to move more rapidly.²¹

The minefields were mainly significant in the context of the larger Russian defensive campaign, however. They increased lethality in the penetration battle and more importantly slowed the Ukrainian advance dramatically. The slow pace of the Ukrainian advance enabled the Russians to take full advantage of the tactical lethality they had developed, to withdraw in good order to prepared subsequent defensive positions, and then to bring operational reserves to bear when needed. The delay, in fact, allowed the Russians to offset the fact that they had not retained an uncommitted operational reserve in the area of the expected Ukrainian attack. The Russians instead were able to pull forces out of the fight in other parts of the theater and bring them to defend against the exploitation of the Ukrainian breakthrough in a timely fashion. The Russians were able to bring reserves from other parts of the front line because the destruction of the Kakhovka Dam freed up the 7th Airborne Division from its defensive duties in Kherson Oblast and allowed it to transfer to the Zaporizhia sector, on the one hand, while the relatively limited Ukrainian counterattacks around Bakhmut consumed only some of the reserves the

Russians could make available from the Kharkiv-Luhansk sector.²² The Russian command was thus able to redirect two regiments of the 76th Airborne Division from the Kreminna area in Luhansk Oblast to Zaporizhia Oblast by the end of August 2023.²³

The nature of the Russian field fortifications was another essential component of the overall Russian success. The long-prepared, visible-from-space Surovkin Line was ultimately not the most important of these. The defensive positions that mattered most were the sub-tactical trench systems that Russian units had dug in all the windbreaks and treelines around all the fields in the attack sector. These were distributed and decentralized defensive positions that were not easily suppressed or destroyed by massed fires (because Ukrainian forces often struggled to identify individual positions before assaults and lacked sufficient artillery munitions to saturate a large area containing multiple dispersed Russian positions) and were lethal enough to preclude Ukrainian infantry advances unaccompanied by armor. Russian soldiers fielded anti-tank systems that made those defenses dangerous for armor, especially because the Ukrainians were unable to mass enough armor to overwhelm them due to the lethality of the integrated tactical drone-based reconnaissance and drone- and artillery-based fires system—which the Russians had developed and used properly in the defense in 2023 for the first time. We will consider this system in much greater detail below.

The Russians largely used an elastic defense in a fairly traditional way. Russian troops in some areas defended at the front lines and accepted higher casualties presumably in an effort to avoid giving up any ground. Sometimes they held ground for informational effects so that they did not have to answer to higher headquarters for losing any terrain. But the UAF also struggled to break through some of these forward defenses more than a force well-trained in tactical mechanized maneuver should have, allowing Russian forces in some areas to stop Ukrainian tactical advances cold.

The bulk of the Russian defense, however, used the elastic defense technique that the Germans had perfected in World War I and that has been successfully modified for mechanized warfare over

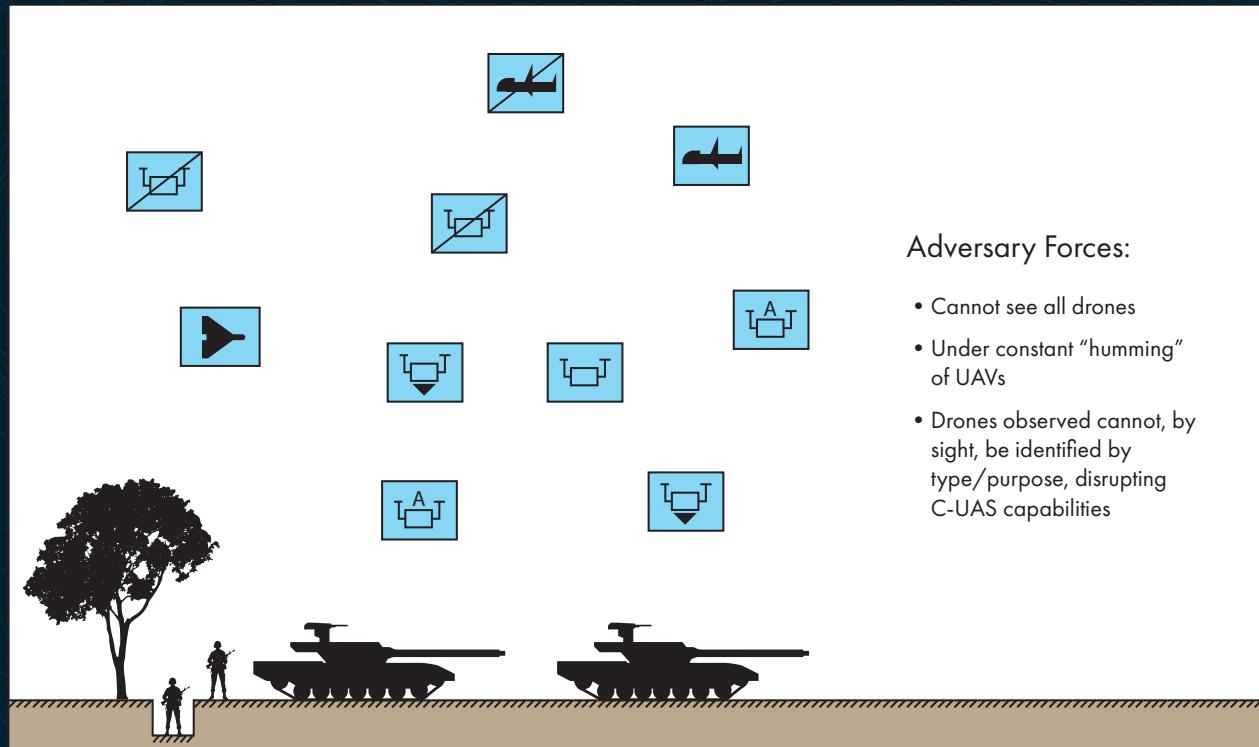
the intervening decades. It places relatively small numbers of defenders at the front lines to begin with in order to minimize the casualties they take from the initial assaults. Those defenders pull back as the attackers advance, drawing the attackers away from their own tactical fires and into minefields and trenchlines that canalize movement and attrit the attackers. The defenders use their own tactical fires to inflict heavy losses on the attackers advancing through known defensive positions. When the attackers are sufficiently weakened, defending reserves launch a counter-attack and push them back to their starting points. Russian forces executed this technique extremely well in 2023.

Contemporary Defensive Innovations

The Russians added two modern twists to the decades-old elastic defense technique. First, they took advantage of the ubiquity of tactical reconnaissance systems, primarily drones, to make the battlefield almost transparent to them. They were able to see all or most of the advancing Ukrainian forces and any reserves immediately behind them. The integration of that tactical reconnaissance with attack drones, artillery, and attack rotary-wing aviation allowed the Russians to bring individual Ukrainian vehicles and infantry concentrations under precise fire throughout the depth of the tactical advance. Russian forces on the defensive were thus able to inflict high casualties on advancing Ukrainian troops even before the Russian tactical reserves launched their counterattacks. The Russian minefields and trenchlines facilitated this Russian approach by slowing and canalizing the Ukrainian advance as much as by generating Ukrainian casualties on their own.

Second, the Russians had developed their electronic warfare (EW) capabilities to a hitherto unprecedented level. They were able to jam the GPS signals on which most Ukrainian precision systems—including Western-provided systems such as HIMARS—relied across wide sectors of the battlefield.²⁴ Russian EW also severely degraded Ukrainian drone operations by interfering with the communications between drones and their ground operators. Russian EW at times even disrupted Ukrainian tactical communications

PERVASIVENESS & DENSITY of UAVs on the battlefields of Ukraine



The modern battlefield in Ukraine is exceptionally deadly with limited cover and concealment. At any moment, scores of unmanned aerial vehicles (UAVs) cover the sky with effective reconnaissance and targeting capabilities. For instance, many reconnaissance drones have electro-optical, thermal and infrared sensing capabilities that identify and strike targets at day and night.

FPV attack quadcopters, quadcopters that precisely drop munitions, fixed wing strike drones, and loitering munitions enable retail killing at wholesale scale. From kilometers away, drone operators can identify and engage adversary firing positions, vehicles, and individual soldiers. Their effective range can be increased through relay drones that pass data from the attack drones to their operators.

Legend

- | | |
|-----------------------------|---------------------|
| Recon Quadcopter | Fixed-Wing Recon |
| Precision Strike Quadcopter | Fixed-Wing Strike |
| Attack FPV Quadcopter | Loitering Munitions |
| Relay Quadcopter | |

to the point where Ukrainian vehicles were unable to communicate with one another on the battlefield. The inexperienced Ukrainian units assigned to the Orikhiv axis were particularly vulnerable to this disruption, as individual vehicles often halted and bunched up when they lost communications.

These modern innovations, more than the minefields and trenchlines themselves, allowed the Russians to replicate the most salient features of the World War I elastic defense—the ability of the defender to achieve fire superiority over the attacking forces while shielding his own troops and tactical fire systems from the attacker.

The Ukrainians nevertheless overcame all these initial challenges. They penetrated and cleared the minefields and passed the obstacles. They drove off and wore down the Russian rotary-wing attack aviation. They regained the ability to communicate and

offset lost precision-guided munitions (PGM) capabilities with drones that did not rely on GPS. They improved their counter-battery fire sufficiently to reduce the effectiveness of Russian artillery. As the Ukrainians were making these slow and costly advances, however, the Russians were able both to bring reserves from other parts of the theater and also to improve their drone-based reconnaissance and fire system. The combination of these Russian mid-campaign adjustments and the manpower and materiel losses Ukrainian forces had sustained while making the initial penetration apparently persuaded the Ukrainian command that it could not exploit that penetration at an acceptable cost, especially with no large stocks of American and Western rearmament in sight. The Ukrainians thus effectively suspended the counteroffensive in October.

Part II: Evaluating the 2023 Counteroffensive

A number of analysts, and former Ukrainian Commander in Chief General Valery Zaluzhny himself, have offered varying assessments of the 2023 counteroffensive focusing on different reasons for its disappointing results.²⁵ Some have criticized the dispersal of Ukrainian combat power among too many axes without sufficiently prioritizing among them. Others have pointed to failures of training and preparation of the Ukrainian forces operating on the Melitopol axis in particular. Still, others have been preoccupied with the problems posed by the extremely deep and sophisticated minefields the Russians laid in the months preceding the operation. These critiques are all more or less valid, but they do not capture other fundamental problems that the Ukrainians and Russians both face. They are insufficient, therefore, as the basis for developing an approach to future Ukrainian counter-offensive operations.

Two Conceptual Failures

The 2023 counteroffensive and Ukrainian and Western preparations for it suffered from at least two

important conceptual failings that most commentary has omitted—the hope that a single operation could achieve a decisive effect on the entire theater, on the one hand, and the failure to recognize that current NATO warfighting concepts and principles of campaign design were and are unsuitable for the development of operations by Ukrainian forces.

The Hope for the Single Decisive Drive Was Mistaken

The Ukrainian counteroffensive of 2023 was clearly intended to drive to Melitopol, sever the Russian ground lines of communication (GLOCs) along the northern Sea of Azov coast, and precipitate the collapse of the remaining Russian forces to the west of the penetration axis. Western officials seem to have expected that a successful operation could have been decisive and do not appear to have been planning for subsequent Ukrainian counteroffensive operations.²⁶ Ukrainian leaders were similarly and understandably focused on creating that desirable decisive effect rather than on serious planning

for subsequent campaigns. It was not clear when the counteroffensive began that Ukraine would not be able to reach Melitopol or get close enough to the GLOC to disrupt it and thereby precipitate the collapse of the Russian defenses to the west. It was clear, however, that subsequent major campaigns would be needed regardless of the success of this campaign, as the authors of this paper argued before the counteroffensive began.²⁷

No single campaign will decisively end the war in Ukraine for either side. The idea of stunning one's adversary with a single crushing blow or breaking his will to fight by directly attacking his population or depriving him of essential resources has been attractive to commanders and political leaders for centuries. But one of the most important insights that military theorists derived from the study of World War I was that modern industrial states cannot generally be defeated decisively in a single sharp blow. The opposing armies fighting in Ukraine are large and relatively evenly matched in size and capability, at least as long as Western aid continues. The active frontline is nearly 1,000 kilometers long (the overall line of contact is more than three times that length), and any successful operation in one sector leaves large amounts of enemy combat power in other sectors intact. Both sides have the ability to mobilize additional personnel and material to make good the losses of a single campaign, although Ukraine would struggle to generate more material at scale without continued Western support. We must abandon the search for a single decisive Ukrainian success and instead accept that Ukraine will have to conduct multiple successive counteroffensive operations.

NATO Warfighting Concepts Are Unsuitable

Ukrainian and NATO military leaders have acknowledged that in preparing Ukrainian forces for the counteroffensive, NATO imported NATO doctrine and concepts into a conflict for which they were not well suited.²⁸ NATO, in fact, lacks doctrine and

campaign design frameworks appropriate for the kind of war Ukraine is fighting. NATO campaign design principles assume that the fighting forces will have access to the full array of NATO capabilities including long-range precision global strike, global surveillance, stealth penetrators, attack aviation, secure satellite-based communications, NATO-level electronic warfare systems, and so on. NATO forces using these capabilities have historically expected to have air superiority if not air supremacy, dominant battlespace information, and the preponderance of lethality throughout the entire theater, leading to the ability to maneuver with the limited losses that their forces and populations have been conditioned to accept. NATO militaries are rightly reexamining many of these expectations in light of both the war in Ukraine and reflections on the ways that further technological innovations can impact them. NATO trainers are also rightly reevaluating their approach to training Ukrainian forces based on lessons learned in this endeavor. But NATO still lacks a framework for designing and executing campaigns suitable for this kind of war, and improvements in NATO approaches to the provision of material and training to Ukrainian forces will not offset that lack.

The need to have a framework for designing campaigns that can be executed by friendly states that lack the full suite of capabilities that the NATO alliance can bring to bear transcends the requirement to help Ukraine. American and other alliance leaders are increasingly discussing the desirability of helping others fight rather than fighting alongside them or as part of a formal alliance. If the United States desires to take such an approach, then it will have to solve this problem in a generalizable way. Developing such solutions is extremely challenging. Intelligent, professional, and committed NATO trainers understandably struggled to imagine what fighting a modern conventional war without access to all the high-end NATO capabilities is like. It would have been difficult for any NATO trainers to

We must abandon the search for a single decisive Ukrainian success and instead accept that Ukraine will have to conduct multiple successive counteroffensive operations.

put themselves imaginatively into such a conflict at a given moment, but the challenge also required recognizing and accounting for the rapid and dynamic changes that both the Russians and the Ukrainians were causing through interactive innovations. The United States and NATO, not just Ukraine, must therefore develop a general campaign design framework that does not rely on the high-end capabilities that countries operating outside the alliance military structure will not have.

Discarding the chimera that it could be possible to help Ukraine fight as if it were fighting with NATO

alongside it does not require accepting that Ukraine is doomed to positional warfare at best. Ukraine can conduct maneuver warfare with its current and projected capabilities if its campaign design and operational objectives are properly designed and scoped for those capabilities and if it receives US military assistance at the levels being proposed. Even NATO is going to have to reevaluate the degree to which it will be able to rely on all its highest-end capabilities to resolve some of the problems of lethality and challenges to maneuver that are apparent in Ukraine.

Part III: Russia Fails to Restore Maneuver to the Battlefield in Early 2024

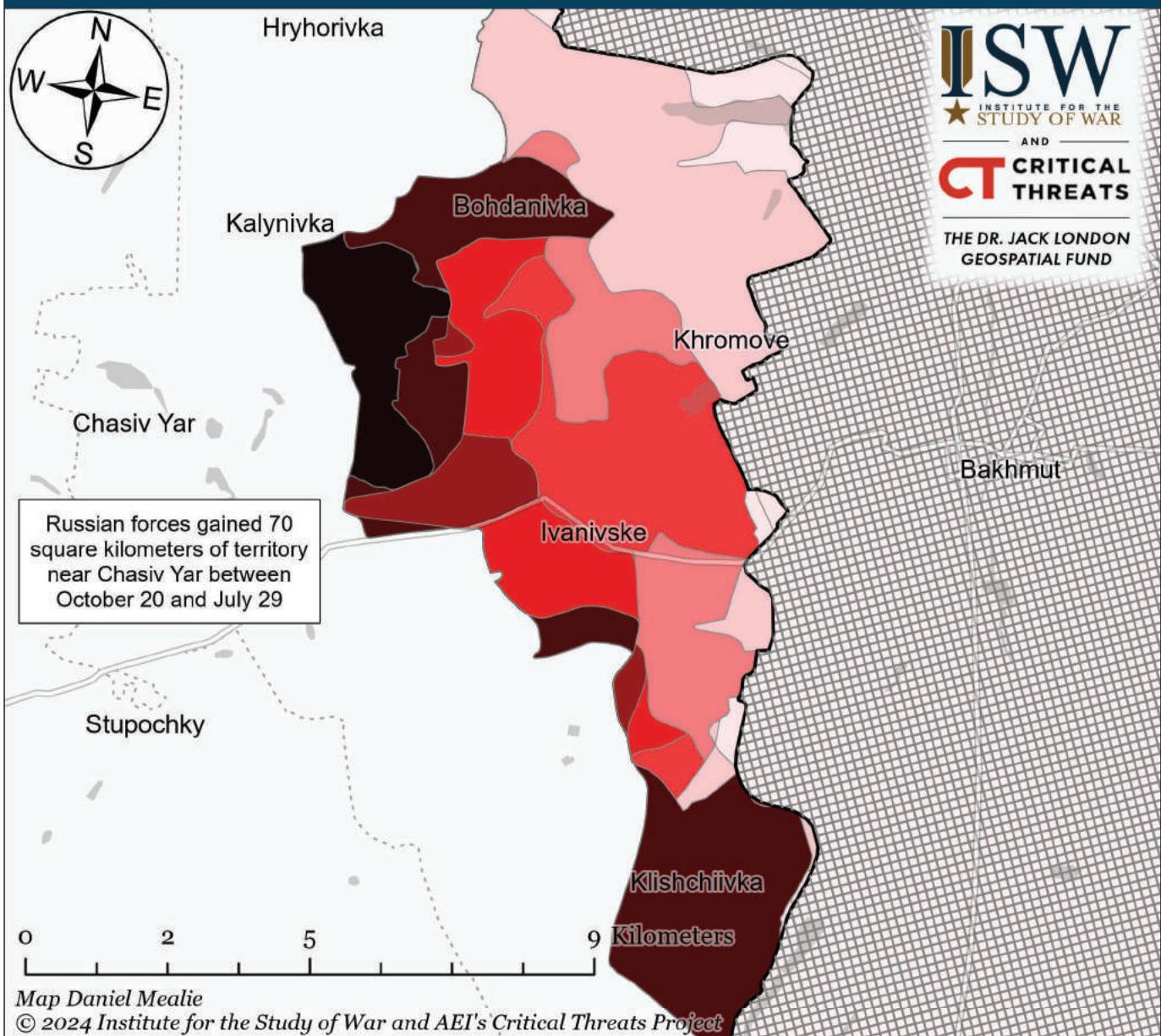
The Russian failure to make operationally significant gains as Ukrainian forces ran out of essential materiel is considerably more surprising than the disappointment of the Ukrainian 2023 counter-offensive. Russian forces massed and attacked all along the frontline in eastern Ukraine starting in January 2024, hitting exhausted, under-manned, and poorly supplied Ukrainian troops who could only stand on the defensive. The Russians resumed large-scale missile and drone strikes against Ukraine in December 2023, which continued for several months with the aims of crippling Ukrainian infrastructure but, more importantly, drawing increasingly limited Ukrainian air defenses away from the front lines. The Russians took advantage of the withdrawal of long-range air defenses from the battlefield to begin large-scale tactical air support using glide-bomb kits for the first time in this war. The Russians have been largely unable to conduct at scale actual close air support (CAS), which requires close coordination between ground units and supporting aircraft. They instead focused on obliterating Ukrainian defenses with massed glide-bomb attacks to open the way for ground offensive operations. These glide bomb attacks supported massed Russian artillery barrages, and Russian forces reportedly achieved artillery ratios of 10-to-1 against Ukrainian defenders on designated

breakthrough sectors. Russian forces tried to resume massed armored operations, particularly against Avdiivka in late 2023, but lost too many armored vehicles and largely abandoned the effort.

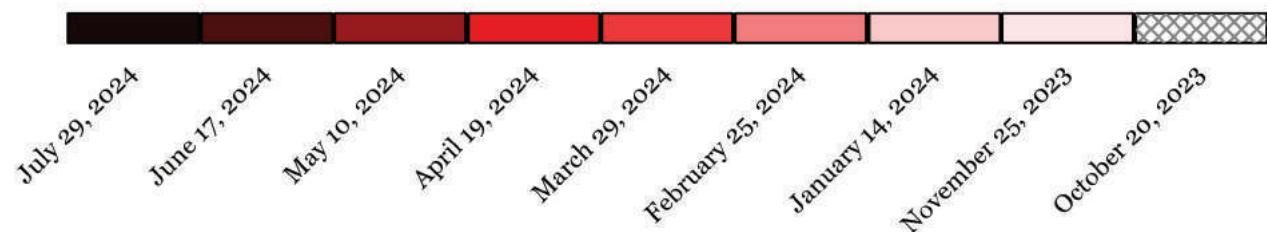
The Russians should have been able to make at least one significant penetration and exploit it in this period, but the closest they came was the double envelopment of Avdiivka that ultimately encircled only a small number of Ukrainian troops. The seizure of Avdiivka did not set conditions for a deep exploitation, however, as Ukrainian forces were able to establish subsequent defensive positions that Russian forces have been pushing back slowly but without making an operational breakthrough they could exploit rapidly. The Russians made a tactical penetration northwest of Avdiivka around the settlement of Ocheretyne in mid-April 2024.²⁹ Apart from that penetration Ukrainian forces have been able to establish defensive positions and force the Russians to conduct repeated and costly frontal assaults without being able to conduct operational maneuver in the rear of the Ukrainian defenses.

The primary reason for the Russians' inability to restore operational maneuver during this period was the fact that Russian forces could not keep their vehicles alive in offensive operations despite the critical shortages of ammunition from which Ukrainian

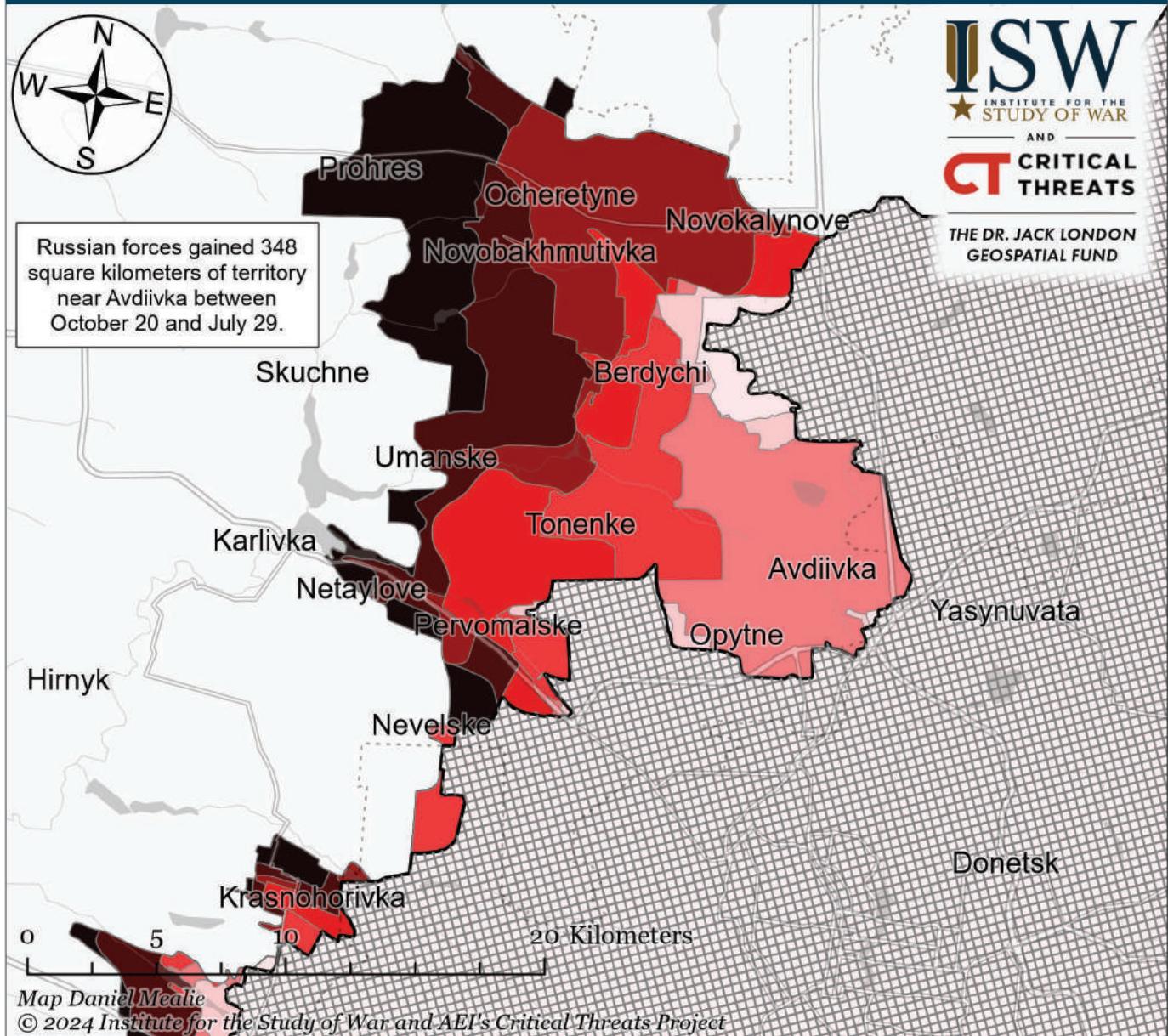
Russian Territorial Advances near Chasiv Yar Between October 20, 2023 and July 29, 2024



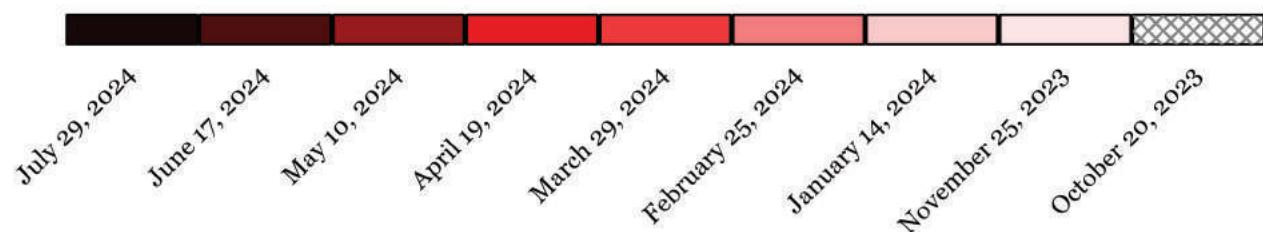
Assessed Russian-occupied Territory in Ukraine



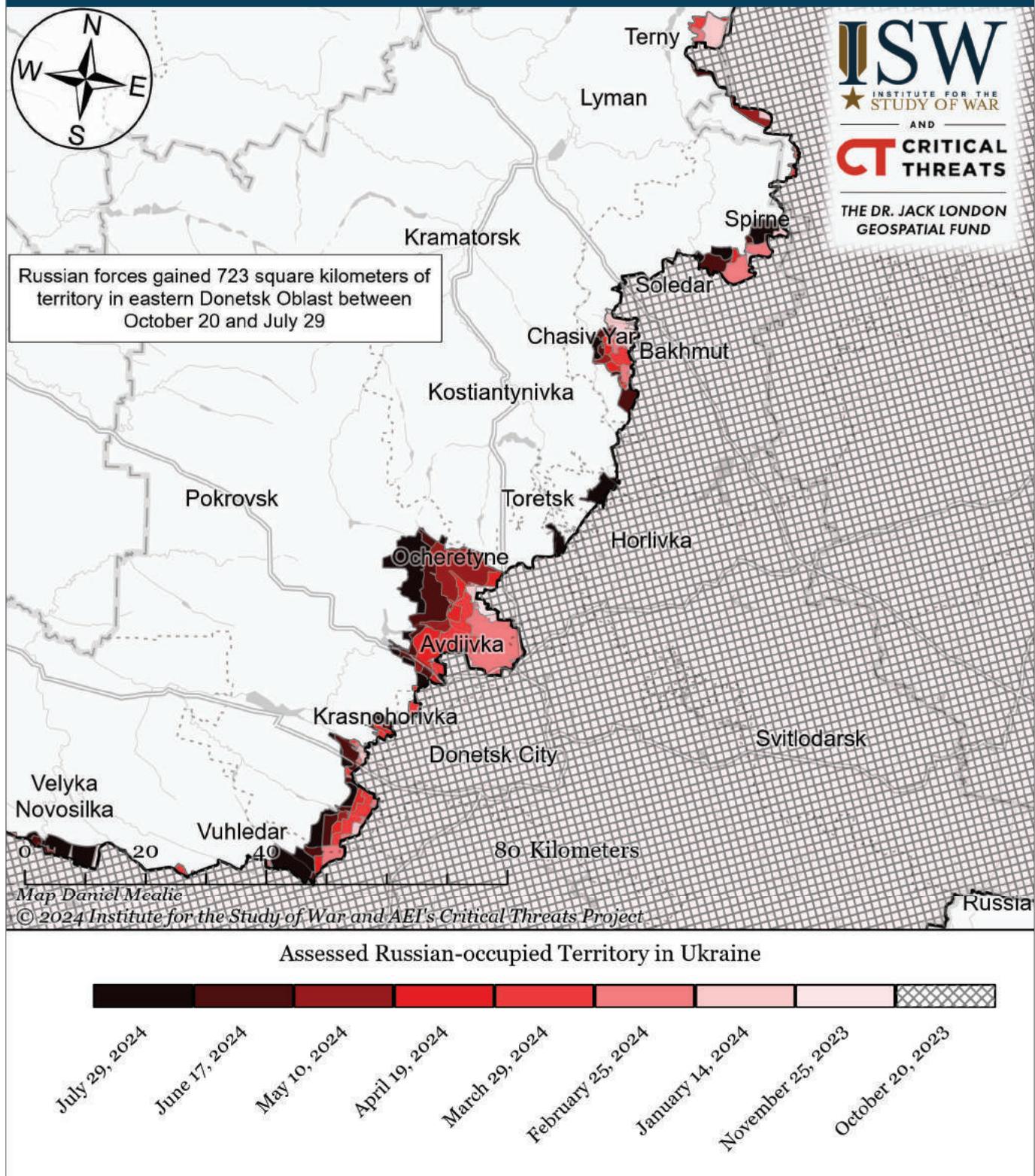
Russian Territorial Advances Northwest of Avdiivka Between October 20, 2023 and July 29, 2024



Assessed Russian-occupied Territory in Ukraine



Russian Territorial Advances in Eastern Donetsk Oblast Between October 20, 2023 and July 29, 2024



defenders were suffering. The Ukrainians had been rapidly expanding their ability to offset their dwindling artillery supplies with tactical attack drones and to use tactical reconnaissance drones to make every artillery round they had count. On the rare occasions when Russian forces attempted to mass vehicles Ukrainian defenders were able to destroy them with artillery fire, husbanded in part for the purpose. The Ukrainians also continued to develop their ability to put Russian armored vehicles out of commission even with drones that could not actually destroy the vehicles. Ukrainian tactical attack drones targeted the optics, communications gear, engines, and tracks of Russian tanks to cause mobility or utility kills that forced the Russians to abandon or pull the vehicle out of the fight for repairs. Over time the Ukrainians have improved their ability actually to destroy Russian vehicles, even tanks, with small munitions fired from tactical attack drones by relying on the drones' ability to place the munitions precisely against the most vulnerable spots of their targets. The Russians have thus become very wary of attempting to concentrate large masses of armor or even to use armored vehicles to conduct attacks—Russian forces in many areas have adopted the approach of having vehicles bring infantry to the point of attack then withdraw, in fact.

The net effect of these developments was that Russian attackers advanced at foot pace, for the most part, and could not move advance faster than Ukrainian forces could retreat. The slow-moving double-envelopment of Avdiivka that let most of the Ukrainian defenders pull back from encirclement resulted from this phenomenon, as did the Ukrainians' ability to establish subsequent defensive positions to prevent Russian exploitations even when the Russians were able to make tactical penetrations.

Ukrainian forces' ability partially to offset their dwindling artillery supplies with drones resulted in part from failures in Russian training and techniques. Russian forces have EW systems suitable for defending vehicles and small units and, of course, the larger EW systems with which they had disrupted Ukrainian attacking forces during the 2023 counteroffensive. But the Russians have not figured out how to integrate their tactical EW systems with their own tactical drones (nor have the Ukrainians) or how to use their tactical EW systems effectively to protect advancing vehicles and small units. These challenges are among the most important problems that must be solved as part of the effort to restore operational maneuver to the battlefield, as we will consider in detail below.

Part IV: Defining the Fundamental Problem in Warfare in Ukraine Today

Approach to the Challenge

Understanding the root of the dilemma facing Ukraine and its supporters well enough to craft a new approach with solid prospects of success in the future requires both a deeper and more structured definition of the problems causing positional warfare in Ukraine today. The approach to this task below results from blending the theoretical framework developed by Soviet military theorists after World War I with a critical framework used by the US military today. The Soviet theoretical approach began by seeking to define precisely the fundamental

challenge in contemporary warfare beginning with a consideration of the nature and capabilities of the combatants and the theater of war and only then descending to the specifics of tactics and technology. It paid particular attention to the operational level of war—the level between battlefield engagements (tactics) and state objectives, national mobilization, and state policy (strategic). The Soviets built upon this foundation a warfighting concept they called operational art and, more specifically, “deep operations” (or “deep battle”), which remains one of the most sophisticated warfighting concepts yet

developed. The US military embraced a variation of that concept in the AirLand Battle doctrine of the 1980s that it employed to such devastating effect against Iraq in 1991 and again in 2003. The core principles of this concept remain informative and applicable in the current war.

US military doctrine also includes an extremely useful framework for thinking about military operations and preparations to conduct them: the levels of war. The levels of war framework not only defines the tactical, operational, and strategic levels mentioned above but also emphasizes the critical role played by the operational level in translating strategic objectives and resources through skillful campaign design (campaigns being operational level undertakings) into specific tactical tasks that units can seek to accomplish on the battlefield. Focusing properly on the operational level helps planners and commanders avoid the danger of focusing excessively on battlefield (tactical) problems and seeking only tactical solutions to tactical problems, on the one hand, or attempting to leap directly from strategic to tactical solutions (or vice versa) on the other. It thus also helps avoid the trap of focusing excessively on technology or manpower as either the cause or the solution to warfighting problems.

The discussion below proceeds primarily in accord with the approach that led to the development of Soviet operational art and deep operations and American AirLand Battle doctrine. It starts by considering in detail the fundamental problems causing war to assume a positional form and then developing a theoretical (doctrinal) framework of campaign design principles. It will consider and evaluate some specific tactical and technological elements—both problems and solutions—but will not attempt to offer detailed and precise tactical or technological recommendations. Those must be derived in subsequent efforts and, in large part, by those actually charged with the heavy responsibility of waging this war and supporting those who do.

Defining the Fundamental Problem

There is no single, simple factor causing the war in Ukraine today to assume a positional form. Drones, trenches, minefields, and the rough parity of the opposing forces all play important roles but are not the reason for the positional character of the conflict alone or even taken together. The positional character of the war results, rather, first from three overarching characteristics of the combatants and the theater, and second from a series of specific capabilities that combinations of technologies and techniques provide the opposing forces and specific limitations that those and other combinations impose on them. Almost none of these conditions are permanent features of this war, let alone inevitable features of any other conflict. If any of them change dramatically, even for a limited period of time, one side or the other can restore maneuver to the battlefield possibly rapidly and unexpectedly, with dramatic consequences. Failing to internalize the potential dynamism of this conflict can fuel both defeatism and complacency, either of which can be fatal to Ukraine.

The three overarching characteristics of the combatants and the theater contributing to the positional character of the current war are as follows:

First, both sides have enough combat power to maintain continuous defensive positions all along the front line with no open flanks and can establish sufficient tactical depth and reserves at key points to require the side seeking to attack to conduct a deliberate and costly penetration battle if the defender can correctly identify the attacker's objective and prepare ahead of time. (This condition holds as long as Ukraine continues to receive necessary levels of Western support). **Neither side, on the other hand, can man large portions of the line at the operational level in great depth or maintain large uncommitted reserves.** This factor creates the possibility of successful offensive operations because the defender, lacking large uncommitted reserves, must take time to get reserves from other parts of

There is no single, simple factor causing the war in Ukraine today to assume a positional form.

the line and accept risk there, creating vulnerabilities in those troop-contributing sectors. This factor also, however, requires the attacker to take risks on secondary sectors of the front in order to generate necessary combat power along the main and supporting axes of advance. It is noteworthy that even the opening of a new axis of advance in Kharkiv Oblast did not restore maneuver—Ukrainian reinforcements forced the limited Russian attack into a positional form. This characteristic of the current war can change depending on the military manpower policies of the opposing sides and, to a lesser extent, on their abilities to redevelop air or maritime maneuver capabilities, however. Full Russian mobilization could allow Russia to man the entire frontline in depth and/or maintain large uncommitted reserves. The exhaustion of Ukrainian manpower could open exploitable gaps in the line. The development of the ability to conduct large-scale amphibious operations could allow operational level attacks in the rear of the lines, although it is unlikely that either side will be able to develop this capability during the active phase of the current war. The ability to conduct large-scale airborne or air assault operations behind the lines would similarly disrupt the relative equilibrium created by this current condition but is an even more unlikely prospect. The drying up of the Kakhovka Reservoir, finally, will eventually open up a new sector of the frontline theoretically changing this condition if only by extending the effective length of the frontline, but the reservoir is drying slowly and in a way that both sides can easily observe, such that it is far more likely that both sides will adapt in parallel without gaining or yielding a significant advantage.

Second, penetration battles have become so costly to the attacker that exploiting breakthroughs is not feasible. We will explore in depth what factors are currently making penetration battles so costly. We observe that the West sought to address this problem in 2023 by seeking to make the penetration battles less costly through technology and tactics and by having the Ukrainians mass on a single axis of advance so that they would be able to

absorb the costs of the breakthrough and still be able to exploit it. Various challenges prevented Ukraine from both amassing enough materiel and training sufficiently on the new equipment and tactics in time to achieve the desired effects in 2023. The concentration on a single axis that the West desired was not the right solution to the problem, as we have argued elsewhere.³⁰ This characteristic is the most likely to change. Its continuation depends on a relatively delicate balance of technological capabilities and materiel quantities, on the one hand, and is amenable to change through the development and application of different tactical and operational approaches on the other. Considering such potential changes will be one of the major tasks of the rest of this paper.

Third, even when an attacker exploits a penetration, large modern states at similar levels of military capability, competently prepared and mobilized for war, are large and powerful enough to establish subsequent defensive lines at some distance in the rear ahead of almost any offensive advance, however rapid. A core requirement for successful campaign designs remains, as it always has been, determining the depth of an exploitation achievable given the time-space relationships of the conflict in given circumstances. (Time-space relationships refer to the distance a force of a given size and composition with given capabilities can expect to cover against known enemy forces and capabilities.) A second requirement is determining how to prevent premature culmination of the offensive and to ensure that planned culmination is followed by planned consolidation able to withstand enemy counterattacks. (Culmination refers to the period in which an attacking force stops its advance and, generally, goes over to the defensive against expected enemy counterattacks. A culmination can be planned—the attacker intends to stop at a particular point regardless of the state of the defender's forces and go over to a defensive that is also planned—or unplanned/premature—the attacker runs out of steam without having reached his objectives or having prepared to go over to the

defensive and thus leaves himself vulnerable to a rapid counterattack.)^{IV} A third requirement is planning and preparing for simultaneous and successive operations whenever, as will usually be the case, a single offensive will not be able to achieve the operational objective on its own. This characteristic is the least likely to change. Dramatic asymmetries in military capability can generate exceptions to this general observation—the US destruction of the Iraqi military in 1991 through the application of vastly superior technology and training was one such exception. Shock can cause the collapse of one side's will to continue fighting as well—France surrendered in 1940 even though it could have fielded subsequent defensive positions and compelled the Germans to conduct successive operations in large part because of the shock caused by the unexpected speed and success of the initial German advance. Ukraine is very unlikely to succumb to such shock in the course of this war, having weathered the shock of the initial Russian invasion. Russia is extremely unlikely, on the other hand, to attain such a dramatic asymmetrical advantage in a short period of time that it would be able to destroy the Ukrainian military in a single blow, however large.

The Too-Costly Penetration Battle

Most of the factors that hindered initial Ukrainian efforts to penetrate Russian defensive lines in western Zaporizhia Oblast in 2023 were not novel, as noted above. The Russian 58th Combined Arms Army conducted a skillful defensive operation using traditional techniques of 20th Century warfare, and the Ukrainians and their supporters suffered from various failures to anticipate, resource, and prepare adequately for those challenges. Militaries have developed various solutions to all these traditional challenges over the past century. These solutions generally rely heavily on the ability to mass armor and mobile artillery. They also often depend on achieving at least localized air superiority both

to protect massed forces from enemy air attack and to strike targets in the enemy's rear both near the front and further behind it in order to disrupt and suppress enemy defenses and hinder the movement of enemy reinforcements to the penetration sector.

The well-established forms of defense used both by the Russians and increasingly by the Ukrainians have been able to drive the current war into a positional form because neither side has been able to use the traditional responses to them. Neither Russia nor Ukraine has been able to achieve even localized air superiority or suppress the other side's artillery systems sufficiently to allow masses of armor to survive long enough to complete the penetration. Even when the Russians have been able to use glide bombs to provide tactical air support, they have been unable to bring to bear the other key components of the traditional approaches to breaking out of positional warfare. It is unlikely that either side will be able to change these conditions in 2024 through traditional means, moreover. The novelty of the challenge presented by minefields, trenches, and the elastic defense thus lies in the need to find novel ways of resolving it, at least in the near term, because the traditional ways are likely unavailable to either side for now.

New Problems—The Tactical Reconnaissance Strike Complex (TRSC)

Technology has brought new problems to the battlefield, however, that are also powerfully contributing to the positional character of the war. Electronic warfare is as old as the use of electromagnetic communications, to be sure, but the effects of advanced EW on militaries that depend both on advanced electronics and on communications between systems has created a novel challenge. More profoundly, the proliferation of unmanned systems, primarily but not exclusively aerial, has let both sides develop the nascent form of an integrated system of sensors linked to armed drones on the one hand and traditional artillery systems on the other. We are

IV US military doctrine uses the expression “culminating point” to describe “that point in time and space at which a force no longer possesses the capability to continue its current form of operations.” (ADRP 3-0). This definition is congruent with our interpretation of the Soviet usage of the expression, with the caveat that the US military emphasizes the importance of planning to cease operations before reaching the culminating point whereas the Soviet usage often calls for continuing offensive operations to a planned culminating point and then transitioning to a planned and prepared defensive.

coining the term “Tactical Reconnaissance-Strike Complex” (TRSC) to refer to this nascent capability of integrated drone and artillery sensor-strike. The challenge of finding new solutions to the old problems posed by traditional defense approaches is greatly magnified by the advent of the TRSC and the complexities introduced by advanced and extensive EW onto a battlefield so heavily dependent on electronics and communications.

The Russian Theory and Practice of Reconnaissance-Strike Complexes Before 2022

The concept of a reconnaissance-strike complex (RSC) is not new. Soviet and Russian military thought has long discussed the RSC as a system “designed for the coordinated employment of high-precision, long-range weapons linked to real-time intelligence data and precise targeting provided to a fused intelligence and fire-direction center.”³¹ The RSC “functioned at operational depths using surface-to-surface missile systems and aircraft-delivered ‘smart’ munitions.”³² The RSC also has a tactical equivalent in Russian thought—the reconnaissance-fire complex, which “linked intelligence data, precise targeting, a fire-direction center and tactical artillery to destroy high-value targets in near-real time.”³³ The Russian command is actively thinking about, developing, and discussing these concepts. Central Grouping of Forces Commander Colonel General Andrei Mordvichev reported on the development of both the RSC and the RFC during the Battle of Avdiivka to former Russian Minister of Defense Sergei Shoigu in late February 2024.³⁴

The Russian military invested in creating the capabilities required by these systems before the full-scale invasion of Ukraine but in conditions so different that the approaches they developed were not suitable for use in Ukraine. Russian forces in Syria implemented many of these systems and integrations during their operations in Syria from 2015-2022.³⁵ They brought their entire battlespace into a single data stream; improved coordination between Spetsnaz

teams on the ground and land-, air-, and sea-based strike platforms; enabled the Russian Air Force and Navy to conduct precise deep strikes into enemy-held areas; and improved their overall accuracy.

Their proud claims to have implemented the RSC approach in Syria, however, concealed the realities that the scale of their involvement in that conflict was so much smaller than their operations in Ukraine as to render nearly irrelevant their experience at integrating systems. Worse still, they appear to have ignored or missed the fact that implementing such systems against the Islamic State and the Syrian opposition in no way prepared them to do so against a near-peer competitor such as Ukraine.

Russia had air supremacy throughout its engagement in Syria but has been largely unable to secure air superiority in Ukraine, precluding the use of aircraft-delivered smart munitions at scale until early 2024. Russia maintained a very small numbers of ground forces in combat in Syria, and those forces operated in an extremely permissive EW environment against an enemy that had very limited drone capabilities. Russian ground forces in Ukraine failed to establish the necessary communications and coordination centers to conduct precision artillery strikes in near-real time at scale, especially in the face of effective Ukrainian counter-battery fire, drones, and capable EW.

The Russians thus had to start largely from scratch in building their RSC and TRSC for the scale and conditions of the war in Ukraine despite having developed the concepts and their initial implementations.

Defining the Tactical Reconnaissance-Strike Complex (TRSC)

The Russian concepts of the “reconnaissance-strike complex” (RSC) and “reconnaissance-fire complex” (RFC) created a logical separation of fires systems (aircraft, artillery, rocket artillery, etc.) by range into the operational-level concept of the RSC and the tactical concept of the RFC. Both sides in the current

The proliferation of unmanned systems has let both sides develop an integrated system of sensors linked to armed drones and traditional artillery systems.

war have merged operational and tactical systems together to achieve direct tactical effects. We have therefore coined the expression TRSC to capture the reality that the complex integrates long-range strikes (drones, missiles, and long-range rockets) with short-range fires (tube artillery, tactical drones, and short-range rockets) into a single system focused on generating effects on a tactical scale with possible operational level implications.

The TRSC is the combination of pervasive tactical reconnaissance, primarily by drone; drone-corrected precision artillery fire; precision munitions delivered by fixed- and/or rotary-wing aircraft; drone-launched precision munitions; and large numbers of first person view (FPV) loitering munitions. Extensive offensive and defensive electronic warfare supports the TRSC, which also draws on operational and strategic reconnaissance assets. Neither side has yet integrated long-range strike systems into efforts to conduct or defend against penetration or exploitation operations at scale, although they could do so. Both sides have long-range strike systems and are using them, to be sure. The Russians have largely focused theirs on strategic targets in the rear of Ukrainian forces, although they have begun to use Shahed long-range attack drones against frontline positions. The Ukrainians have generally not integrated long-range, precision systems directly into the penetration battle or attempts to exploit breakthroughs either.

The proliferation of reconnaissance and attack drones, especially at the tactical level, is allowing both the Russians and the Ukrainians to generate many of the effects that the artillery-based reconnaissance-fire complex could not. Artillery systems continue to suffer from limitations that severely undermine their ability to achieve the rapid destruction of large numbers of tactically dispersed targets efficiently. Both sides have generally learned to separate individual vehicles and small groups of infantry from one another by significant tactical distances to prevent their destruction by one or two artillery salvos (apart from a few notable errors made largely by Russian tactical commanders). The overwhelming majority of shells used by both sides are “dumb” shells—unguided rounds that follow ballistic trajectories once fired. The Ukrainians have access to a

limited number of Western-provided guided shells and, of course, HIMARS rocket systems, but have had to hoard those systems due to their scarcity. The current art of generating precision using unguided artillery rounds lies in correcting fire rapidly, something that loitering tactical reconnaissance drones have made possible for both sides.

But artillery systems even thus corrected by spotter drones still suffer from important limitations. The artillery tubes themselves are highly vulnerable to counter-battery fire, since modern counter-battery radars can locate them quickly after they fire, and artillery (or other systems) kept ready to conduct counter-battery fire can strike and destroy them rapidly if they remain in place. Both sides have thus learned to perfect the “shoot and scoot” technique in which an artillery piece fires a few rounds in a short period of time and then rapidly moves away from its original firing position to survive. This tactic helps keep the artillery alive but precludes prolonged massed artillery fire, on the one hand, and generally reduces the effective rate of fire of artillery systems and, thus, the number of targets they can engage, however precise they might be, on the other. These are some of the factors explaining why artillery remains most effective at engaging large numbers of vehicles or infantry concentrated in a small area but continues to struggle to stop the movement of forces moving dispersed over a wider area.

Attack drones have finally brought to the battlefield the capability to strike large numbers of vehicles and infantry dispersed over a wide area. Cheap and plentiful reconnaissance and FPV drones can loiter over the battlefield for extended periods as their operators search for individual targets. FPV drones can strike those targets immediately; reconnaissance drones can call in fires from available artillery when possible or from other FPV or regular drones. This fusion of the sensor-shooter function in tactical drones and between those drones and longer-range artillery and rocket systems is what has brought the intended effects of the reconnaissance-strike complex, originally conceived as an operational level system, to the tactical level—hence the TRSC.

The tactical-level nature of the TRSC is a critical component of its success. Units as small as companies operate reconnaissance and FPV drones and have the authority to prosecute targets they see with their own systems. The Ukrainians had already permitted their artillery gunners to interact with frontline drone operators in a similarly rapid reconnaissance-strike cycle, whereas the Russians had retained control of their artillery, often massed in battalions or brigades, at much higher levels until after the battle of Bakhmut before taking steps to decentralize artillery fire control prior to the Ukrainian counter-offensive.³⁶ Russian forces and milbloggers regularly complain about the delays imposed on Russian artillery's prosecution of identified targets because of this centralization.³⁷ The emergence of a decentralized, drone-based TRSC on the Russian side in roughly May and June 2023 has enabled Russian troops to identify and prosecute targets much more quickly than they had previously been able to do.

Tactical drones offset the artillery's survivability problem for both sides. Many tactical drones require little or no infrastructure for launching and can be guided from hidden and bomb-proof bunkers that are difficult to trace. Conducting the equivalent of counter-battery fire on tactical drones does not, thus far, appear a feasible undertaking. Larger fixed-wing drones require minimal runways, to be sure, but they also have very long ranges (the Shahed-136 has a published range of around 2,500 kilometers, for example). These factors combined with the relatively low cost of mass-producing tactical drones (or purchasing commercially-available drones and retrofitting them for use in combat) have made drones pervasive on this battlefield and rendered the TRSCs of both sides very robust and resilient. **The effectiveness of both sides' TRSCs has, in turn, contributed powerfully to the positional nature of the current stage of the conflict.**

Retail Killing at Wholesale Scale

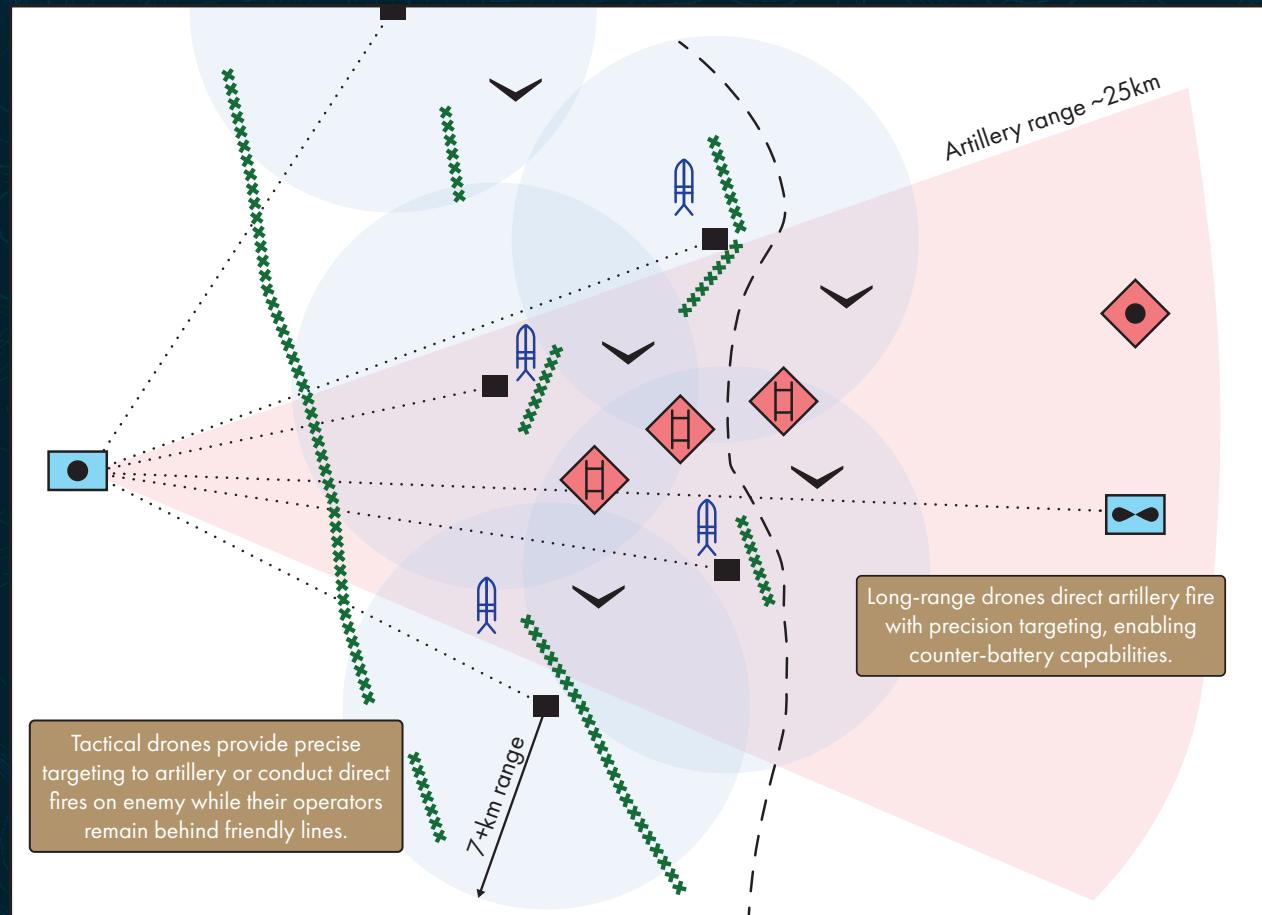
It is vital to note that most drones on the Ukrainian battlefield are independently operated often by individual operators rather than functioning as parts of drone swarms—groups of drones working together

and directed by a single overarching controller, whether human or algorithmic. Western military literature has long considered the challenges of drone swarms, which can in principle overwhelm anti-drone systems and do massive damage against individual targets.³⁸ **The Ukraine war will likely see the emergence of drone swarms, to be sure, but the current approach to drone operations prioritizes radical decentralization allowing thousands of drones and their users to identify and attack individual targets on their own.** This approach suffers from numerous bottlenecks that slow down the functioning of the kill-chain and limit the number of discrete targets that can be engaged, as we will discuss below. It is likely, therefore, a stage in the development of drone-based tactical engagements rather than their final form. But this approach, radical decentralization, is likely to be the basis on which that final form emerges and to replace the pre-war ideations of algorithmically-controlled drone swarms with battle-tested approaches to coordinating vast numbers of reconnaissance and attack drones against many individual targets.

Implications for Air Superiority

The pervasiveness and small size of tactical drones creates another challenge to traditional notions of air superiority. In the past, the side with air superiority could largely prevent the adversary from operating fixed or rotary-wing aircraft in a given area, thus in principle protecting his own forces from aerial attack and/or subjecting the adversary's forces to such attack. In the new environment, it is possible to conceive of situations in which one side has air superiority in the traditional sense but is unable to prevent the adversary from attaining a kind of low-altitude air superiority using drones because fixed-wing aircraft will be unable to destroy enough small, fast-moving drones operating much closer to the ground to disrupt their operations. Achieving the effects of air superiority in this new environment will thus require addressing both the traditional fixed- and rotary-wing threats and the new near-ground drone threat. The corollary is that one can still hope to secure drone-based air superiority benefits even in the face of an adversary's traditional air superiority.³⁹

DEFENSIVE TRSC: Spatial and informational relationship between artillery and drones.



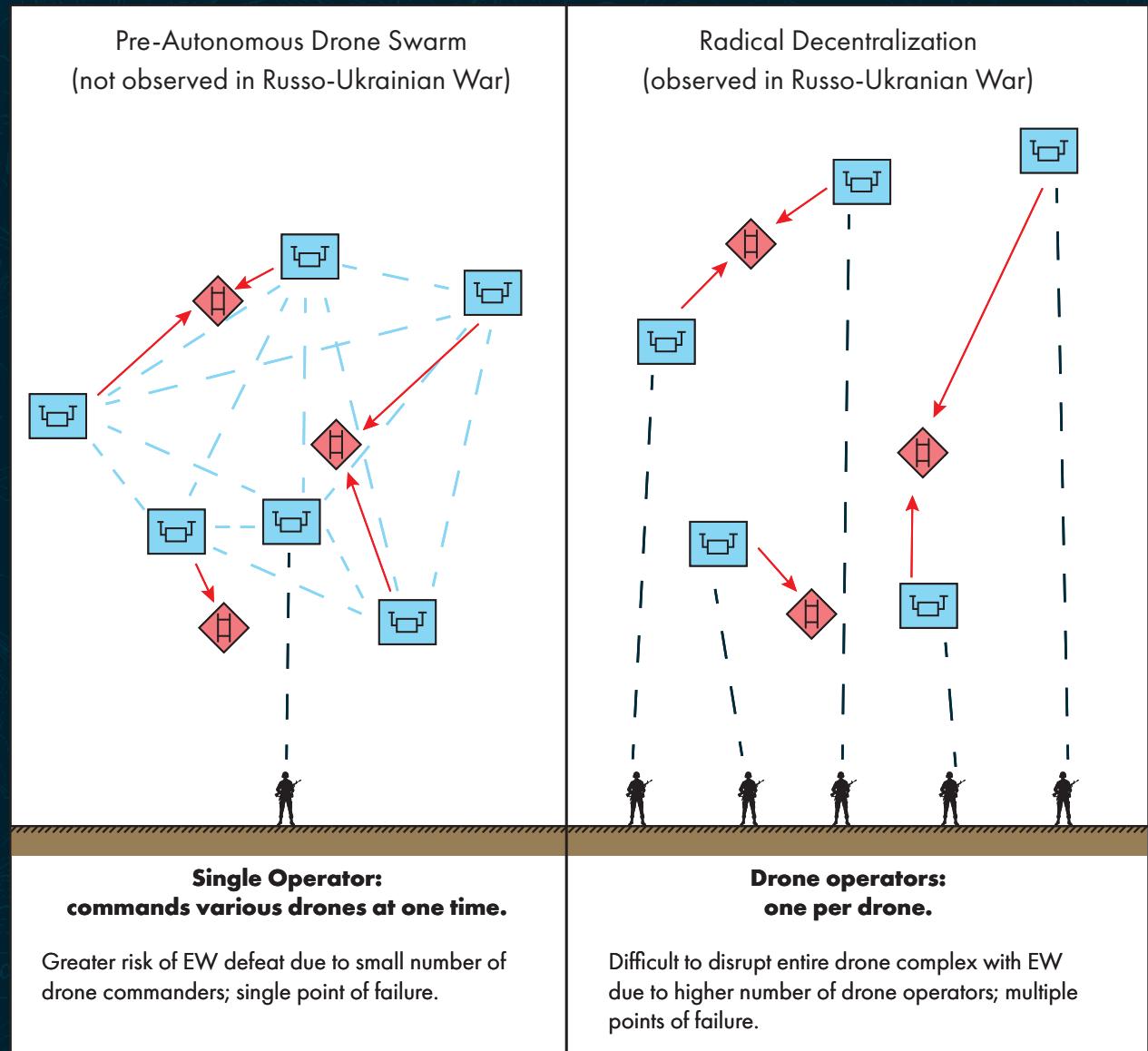
Legend

- | | |
|--|---------------------------------|
| ■ Drone operator | ◆ Artillery |
| ▼ Tactical drone | ◆ Tank |
| --- Approximate front line | ● Drone flight range |
| ***** Defensive fortification or trench line | ◆ Anti-tank guided missile crew |
| Communication flow | ◆ Fixed-wing aviation |

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RADICAL DECENTRALIZATION: Russo-Ukrainian War



Legend



Drone



Drone Operator



Tank

- - - Operator-Drone Communication

- - - Drone-Drone Communication

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Implications for Time-Space Relationships in Campaign Design

The approaches to counteroffensive operations that Ukraine used as well as those that some in the West advocated will not resolve the problems posed by the combination of old and new challenges in current circumstances. Massing more and/or better trained forces for a future penetration battle will still be suicidal unless a way is found to suppress the Russian TRSC and traditional defensive measures. **Permanent suppression of the TRSC and defenses is likely unattainable, however, given the dynamism of the tactical and technical offense-defense competition.** The Ukrainian tasks will therefore be 1) to find ways to suppress both the TRSC and the traditional defenses at the right moment, 2) to sustain the suppression long enough for counteroffensive forces to mass and complete the penetration, and 3) to conduct a sustained exploitation.

The designs of future penetration battles will have to reflect continuous and dynamic reassessments of time-space relationships based on the rapidly evolving technical conditions of the war. The speed with which the penetration battle itself can proceed will depend in considerable part on the degree to which the attacker can concentrate and use vehicles. If conditions cannot be set to allow the large-scale use of vehicles, then the attacker will have to rely largely on infantry advancing at foot pace. Penetrating deep and prepared defensive lines on foot is possible. The Germans did so to great effect in 1918. They suffered crippling losses in doing so not in the penetration battles themselves but rather in the subsequent exploitation, which they had not adequately thought through. Ukraine and its backers should not disdain the prospect of infantry-based penetrations, however undesirable they might be but must be prepared to

conduct penetration battles in both conditions—with and without large-scale vehicle support.

Ukrainians are right to focus on finding ways to mitigate the effects of the TRSC and Russian traditional defenses to facilitate armored penetrations, nevertheless, since mechanized operations will move more rapidly and likely gain more ground faster. The challenge will be one of timing as much as technology. The Ukrainians will need to disrupt the Russians' ability to target forces concentrating for the counteroffensive long enough to complete the concentration and begin the advance. They will need to begin disrupting the TRSC before the advance begins and sustain the disruption through the decisive phase of the penetration battle. A dialectical (interactive) relationship will shape the optimal breadth and depth of the planned penetration based on the assessed feasible scale and duration of the disruption of the TRSC. The longer and broader the disruption of the TRSC, the wider and deeper the appropriate objectives of the penetration battle will be. The relationship will be dialectical because the conduct of the penetration battle itself contributes to the suppression of the TRSC by disrupting defensive positions and forcing front-line operators of drones and other essential defensive systems to move or be destroyed.

The optimal scale of offensive operations will only emerge empirically through actual attempts to conduct them. Modeling and simulations combined with observations of current and previous engagements can provide guidelines, but the Ukrainians will have to refine those guidelines through hard-won experience trying and sometimes failing. Overall campaign design will therefore have to provide opportunities to gain such experience at costs that do not disrupt or prevent future efforts. This requirement, in turn, must feed back into determinations of the scope and scale of offensive

The Ukrainian tasks will be 1) to find ways to suppress both the TRSC and the traditional defenses at the right moment, 2) to sustain the suppression long enough for counteroffensive forces to mass and complete the penetration, and 3) to conduct a sustained exploitation.

efforts, likely constraining them even more than assessments of the feasible extent and duration of the suppression of enemy defenses would suggest.

There is a minimum threshold that any penetration battle must meet to permit meaningful exploitation, however. A penetration that is too shallow and that does not actually breach the main enemy defensive positions will not permit a straightforward

exploitation. A penetration that is too narrow will permit enemy forces on either side to attack forces attempting to exploit it, thereby disrupting the exploitation even if they do not cut off the penetration itself. This threshold will also have to be determined empirically, as it depends in part on the degree to which enemy forces to the flanks and rear of the penetration can operate freely.

Part V: Solutions: A New Approach to Campaign Design

Ukraine and its supporters must focus on three major intellectual tasks in order to break out of positional warfare and restore operational-level maneuver:

- I. Developing methods to neutralize the Russian TRSC at designated times and places to facilitate a penetration that can be exploited;
2. Developing principles of campaign design incorporating those methods along with new approaches to sustaining exploitation through to the accomplishment of a predetermined and achievable objective; and;
3. Expanding principles of campaign design to encompass planning and preparation for the successive operations that will be required to achieve operationally decisive outcomes.

Neutralizing the Russian TRSC

The obvious effectiveness of the TRSCs of both sides can create the impression that the TRSC is a fixed feature of this war; that armor and, indeed, mass of any sort is not survivable; and therefore that maneuver cannot be restored here or anywhere. If that premise were true, then this conflict (and possibly future wars) would be permanently mired in positional warfare, and both sides would be reduced to trying to optimize positional warfare operations or resolving the war exclusively through air, missile, and drone operations (which would almost certainly fail). There are ways to optimize positional warfare operations, to be sure, and they must be considered. But

it is premature to accept the premise that the TRSC cannot be defeated or at least neutralized in ways that would permit the restoration of maneuver. The sections that follow examine approaches to this problem.

Limitations and Vulnerabilities of the TRSC

The TRSC template described above remains partly aspirational for both sides. Neither Russia nor Ukraine has been able to field fully developed TRSCs across the theater. The competition between drone developers and operators and EW systems also creates periods of temporary advantage for one or the other. Russian milbloggers continue to complain about excessive centralization and bottlenecks in the delivery and use of Russian drone and EW systems, moreover, suggesting that the Russian military remains challenged to take full advantage of the dispersed nature of the TRSC.

The TRSC suffers in addition from a number of important and exploitable, inherent vulnerabilities at the current state of technology including especially the competitive interaction between drones and EW that Ukrainian Commander in Chief General Oleksandr Syrskyi has highlighted and discussed in depth in terms of future UAV complex design by RUSI's Jack Watling and Justin Bronk:⁴⁰

- I. The drone complex currently relies on communications that can be jammed or interfered with even when individual drones operate autonomously. (This fact will accelerate the development and use of lethal autonomous systems [LAS] rapidly. Neither side has yet

- fielded LAS at scale, but both will surely do so because the requirement for such systems is so obvious and urgent. It is not possible to estimate the timeline for the large-scale deployment of such systems in this war because of the difficulty of estimating the rate of major technological breakthroughs and their rate of fielding. LAS are starting to appear in limited forms already and will likely emerge over 2024 and in 2025 as a major factor on the battlefield);
2. The drones are slow-moving electronics that can in principle be detected and disabled (unlike artillery rounds as a general rule);
 3. Tactical drone payloads are limited. They have to rely on precision for kills and generally individual tactical drones cannot currently generate area effects or operate against hardened targets;
 4. Larger drones with longer ranges and larger payloads require more infrastructure to operate, specifically launching areas (since they are generally fixed- rather than rotary-winged), and can be more easily detected and downed as they approach friendly forces;
 5. Current drones are more impacted by weather effects than artillery;
 6. Limited drone payloads drive tradeoffs between sensors and weapons. The more the drone complex can rely on real-time digital communications, the more this problem can be offset by separating the target-identification from the target-servicing functions, but that offset expands the vulnerability to disruption of communications; and;
 7. Since neither side can yet field a fully automated TRSC with computer-managed sensor-to-shooter directions at scale, humans are still very much in the firing loop, a factor that slows down each kill-chain and dramatically reduces the number of individual targets the TRSC can service regardless of the number of drones in the air or available at any given time.

Both sides (and other states around the world) are investing heavily in counter-drone capabilities and have begun to field such systems. These include:

1. Advanced EW to jam communications and force adversary drones into autonomous modes;
2. Advanced EW to damage or destroy drones not sufficiently hardened against EW;
3. Vehicle-mounted counter-drone systems (including directed-energy systems);
4. Appropriately modified reactive armor or other physical defenses of vehicles;
5. Dispersion of systems with decoys and other forms of maskirovka (military deception and misdirection);
6. Disruption of adversary logistics to prevent resupply of tactical drones to front-line units. This is both tactical and operational. Moving tens of thousands of drones around creates a footprint that can be targeted. Forcing the adversary to disperse the movement can have effects similar to those that the HIMARS strikes on artillery depots did.
7. Autonomous kinetic interceptors that can identify and destroy adversary drones. Neither the Russians nor the Ukrainians appear to have fielded such systems at scale, as of July 2024, but Western industry has already produced them, and anti-drone UAS (although not necessarily autonomous) have begun to appear on the battlefield in limited numbers. Counter-drone UAS systems will likely begin to proliferate as the technology becomes available to both sides.

Finally, both sides and other states are investing in lethal, autonomous drones whose AI algorithms will enable them to perform functions without additional communication as noted above. While recognizing the importance of drones and their potential for transforming war it is also vital to recognize that drones are not a victory mechanism in themselves and that success will come from their correct and dynamic integration with other more traditional systems and forms of combat, suitably modernized and adapted.

Restoring Maneuver in the Face of the Enemy TRSC

The basic requirement for successfully operating in an environment characterized by drone-based TRSCs is the ability to disrupt them locally and temporarily and take advantage of the temporary disruption in a **moving envelope** that continues to suppress or neutralize the TRSC in the vicinity of the advancing forces. The requirement is not to destroy them permanently or universally. Temporarily suppressing the local TRSC will require combining the EW and other counter-drone capabilities described above with effective counter-battery fire and other capabilities to suppress traditional artillery alongside effective tactical air defense against fixed- and rotary-wing attack aviation in pre-determined sectors to permit the concentration first of penetration and then of exploitation forces. The suppression of the defender's TRSC must be accomplished in a way that permits the attacker's TRSC to continue to operate. The attacker's TRSC must be able to identify and strike dispersed defensive positions such as treeline trench systems and isolated enemy vehicles in advance of attacking ground forces. EW systems must thus be designed and operated in a way that does not suppress all drone activity in the attack sector.

Neither Russia nor Ukraine has found a way to deconflict EW and tactical UAS operations either locally or at scale. Both sides have struggled with the fact that EW and tactical UAS systems have hitherto been centralized at different echelons of command, although Ukrainian forces were reportedly taking up this problem in the spring of 2024. The centralization of control by itself will not solve the core problem, however, which is that soldiers seeing a tactical UAS operating near their position are heavily inclined simply to disable it for obvious reasons without taking time to try to figure out if it is friendly or not. A sizable proportion of UAS battlefield kills on both sides thus result from friendly fire. General solutions to this problem are

not obvious. Identify-friend-or-foe (IFF) transponder solutions will likely be subject to spoofing and jamming. Developing a digital tactical common operating picture (COP) able to track the precise locations of thousands of tactical UAS is inherently challenging and also relies, presumably, on those UAS being able to communicate with the IT systems producing the COP. These and other approaches will likely need to be combined to reduce the EW-UAS friendly-fire problem, but they are very unlikely to eliminate it entirely.

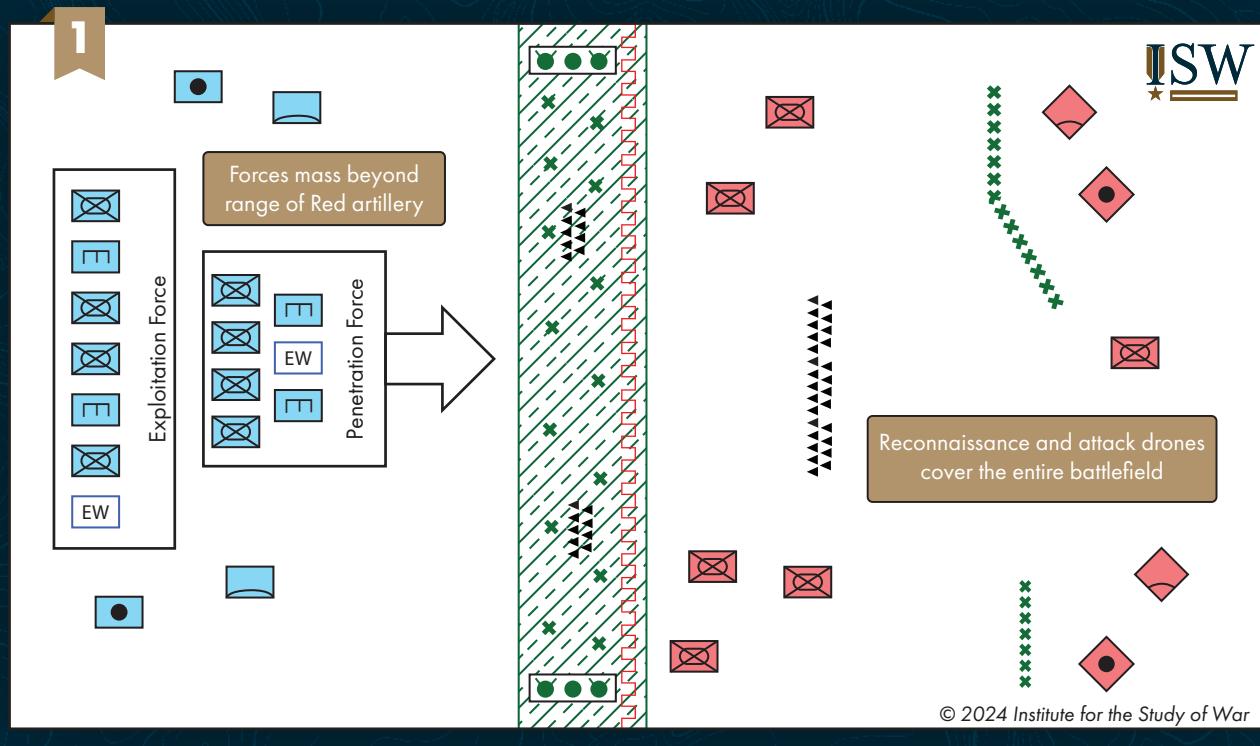
The advent of LAS will likely prove to be another partial mitigation. LAS are currently being developed along two lines—last-mile autonomous and fully autonomous. Last-mile autonomous systems are manually launched by an operator and directed over enemy lines, at which point they can be shifted to an autonomous target-seeking mode and operate without further communications. Fully autonomous systems can launch themselves and guide themselves to designate battlefield sectors in which they can

seek and destroy enemy targets. Both Ukraine and Russia have amassed vast manually-tagged datasets with which to train LAS in target identification and acquisition. The primary challenge in the use of these systems lies in ensuring that they do not identify and strike friendly forces as targets. Last-mile autonomy addresses this challenge by having the operator fly the LAS to an area in which there are no friendly forces to be targeted. Fully autonomous systems will likely have to rely on some form of geofencing or other approach to ensure that they do not strike friendly forces. These factors explain why last-mile autonomous systems are being developed and deployed now whereas fully-autonomous systems are likely still some time off.

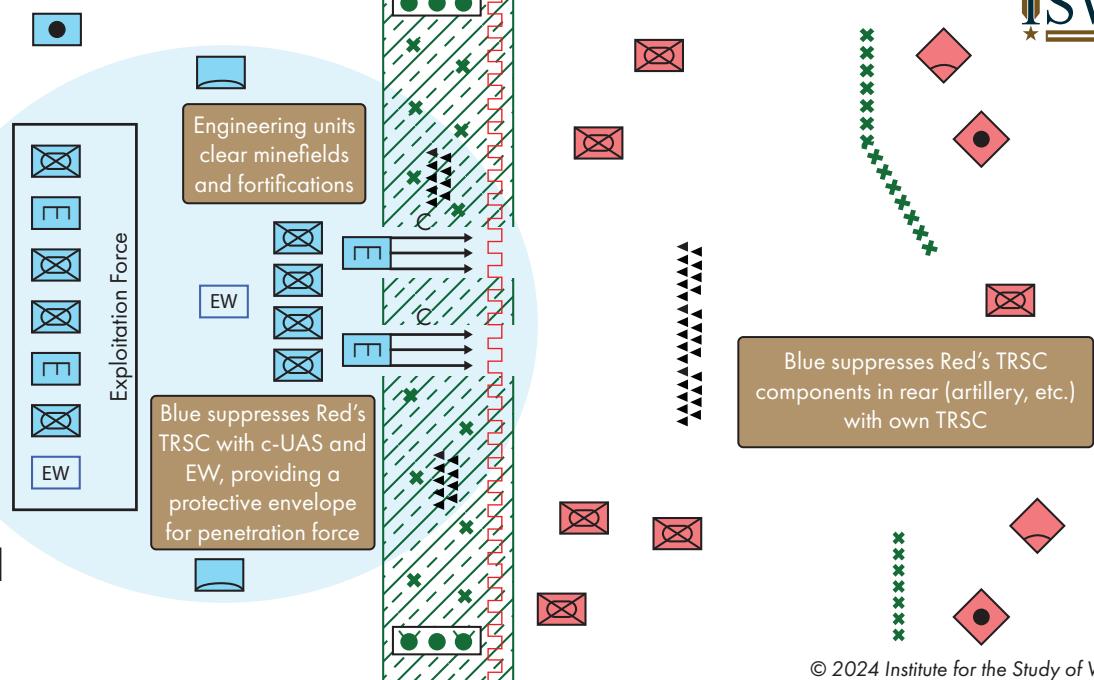
LAS are unlikely to solve the problems of deconfliction in the close fight in any event, however, even with geofencing and IFF. The human ability to distinguish friend from foe in the close fight is imperfect to begin with, but is also likely to be a considerably more difficult capability to replicate in

Restoring maneuver requires disrupting and suppressing the enemy's TRSC locally and temporarily to create a moving envelope that lets friendly forces advance.

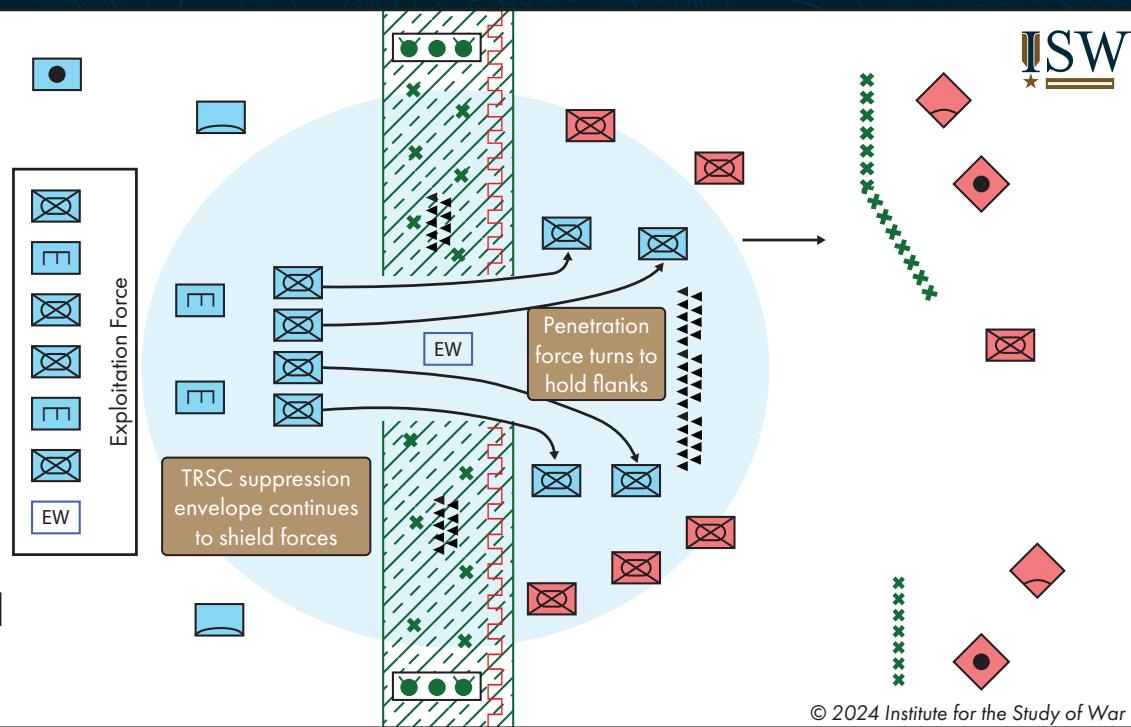
ESTABLISHING MANEUVER: Penetration and Exploitation against adversary TRSC



2



3



4

Exploitation force uses breach to move into Red territory

Exploitation Force

C

EW

Engineer units conduct in-stride breach

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5

Forces continue exploitation until planned culmination

Exploitation Force

EW

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autonomous systems. Nor are soldiers likely to be comfortable relying on the accuracy of such systems in their near proximity. The requirement to deconflict tactical EW with tactical manned UAS is thus likely to remain salient for the foreseeable future.

Non-EW man-portable and vehicle-mounted counter-UAS systems are thus likely to be essential parts of any solution to this problem of deconfliction. Individual vehicles and dismounted small units must be able to have some confidence that if they mistakenly identify an enemy tactical UAS as friendly they have a decent chance of surviving the error. This counter-TRSC capability is already evolving dynamically as both sides experiment in ongoing positional engagements. It will continue to evolve rapidly. Systems suitable for such purposes likely already exist in the form of the Trophy system that Israeli vehicles have used to excellent effect defending against RPGs and other anti-tank systems, but they have not been made available to Ukraine hitherto. More traditional approaches to defending against shaped-charges such as reactive armor and cages have generally appeared to be less effective or subject to circumvention because of the extreme precision with which tactical UAS can strike very small vulnerabilities that cannot be easily protected such as turret rings. A combination of such established technologies with more advanced active defense systems seems likely to be necessary.

Counter-drones—drones designed to locate and attack enemy drones—will likely begin to appear at scale, although possibly not for some time. Ukrainian forces have started to use FPV drones as anti-drone interceptors. Both sides are already operating surface drones to scout and attack enemy minefields and bunkers, and the use of such unmanned ground systems will increase and will be increasingly integrated over time into the unmanned aerial system fusion centers. Attaining a meaningful advantage in this capabilities race will require the ability to imagine new solutions to problems posed by enemy systems and new ways to pose problems for the enemy, as well as the flexibility to innovate to create such solutions and then implement them rapidly at scale. The Ukrainians have so far shown themselves superior in all these categories and are likely to remain so.

Achieving Surprise on the Transparent Battlefield

The proliferation of UAS and other remote sensing capabilities has made the battlefield in Ukraine largely transparent. Both sides can see any individual vehicles and soldiers that are not actually well concealed (and can often detect signs of concealment). Battlefield reports indicate that both sides can likely see and sense dozens of kilometers into each other's rear areas as well making it impossible, in principle, to amass reserves or forces for an attack undetected. These realities of war in this theater would seem to make surprise impossible to achieve. One could also wrongly conclude that they have eliminated the fog of war.

Surprise is still attainable even in these conditions. The doctrinal definition of surprise is to “attack the enemy in a time or place or in a manner for which he is unprepared.”⁴¹ Achieving military surprise does not require sneaking up on the enemy unawares, and it does not necessarily require attacking in an unexpected place—those are merely among the most obvious and dramatic examples of surprise. The key requirement of surprise is that the enemy be unprepared to respond effectively.

There are at least two ways of achieving surprise in the current conditions of the war in Ukraine. The first flows from impossibility of discerning the enemy’s intent confidently simply by observing the dispositions of his forces. Troops massing behind an initial defensive line can be intended to establish subsequent defensive positions or to launch a significant counter-offensive. An attacker can initiate offensive operations in multiple areas in order to obscure the one on which he intends to make his decisive effort. A commander can mass forces in different sectors to confuse the defender about where the attack will come. No amount of visibility of forces on the battlefield in itself will automatically reveal the intent of the opponent, so this central element of the fog of war will remain.

Technological advances can provide a second means of achieving surprise in a war that is seeing such a rapid technological innovation cycle. The EW-UAS competition in this war has caused the advantage to

shift from one side to the other in a matter of weeks. Minor adjustments to the frequencies on which UAS communicate or the ways in which EW systems can jam them can make drones that had been able to operate freely suddenly ineffective in a given area or for a given mission set—or can allow UAS to begin operating in the face of EW systems that had previously been able to disable them. It is possible to make such a technological change and deploy the modified systems but withhold their use until forces are ready to take advantage of the new, gained, or regained capabilities, thereby achieving surprise by presenting the enemy with a dilemma for which he is unprepared.

Both sides have used this approach with varying degrees of effectiveness.

American provided HIMAR systems gave Ukrainian forces a key capability to which Russian forces were slow to react to throughout the second half of 2022. Precise and persistent Ukrainian HIMARS strikes in part forced Russian to withdraw from west bank Kherson Oblast after Russian forces were no longer confident in their ability to support defensive positions on the west bank of the Dnipro River. Ukrainian forces successfully struck several concentrations of Russian personnel—such as awards ceremonies—which Russian commanders were slow to react to.

Russian forces surprised Ukrainian forces by successfully employing electronic warfare and GPS jamming on an unprecedented scale to help defeat Ukraine's initial efforts to penetrate the Zaporizhia frontline in June 2023.⁴² Russian electronic warfare and GPS jamming severely interfered with Ukrainian command and control signals, GPS-enabled devices, and Ukrainian UAV controls. These electronic warfare and GPS jamming capabilities degraded Ukraine's ability to coordinate frontline forces including tactical combat vehicles, make full use of Western-provided precision munitions that

rely on GPS, and degraded Ukraine's own drone systems.

There are sometimes opportunities to achieve surprise by changing fundamental assumptions about the shape and characteristics of the theater itself.

The Russians achieved surprise at the start of the Ukrainian 2023 counteroffensive by destroying the Kakhovka Dam, which flooded the entire Dnipro River area south to the sea and disrupted a nascent Ukrainian cross-river operation that had likely been meant to draw Russian troops away from the main counteroffensive sector and then let the Russians to pull the 7th Airborne Division away from

the Dnipro and use it to stop the counteroffensive. The Russians have targeted dams elsewhere in Ukraine with lesser effects, mainly because they did so at moments when they themselves were not prepared to take advantage of the surprise thus gained in contrast to the destruction of the Kakhovka Dam.

The Russian re-invasion of northern Kharkiv Oblast in May 2024 was another effort to achieve surprise by attacking in an area the Ukrainians were not well-prepared to defend and where the Russians benefitted from the sanctuary created by the policies of Ukraine's Western supporters barring Ukraine from using Western-provided weapons against targets in Russia itself. The Ukrainians were aware of the buildup of Russian forces in the area and so were not strategically or operationally surprised, but the Russians launched the attack before their own forces were fully prepared and thereby achieved a limited degree of tactical surprise. The Russians were not ready to exploit that tactical surprise, however, and so the Ukrainians were able to respond effectively and rapidly.

Surprise is an inherently temporary condition. It is meaningful only if one is able to take advantage of it in time and space to achieve significant advantages. But it is still very possible to generate even on the transparent battlefield of Ukraine.

Surprise is still attainable on the partially-transparent battlefield by concealing the intent of observable force deployments.

Reducing the Cost of Penetration Battles: Counter-Attacking into a Culminating Offensive

Ukraine has an opportunity to avoid having to penetrate deep, well-prepared Russian positions like those they faced in the 2023 counteroffensive. Russian forces are on the offensive all along the line and are not preparing defenses-in-depth as they did in 2023. Ukrainian forces can therefore counter-attack as Russian offensives culminate without having to confront all the dilemmas of penetrating a prepared defensive position. Ukrainian forces have already begun to conduct successful, highly-localized counter-attacks in late June 2024, in fact, such as those they have conducted in Kharkiv Oblast particularly around Vovchansk. Such small-scale tactical counter-attacks are important, but cannot be turned into more operationally significant maneuvers. Ukraine could, however, plan and prepare to conduct operationally-significant counter-offensives that begin with counter-attacks into culminating Russian offensive operations and have the necessary reserves and other resource to make and sustain significant gains. We will consider some of the requirements for sustaining the exploitation of such breakthroughs in more detail below.

The 1943 Battle of Kursk is the archetype of using a successful defense as a springboard into a large-scale operational counter-offensive—the Soviet General Staff, knowing that the Germans were going to attack the Kursk salient, prepared reserves to initiate a large-scale counter-offensives as the German attack culminated, achieving great success. Ukraine will be unable to conduct a counter-offensive on anything like the scale of the Battle of Kursk, to be sure. Several factors will constrain the effects such Ukrainian operations are likely to be able to achieve in the remainder of 2024 and in 2025. The Ukrainians are very unlikely to be able to generate and equip a large enough force to conduct very wide and deep penetrations or to follow them

rapidly with successive operations on a large scale. The transparent nature of the battlefield will also challenge Ukraine to concentrate the reserves necessary for such an operation safely. The rapidity of the technology adaptation race will also likely mean that windows of advantage that Ukrainian innovation can generate will close relatively quickly. The principle that a culminating enemy offensive is a vulnerability that can be exploited remains valid and should be pursued nevertheless remains valid.

Force Ratios

Ukraine is expanding its recruitment efforts and the size of its force as well as reconstituting the assault units necessary for counter-offensive operations, but that effort will take considerable time. Ukraine is also waiting on the arrival of promised US and European equipment necessary to kit out its expanded and reconstituted forces. That equipment, particularly vehicles, is not arriving as rapidly as Ukrainian mobilization efforts are proceeding and is therefore becoming a key pacing factor constraining the expansion of effective Ukrainian combat power. Ukrainian forces will nevertheless continue to grow and reconstitute in 2024 and 2025. Ukraine should therefore be able to conduct counter-offensive operations of the sort described above initially followed by lengthy operational pauses that provide the Russians various opportunities to react. The Ukrainians should be able over time to reduce the length of those pauses if Western support, the development of Ukraine's own defense industrial efforts, and Ukraine's increased mobilization efforts continue.

Surprise

The relatively slow evolution of Russian offensive operations gives Ukrainian defenders time to assess the optimal locations for planned counter-offensives and to amass and prepare reserves of manpower and materiel to support such counter-offensives. The Ukrainians will be challenged to obfuscate their preparations, to be sure, given the relative transparency of the theater. But reserves preparing for a counter-offensive can be postured

as if they were establishing subsequent defensive lines or reconstituting for planned rotations, and other opportunities for deception abound. We will consider the question of achieving surprise on the modern battlefield in more detail below.

Ukrainian forces counter-attacking into culminating Russian offensives will benefit from not having to penetrate deep minefields and well-prepared defensive positions. They may also benefit from attacking exhausted Russian troops if the counter-attack can be timed precisely enough. This approach suffers from an important disadvantage, however—it requires counter-attacking where the Russians have chosen to attack, and the Russians thus far have focused their attacks in areas of relatively lower strategic significance for Ukraine (apart from Kharkiv, but Ukrainian war aims preclude doing more than pushing the Russians back beyond the Russian border). Russian troops on the Melitopol and Velyka Novosilka axes are also attacking, to be sure, but at a much lower tempo and intensity and in a way that is much more likely to support the rapid transition to the defensive than the way in which Russian forces around Avdiivka or Bakhmut are currently operating. In addition, the Russians have already prepared extensive defensive positions along those axes for the 2023 counter-offensive, although it is not clear how suitable those positions will be for a future operation if the Russians have not been maintaining them (which remains unclear).

We should not assume that this approach will by itself neutralize the Russian TRSC, however, even though Russian forces are struggling to bring all elements of their TRSC forward in their offensive operations. Russian forces have tactical drones and both tactical and EW systems all along the line and will very likely be able to use them in response to Ukrainian counter-attacks more effectively than the Russians have been able to employ them in the attack. Finding ways of suppressing the Russian TRSC during the penetration and sustaining that suppression throughout the exploitation therefore remains a central task.

Penetration to Exploitation

The temporary neutralization or suppression of the defender's TRSC at the point of penetration can permit the more rapid breakthrough at a lower cost needed to make exploitation possible. But at what depth must the attacker neutralize the defender's TRSC both to complete the breakthrough of deep defensive positions and to support meaningful exploitation of it? What factors, in turn, control the depth at which a counter-TRSC system can be effective? To what extent can a counter-TRSC capability advance with penetration and exploitation forces? How deep, in other words, can the counter-TRSC envelope be and how rapidly can it advance? The answers to these questions will determine the time-space relationships of potential penetration-exploitation operations and the depth at which campaign objectives can appropriately be set.

These answers are unclear at this time, as neither side has apparently tried to suppress the other's TRSC in support of an offensive operation in depth at scale. The ranges and mobility of the various components of a counter-TRSC system do not yet offer clarity. The Russians have demonstrated the ability to suppress GPS and other signals at ranges of dozens or hundreds of kilometers, but they did so in the absence of Ukrainian capabilities to locate and strike or otherwise disrupt their jammers. Such systems exist, however, and the survivability of jammers is likely to become a more serious problem than it has been thus far in this war. Jammers, after all, by design have a massive electromagnetic footprint that allows them, in principle, to be located and, therefore, again in principle, targeted. The Ukrainians have had success in destroying scarce Russian EW systems, although not as part of a coordinated offensive operation, suggesting that both sides will be able to capitalize on this inherent vulnerability in such systems.⁴³ Every measure has a counter-measure, though, and both sides will very likely find ways to keep EW alive.

The ranges of the drones themselves also do not offer a clear guide to the depth at which the enemy TRSC can be suppressed or the speed with which the attacker's TRSC can advance. Tactical drones generally have short effective ranges, especially if used as loitering reconnaissance systems or munitions, but are also highly mobile with very small footprints. They can in principle accompany advancing troops. In practice, however, it is not clear how many tactical drones advancing troops will be able to bring with them. Small though they are, they take up space. The requirement to remain dispersed and with minimal logistics footprints necessary to survive even amidst the suppression of the enemy's TRSC will likely set hard limits on the availability of tactical drones to penetrating and especially exploiting forces. Longer-range drones can offset this challenge, but they are more expensive and easier to spot and down, at least for now.

The traditional limiting factor for advancing forces has been the range of artillery, currently still fixed at the roughly 25-kilometer maximum effective range of the 152mm howitzer most commonly used by both sides. This range is no longer a reliable guide, however. First, neither side is generally willing to bring its howitzers too close to the front line for fear of losing them to the adversary's TRSC or counter-battery fire. Second, the TRSC itself functions largely to offset the dependence on artillery for offensive firepower given general shell shortages and other challenges with artillery that both sides face.

The principal factor that has allowed mechanized forces to advance beyond the range of artillery in the past was fixed-wing attack aviation, but neither side can rely on this capability as long as neither can achieve even localized air superiority. That limitation would still hold even if Ukraine could field a larger air force using F-16s or other Western aircraft. It is possible that one side or the other will find a way to create a temporary and likely fleeting bubble of air superiority over a limited part of the front line through a combination of suppression of enemy air defense (SEAD) and concentration of manned and unmanned aircraft along with ground-based long-range fires. The US Air Force

leadership is already considering the possibility that even the United States will have to be prepared to fight in circumstances in which it can generate only temporary pockets of air superiority.⁴⁴ The challenge in such a scenario, apart from creating it in the first place, will be to time the emergence of any such air superiority bubble with the attack and transition to the exploitation of the ground forces. It seems unlikely that either the Russians or the Ukrainians will accomplish this feat soon, but it is not inconceivable.

Both sides will thus have to experiment to determine the depth of the defensive envelope a counter-TRSC can provide and the ability to have that envelope keep up with penetrating and exploiting forces. They will also have to experiment with the depth of their own offensive TRSC capabilities and the mobility of those capabilities in the face of the defender's efforts to neutralize or suppress them.

The proper time-space relationships for penetration battles and for the objectives to which exploitation forces should seek to advance will thus have to emerge empirically through iterations of experimentation. This need to experiment and iterate is yet another reason why pressing Ukraine to remain on the defensive in 2024 while amassing an iron mountain of materiel for counter-offensive operations in 2025 is unwise. Such an approach will deprive Ukraine of the ability to experiment, iterate, and innovate even while affording the Russians the unchallenged opportunity to do so.

Planning and Preparing for Successive Operations

A single penetration-exploitation campaign was never going to win the war, as we have observed. The theater is too large, and the combatants have mobilized too many forces for one campaign to be decisive. This factor is even more relevant because the challenges discussed above will constrain offensive operations to limited breadth and depth, but it was inherent in the situation from the moment the initial Russian invasion failed to defeat Ukraine. The limited scope of any feasible,

single Ukrainian counteroffensive operation brings into sharp relief the requirement to design each offensive operation not only to achieve its objectives but also to set conditions for the next offensive operation.

The effort to achieve an objective such as driving to Melitopol, therefore, requires the planning and execution of multiple successive operations, each aimed at a more limited goal. This requirement is not reduced by the prospect of attacking into a culminating Russian offensive.

Soviet operational art theory offers valuable principles for consideration when designing such a series of successive operations. The Soviets rightly observed that the penetration battle is the costliest and most dangerous part of an offensive operation against a prepared defender.⁴⁵ They noted that the culmination of an offensive operation normally ends with the attacker going over to the defensive and entering an operational pause. That operational pause allows the defender two opportunities. First, it allows the defender to reconstitute his forces, bring up additional reserves, and prepare a new defensive position that will force the attacker to conduct a costly and risky new penetration battle. Second, it gives the defender the chance to wrest away the initiative by launching a counterattack where the penetration was made or by launching a new attack elsewhere on the front. The Soviets concluded correctly that the attacker should therefore seek to minimize the length of any necessary operational pause and act to disrupt the defender's ability either to reconstitute a new coherent defensive position or to launch his own attacks elsewhere. The Soviets put these principles into practice in World War II especially beginning with Operation Bagration in 1944, which started a series of nearly continuous offensive operations that culminated only when the Red Army had taken Berlin.

Neither side in this war can replicate the scale of those Soviet offensives, to be sure. The limited resources available to Ukraine would seem to suggest, in fact, that the Ukrainians have no choice but to build up for a single offensive as large as they can manage, allow it to culminate, and then spend

months preparing for the next operation. But that is not the only possible approach even with limited resources. **Ukraine should not continue to attempt one or two massive offensives with long operational pauses following each.** Rather, Ukraine's commanders could and likely should scale their offensive operations to retain the ability to launch a successive operation shortly after the first one culminates. Ukraine should incorporate its long-range strike and reconnaissance-strike complexes into the planned culmination of each offensive to disrupt Russian efforts to reconstitute and regain the initiative. It is better, in other words, for Ukraine to plan for a larger number of offensive operations — each one of which has more limited objectives, but all of which can be conducted in relatively rapid succession. And Ukraine must use its long-range strike deliberately to enhance its maneuver and retain the initiative.

Integrating Long-Range Strike and Maneuver

Western discussions of Ukrainian long-range strike systems and Ukrainian use of those systems can be better optimized to solve the problem of restoring maneuver to the contemporary battlefield.

Current Ukrainian Use of Long-Range Strike Systems

The Ukrainians have been using their limited long-range strike assets primarily for three purposes, two strategic and one operational. The first strategic purpose has been the “demilitarization of Crimea,” as Ukrainian officials call the strike campaign that has driven elements of the Russian Black Sea Fleet (BSF) from its bases in the peninsula, on the whole, and has been degrading and demonstrating the ability to penetrate Russian air defenses in Crimea.⁴⁶

The long-range strike campaign to demilitarize Crimea has had important strategic impacts. It has allowed Ukraine to resume exporting grain and other products after Russia withdrew from the Black Sea grain agreement on July 17, 2023.⁴⁷ It

foreclosed a strategic option for Russia by precluding the Russian effort to establish a de facto blockade of Ukrainian ports in the summer of 2023. It forced the BSF to change its operational patterns fundamentally, and it has eroded Russia's sanctuary by putting Russian rear areas in Crimea at risk. The campaign has also degraded Russia's ability to use Crimea as a place-d'armes to support operations throughout southern Ukraine and force the Russian military to concentrate air defense assets here at the expense of other sectors of the front where Russian forces are trying to advance.⁴⁸ It has also reduced the effectiveness of the Kremlin's efforts to constrain Western policy decisions by demonstrating the unseriousness of yet another supposed Russian "red line" and by helping make the case for providing Ukraine with long-range strike systems and permissions to use them. These effects are all important contributions to the overall Ukrainian war effort, and Ukraine should sustain these operations to demilitarize Crimea. The argument below for a revised approach is not an argument for halting this campaign.

The second strategic purpose of Ukraine's long-range strike campaign has been to attack Russian petrochemical and some military assets deep in Russian rear areas. This campaign has relied on very long-range drones to hit critical components of Russian petrochemical facilities in ways that take them offline for notable periods of time (usually weeks) in order to impose economic costs on Russia and bring the war home to Russians as the Russians are bringing the war to Ukrainians on a continual basis. This effort is very likely not intended to affect ground operations in Ukraine itself and is unlikely to do so.

Ukrainian forces have also used very long-range drones to attack Russian airbases, air defenses in

Russia, and long-range radar systems in an effort to degrade the Russians' ability to sustain their strategic bombing campaign against Ukraine. This effort is likely meant in part to mitigate the damaging effects of the limitations the US has imposed on the ground-based long-range strike systems it has provided to Ukraine, particularly the ban on using ATACMS in Russian territory. That ban precludes Ukraine from using US systems to hit any of the airfields from which Russian aircraft launch missiles and glide bombs against Ukrainian critical infrastructure, cities, and front line forces even though many such airfields are within range of ATACMS. **The disruption of Russian air operations from those bases likely would impact ground operations by forcing Russian aircraft to fly from more distant airfields and either conduct aerial refueling or reduce their target coverage areas and/or loitering times. Those effects would reduce the Russians' ability to support their own offensive operations as well as their ability to respond to future Ukrainian counter-offensives. The partial removal of the sanctuary has already had a positive effect, underscoring the latent potential a larger policy change could achieve.**^v

The third Ukrainian effort has been to use its long-range strike assets to attack Russian GLOCs and supply points to achieve a general degradation of Russian logistics. Ukrainian strikes have also hit Russian headquarters and communications facilities and some airfields.⁴⁹ Ukrainian forces have opportunistically hit concentrations of Russian forces when Russian commanders have foolishly exposed themselves to such attacks.⁵⁰ This is the aspect of Ukrainian long-range strike campaigns that can likely benefit the most from the optimizations recommended below.

It is better for Ukraine to plan for a larger number of offensive operations – each one of which has more limited objectives, but all of which can be conducted in relatively rapid succession.

V Angelica Evans et. Al., "Russian Offensive Campaign Assessment, June 22, 2024," ISW, June 22, 2024, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-june-22-2024>; Christina Harward et. Al., "Russian Offensive Campaign Assessment, July 7, 2024," ISW, July 7, 2024, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-july-7-2024>

Striking logistics nodes, headquarters, and GLOCs in a way that is not closely coordinated with ground operations generates a primarily ephemeral effects to which the Russians can generally adapt in time. Modifying the approach could directly support Ukrainian ground maneuver more effectively by coordinating strikes with maneuver so that Ukrainian forces can take advantage of the temporary effects the strikes cause. The destruction of individual supply points, command and communications nodes, and local troop concentrations strikes temporary blows from which Russian forces can and do recover relatively quickly. Ukrainian forces have damaged key bridges, disrupting Russian logistics far in the rear of Russian defending forces. Ukrainian forces have generally not timed such strikes to create those ephemeral effects at times and places that would allow their own ground forces to take advantage of them before the Russians can recover, however.

The suggestions made in some Western recommendations for Ukrainian operations in 2024 that Ukraine continue and expand strike campaigns against discrete logistics targets and force concentrations uncoordinated with specific ground operations in order to set conditions for a major counteroffensive operation in 2025 do not take sufficient account of the ephemerality of the effects of most such strikes or the Russians' ability to develop mitigations for the longer-term effects. A more effective strike campaign would concentrate strikes in time closely coordinated with planned ground operations.

Redesigning Long-Range Strike to Support Ground Maneuver

Ukraine must use long-range strike to offset its lack of manned, fixed-wing airpower to help restore maneuver. Ukrainian forces should concentrate on using long-range strike to disrupt the elements of the Russian RSC that are out of range of their tactical systems at sufficient scale and coordinated with Ukrainian offensive operations to facilitate not only the penetration battle but also the exploitation of the penetration. In this context, they must also

use their long-range strike capabilities to prevent the Russians from sending operational reserves to the exploitation sectors by timing attacks on bottlenecks on Russian GLOCs to support ongoing and planned Ukrainian ground offensive operations.

This use of long-range strike will also reshape the requirements for tactical fires. First, tactical fires will have to be integrated into the new fire scheme to create and sustain seamless effects from the front line into the adversary's operational rear. Second, tactical fires must be sufficient to handle tactical problems so that the precious long-range capabilities of all sorts can focus exclusively on the missions only they can achieve to accomplish operational-level objectives.

Ukraine should use its missile and drone capabilities, in other words, to perform the functions that NATO doctrine encompasses under the concepts of Battlefield Air Interdiction (BAI) and Close Air Support (CAS), for which NATO would primarily use fixed-wing aircraft. NATO doctrine in this regard would focus on first achieving air superiority, including suppressing enemy air defenses using 5th generation aircraft and long-range precision strike. NATO would then rely on high-altitude (i.e. above tactical air defense) aircraft dropping Joint Direct Attack Munitions (JDAM) and similar systems against point targets to the full depth of the enemy defensive position. NATO would thus be able to prevent the Russians from operating their own fixed or rotary wing aircraft, removing one element of their RSC. It would render Russian artillery operations extremely challenging by rapidly destroying artillery concentrations, significantly reducing the effectiveness of Russian artillery. And it would reduce the effectiveness of Russian sub-tactical defensive positions, since air superiority would allow NATO forces to identify by reconnaissance the presence of such positions and then drop a JDAM or similar munition on it thereby destroying it rather than having to fight through it. NATO air would also preclude the movement of operational reserves at scale both by destroying any concentrations of such reserves and by destroying key chokepoints on GLOCs such as bridges.

The Ukrainians will not have enough manned fixed-wing aircraft to rely on for these purposes, as

they well know. They will primarily use F-16s and similar aircraft to be able to push Russian attack aircraft further from the line in order to limit or deprive the Russians of the ability to use their own fixed-wing aircraft for the equivalent of CAS and BAI. This requirement has become more urgent in the wake of the Battle of Avdiivka in which the Russians apparently achieved temporary and localized air superiority sufficient to allow them to drop hundreds of unguided glide bombs on Ukrainian defenders from Su-34 and Su-35 fighter-bombers in the final stages of the assault.⁵¹ Ukrainian F-16s or similar aircraft with modern target acquisition radar and modern air-to-air missiles could likely have kept the Russian strike fighters further away from Ukrainian ground defenses than the 50-80 kilometer ranges of their glide bombs.

The Ukrainians also need fixed-wing aircraft as missile trucks to use air-launched precision systems such as Storm Shadow. More missile platforms would increase the rate and reliability of such long-range strikes and could also allow Ukrainian forces to fire from closer to the front line thereby extending the range they can hit into the Russian rear. They would be more able to strike Russian airfields and major supply and repair depots as well as force concentrations throughout Russian-occupied Ukraine, whereas some important Russian bases in Ukraine are beyond the reach of Ukrainian long-range strike systems but still able to support Russian operations in Ukraine. The effect of opening up all Russian targets in Ukraine to Ukrainian long-range strike would be to degrade further the Russian's ability to use their own long-range air and ground-based systems and thus to degrade the Russian RSC and TRSCs.

Given the scarcity of the modern fixed-wing manned aircraft Ukraine can expect to have in the coming year, **Ukrainian forces will have to find ways to use the drone and missile strike systems it has to generate the effects of BAI and CAS in direct support of the penetration battle and the exploitation phase of each offensive operation.** Ukrainian commanders have likely had this thought, to be sure. Executing it in current conditions is extremely challenging. Russian air, missile, and

drone defenses are formidable, and Ukraine has so few long-range strike systems that it cannot afford to waste them against well-defended targets. Ukraine also lacks systems that can reliably destroy significant infrastructure such as bridges in a single shot, which makes the prospect of timing the destruction of key GLOC bottlenecks to support ongoing ground operations daunting but not impossible, as we will consider below.

The West Must Provide Ukraine with Long-Range Strike Systems and Full Permission to Use Them

Prioritizing the use of long-range strike to support the restoration of Ukrainian ground maneuver should reshape Western decision-making about how many such systems of precisely what capabilities to provide. Substituting missiles and drones for air-dropped precision bombs requires having systems that can reach wherever manned aircraft would have been able to reach. That target set includes targets deep in the rear of Russian forces in Ukraine as well as close to the front lines.

Using long-range strike to offset the lack of airpower requires significantly more long-range strike systems than the West has provided Ukraine with to date, however. Ukrainian forces must be able to strike multiple targets at varying depths in the Russian rear simultaneously and repeatedly in order to generate systemic effects on the defending Russian forces and to sustain those effects for long enough that Ukrainian ground maneuver forces can take advantage of them. Ukrainian forces must also be able to strike targets in the Russian rear in a planned and coordinated fashion rather than opportunistically. They will have to be able to lose long-range systems to Russian air defenses and still accomplish their missions. The actual requirements for such munitions, therefore, are likely in the thousands rather than in the dozens and for systems that can range all of Ukrainian territory, not just limited portions of it. Ukraine's supporters will likely be challenged to find enough such systems already in their arsenals to provide Ukraine--a fact that should generate a sense of renewed urgency to revitalize the West's defense industrial base and specifically to boost production of such systems as rapidly as possible.

Campaign Design for a Single Penetration and Exploitation

This section synthesizes and summarizes the effects the Ukrainians need to achieve in order to make and exploit the penetrations discussed above.

1. The Ukrainians need to be able to mass forces both for the penetration and for the exploitation and have those forces survive the concentration, attack, exploitation, and consolidation phases. Mass in this context incorporates considerable tactical dispersal of forces, but the Russian TRSC can destroy even tactically dispersed forces if not countered.
2. They must suppress the TRSC around the points of penetration and in the rear along the exploitation axis for long enough to make operationally significant gains.
3. They must have enough armored breaching systems for the penetration operation reliably to clear deep and complex minefields and overcome defensive engineering obstacles, and they must be able to keep these systems alive long enough to complete the breach.
4. They must have armored breaching systems mobile enough to accompany the advancing exploitation forces to conduct in-stride breaching of subsequent prepared defensive positions and hastily established minefields and defensive obstacles. These systems must be able to survive while advancing and while conducting the in-stride breach.
5. They must be able to survive Russian counterattacks and concentrations of fire at their culmination point. They must then be able to hold their final positions through whatever operational pause is required before the planned successive operation can begin.
6. They must suppress Russian long-range strike at their concentration areas and rear areas as well as their forward positions and their objective.
7. They must prevent the Russians from moving reserves to block the penetration or exploitation.
8. They must be able to supply their advancing forces and maintain communications with them.

The United States would approach many of these problems in the following fashion:

US forces would suppress enemy air defenses and deprive the enemy of the ability to fly large aircraft, fixed or rotary wing, using a combination of 5th-generation aircraft and long-range strike to destroy air defenses and airfields along with long-range anti-aircraft missiles fired from 5th-generation aircraft to keep long-range Russian aircraft from the area. US forces would then target concentrations of artillery and supplies and continually attack firing positions as they manifested on the battlefield using combinations of long-range stand-off precision strike and aircraft orbiting the battlespace. US forces would use combinations of long-range strike and JDAMs to destroy tactical strongpoints, EW systems, command nodes, and communications facilities. The effect would be to disrupt the enemy TRSC, theater RSC, defensive positions, and ability to concentrate and move reserves.

The United States would also use advanced munitions such as artillery-deployed minefields (FASCAM); long-range precision-guided anti-armor artillery rounds such as the Vulcano; and GATOR aerial anti-armor mines to isolate the penetration sector and the exploitation lane.

Ukrainian forces must find ways to use land-based long-range fires directly to support ground maneuver.

This approach would mitigate but not eliminate the challenge of the proliferation of tactical drones. US systems are much more resilient to enemy EW than Ukrainian systems, and one can posit that US EW could be better at interfering with tactical drones, but the United States should not take that assumption for granted given the offense-defense race now going on in Ukraine. Without effective counter-drone systems, even the airpower-focused approach above would lead to considerably higher United States vehicle and personnel losses than the United States has experienced in any recent conventional war. But the United States would likely be able to keep enough combat power alive and operational to drive through the remaining defenders in the current conflict and achieve their objectives even at higher cost.

The United States would address the challenges of the initial breaching operation and in-stride breaching by massing engineering vehicles and equipment such as mine-clearing line charges (MICLICs), armored combat excavators, mine flails, mine blades attached to tanks, and other systems.

The Ukrainians must take a different approach. They will not have enough airpower and they will not have 5th-generation aircraft, and so will not be able to rely on the US approach. They need to create similar effects using different systems and capabilities that are overwhelmingly ground-based. They will also lack the concentrations of purpose-built US breaching systems needed to conduct initial breaches and in-stride breaches and will have to develop alternative approaches to these challenges (although the United States and its allies and partners should prioritize delivering such systems to Ukraine at scale). They need to create conditions in which:

- I. Ukrainian drones can operate, and Russian drones cannot. This effect will likely result primarily from EW efforts, but it will over time also benefit from increasing counter-drone technology.
2. Russian aircraft cannot decisively interfere with either the penetration or the exploitation battle. This effect can be achieved through a combination of ground-based and air-based air defense along with long-range strike against Russian air bases in Ukraine supported by EW.
3. Ukrainian artillery can operate and survive, particularly in the penetration battle. This effect can be achieved by:
 - a. Increasing the range of Ukrainian artillery rounds through the provision of larger numbers of more advanced Western systems;
 - b. Fielding effective anti-drone systems (and successfully preventing Russian air from attacking the artillery); and
 - c. Suppressing Russian counter-battery capabilities, likely by driving Russian artillery systems further to the rear for their own survival using Ukrainian drones and superior Ukrainian counter-battery capabilities.
4. Disrupting Russian supply in a way that directly supports Ukrainian penetration and exploitation operations.
5. Preventing the Russians from massing or moving operational reserves before or during the attack and exploitation. This effect can be accomplished using long-range precision strike against key GLOC chokepoints and concentrations of forces in a timely fashion coordinated with ground operations.
6. UAF can clear obstacles and minefields in a timely fashion. This effect requires keeping engineering assets alive and having enough of them, but also likely finding other solutions possibly using unmanned systems to locate and neutralize mines.

In the current environment, Ukraine cannot reasonably expect to have the following assets in 2024 or 2025:

1. Large masses of armor;
2. Large numbers of aircraft;
3. Large amounts of breaching equipment;
4. Large amounts of artillery ammunition;
5. Large numbers of long-range strike systems;
6. Large quantities of purpose-built breaching equipment and vehicles;
7. Numerical superiority.

Ukraine can expect to have:

1. Enormous numbers of drones of all varieties;
2. Advanced and improving EW capabilities;
3. Improving counter-battery capabilities;
4. Air defense capabilities;
5. Continued advantages in the ability to adapt rapidly, and to learn and disseminate lessons and solve problems across the force more quickly and effectively than the Russians.

Ukrainian future success thus rests on the following key factors:

- I. Skillful campaign design that takes maximum advantage of Ukrainian advantages and minimizes Ukrainian disadvantages and Russian advantages.
 - a. This campaign design must focus not only on the initial penetration battle but also on the exploitation phase;
 - b. It must find ways to achieve surprise even in the context of pervasive ISR (therefore attacking *in a manner that is unexpected* rather than a time or place); and
 - c. It must include a conditions-setting phase to set the terms of battle in Ukraine's favor, likely by starting in a location that will not be the primary axis of attack.
2. Integrating the Ukrainian TRSC with Ukrainian ground operations, particularly including mechanized offensive operations. We have observed the following challenges and requirements in this regard since 2023:
 - a. The opportunistic approach to drone targeting is not sufficient to enable either rapid penetration or sustained exploitation.
 - b. Ukrainian vehicles and units will lose communications, especially as they advance. The drone-based TRSC must be able to continue to support advancing Ukrainian armor without communicating with it, and the armor must have confidence that the TRSC can and will do so. Ukrainian troops will have to be trained to operate without even vehicle-to-vehicle communications as well.
 - c. The speed and scale of the TRSC must be dramatically increased by improving situational awareness systems, using automation to accelerate target identification and execution, and communications.

- d. The TRSC must be hardened against and reactive to Russian EW and counter-drone systems that will be developed.
 - e. Observation: Ukraine will be offsetting limited artillery ammunition with drones, especially FPV drones. It must develop the TRSC so as to be able to service targets as necessary with either artillery or drone strikes, noting an increasing reliance on drones.
3. Establish mobility through obstacles including mines;
- a. US military doctrine identifies four major tasks that a breaching force must conduct prior to the assault: suppress, obscure, secure, and reduce.⁵²
 - i. Suppress: "Suppression is a tactical task used to employ direct or indirect fires or an electronic attack on enemy personnel, weapons, or equipment to prevent or degrade enemy fires and observation of friendly forces. The purpose of suppression during breaching operations is to protect forces reducing and maneuvering through an obstacle." The discussion above about suppressing the defender's TRSC largely addresses this requirement.
 - ii. Obscure: "Obscuration must be employed to protect forces conducting obstacle reduction and passage of assault forces." Obscuration also requires suppressing the defender's TRSC in addition to other more traditional methods.
 - iii. Secure: "Friendly forces secure reduction areas to prevent the enemy from interfering with obstacle reduction and passage of the assault force through lanes created during the reduction." In addition, US doctrine adds: "The far side of the obstacle must be secured by fires or be occupied before attempting efforts to reduce the obstacle. The attacking unit's higher headquarters is responsible for isolating the breach area by fixing adjacent units, attacking enemy reserves in-depth, and providing counterfire support." These requirements are addressed by the discussions above regarding maintaining the effectiveness of the offensive TRSC at the point of penetration and beyond as well as the discussions about integrating long-range strike to offset the lack of air superiority.
 - iv. Reduce: "Reduction is the creation of lanes through or over an obstacle to allow an attacking force to pass."
 - b. Ukraine will have to innovate to offset the near-certain lack of sufficient Western-provided purpose-built breaching vehicles and systems.
 - i. Innovation can involve unmanned systems in part. UAS and UGS can potentially work to identify the pattern of placement of enemy mines in order to locate optimal lanes that engineering assets can reduce.
 - ii. Ukraine will likely also have to make field modifications and adaptations of existing vehicles and systems. The US Army famously made such adaptations to its tanks to facilitate maneuver through hedgerow country in Normandy.
 - c. The initial tactical engineering requirement includes ensuring engineering asset survivability at the point of penetration and beyond.
4. Isolate the penetration sector. The required effect is that Ukrainian penetration echelons can confront and defeat the initial Russian defensive forces in front of them without interference by Russian forces outside of the immediate penetration sector. That Russian forces on the defensive must be deprived of resupply and reinforcements as well as tactical mobility during the penetration battle.
- a. Drive Russian artillery out of range of the penetration sector;

- b. Drive Russian fixed- and rotary-wing air out of range of the penetration sector;
- c. Fix Russian tactical reserves and hinder Russian front-line forces' ability to move freely from one tactical defensive position to another;
- d. Defend against Russian long-range precision strike by concentrating necessary anti-missile as well as anti-air defenses;
- e. Disrupt the Russian GLOCs needed to bring locally available reserves to the penetration sector. This is a big challenge because Ukraine generally lacks the systems needed reliably to destroy GLOC infrastructure in a single shot and therefore is challenged to do so in a way that directly supports upcoming or ongoing Ukrainian offensive operations. Barring the provision of the strike capabilities at scale that would enable the destruction of Russian GLOC infrastructure in a single shot, Ukrainian forces likely must increasingly integrate these strikes with tactical ground maneuvers, achieving the minimum effect of keeping Russian reserves away from key areas of the penetration sector if not the entire axis of advance. This requirement thus also demands careful timing coordinated to support achieving surprise, as strikes against GLOCs cannot occur in such a fashion as to tip off the Russians to the impending focused penetration effort.
- f. Disrupt Russian tactical logistics, even those that are highly dispersed at critical moments; and
- g. Prevent the neighboring Russian units from moving to close the breach or otherwise attack the flanks of the penetrating forces.

The West must help get Ukraine the resources it needs to support a properly sequenced series of successive operations.

5. Maintain mobility through obstacles including mines, including hastily-deployed minefields;
 - a. This requirement demands mobile engineering assets and the ability to ensure the survivability of engineering assets at depth. These assets must be able to conduct in-stride breaching of subsequent prepared defensive positions and hastily laid minefields and improvised defensive positions. The requirements for in-stride breaching are similar to those for breaching initial prepared defensive positions described above.
 - b. Soviet practice in addressing this requirement had focused on the need for echelonment of engineering assets mirroring the general Soviet emphasis on echelonment of forces for deep penetrations.⁵³ Ukraine will not be able to amass enough purpose-built equipment to echelon it. Ukrainian forces will therefore need to improvise similar capabilities to support in-stride breaching, as they must assume that many of the purpose-built systems they have initially will be expended in making the first penetration.
6. Isolate the exploitation axis;
 - a. Fix and degrade Russian reserves throughout the axis;
 - b. Prevent Russian operational and strategic reserves from arriving to the axis in time to affect the outcome of the campaign;
 - c. Continue to drive Russian artillery and long-range strike away from the axis as Ukrainian forces advance;
 - d. Expand Ukrainian air and missile defense over the advancing Ukrainian exploitation forces;
 - e. Disrupt Russian operational logistics throughout the depth of the axis;

- f. Prevent Russian forces in neighboring sectors from attacking the flanks of the advancing Ukrainian forces;
7. Disrupt the TRSC of the initial Russian forces on the defensive even after they are isolated. The required effect is fundamentally to disrupt Russian front-line defensive drone operations.
- a. This effort will rely heavily on EW and counter-drone capabilities, possibly with some tactical adaptations.
 - b. If the TRSC of the isolated defending Russian forces cannot be disrupted directly, attacking Ukrainian forces will still likely be able to penetrate once the isolated defenders run out of systems or Ukrainian forces manage to target enough of them to neutralize the TRSC as a cohesive system. The problem with this approach is that it will cause delays in the penetration and increase the burden on Ukrainian forces to maintain the isolation not only of the penetration sector but also of the designated exploitation axis. Reliable assessments about the Ukrainian ability to disrupt or suppress the isolated forces' TRSC are therefore essential planning assumptions for the entire operational-level undertaking.
8. Maintain and sustain momentum to the operational objective and be able to consolidate and defend along the exploitation sector all the way to the operational objective.

We cannot orient our thinking about mechanized offensive operations in contemporary conflict around mass as the US historically has done. A certain minimum mass is required to conduct offensive operations of any variety successfully, to be sure. But beyond that minimum, offensive operations can be developed at varying scales depending on what resources are available and how advantageously conditions can be set. The theater requirement for successful offensive operations is not a theater-wide numerical superiority or any theater-wide superiority. **The requirement for successful offensive operations, rather, is to be able to achieve temporary localized superiority and sustain it sufficiently through to the accomplishment of the operational objective without compromising the stability of the rest of the theater.**

Achieving this aim requires properly-scoped simultaneous and successive operations. Simultaneity is important both to achieve the limited degrees of surprise possible in this ISR environment and also to fix enemy reserves in place away from the intended penetration sector. Successive operations are necessary because no single decisive operation is possible.

Ukraine is not likely going to be able to sustain a series of successive operations without interruption all the way to a conclusion in the current resource environment, and possibly given their organization and planning capabilities as well. But neither can Ukraine attempt one big offensive at most per year. A suboptimized cadence of operations based on Ukrainian limitations that nevertheless reduces as much as possible the Russian ability to reconstitute and make successive penetration battles too costly or slow must be found. There is historical precedent for a military working through this problem as the Soviets did during and after the Battle of Stalingrad.⁵⁴

The difference between a cadence of small penetrations of this sort and positional warfare lies in the fact that positional warfare, on the whole, does not include penetrations and exploitations of them at all. Positional warfare is fundamentally a series of periodic frontal assaults pushing defenders back rather than penetrating front lines to enable maneuver in the rear. The more the attacker can advance in the rear following a penetration, the more ground he can gain at the least cost, which is why it is worthwhile working to restore maneuver even at a limited scale that does not produce immediately decisive results.

The conversation Ukraine and its Western supporters must have is thus not about how to get the Ukrainians everything they need to conduct a 2023-style offensive operation in 2025, but rather how to get the Ukrainians what they need over time to support a properly sequenced series of successive operations that are individually much smaller but collectively can achieve operationally significant effects.

Implications for Resourcing

The operational approach recommended above requires significant changes to the current and planned approach to providing Ukraine with the resources it needs. The West must work with Ukraine to lay out the combination of simultaneous and successive defensive and offensive operations that Ukraine will have to conduct, on the one hand, and will seek to conduct, on the other, over the coming year and determine the resources required for each. This approach will require abandoning the effort to stockpile a large amount of materiel in preparation for a single big offensive in 2025. It may be somewhat easier in that each individual combination of operations will require fewer resources than would the single big offensive. It will be considerably more difficult, however, as it will require a much closer integration of concrete Ukrainian operational plans with the timely provision of specific systems and materiel in the necessary amounts by Ukraine's Western partners. The magnitude of this last challenge cannot be overstated, as Ukraine and its supporters have yet to show the ability to integrate operational plans with the timely provision of necessary resources.

This approach also requires the long-term and reliable commitment of Ukraine's supporters to making necessary materiel available. Planning for successive operations is sensible only if there is reason to be confident that materiel for future operations will be available. The West's reluctance until very recently to

commit to long-term aid at scale has posed serious obstacles for Ukrainian commanders who might have wished to plan for the longer term.

The new approach also changes the balance of materials required. Ukraine will still need large numbers of armored vehicles of all sorts, artillery, aircraft, air defenses, and so on. Focusing on supporting a series of planned successive operations, each of which is considerably more limited than the single massive offensive apparently contemplated for 2025, could allow tailoring of packages to flow into Ukraine at a predictable pace for rapid use in these smaller operations.

Accepting the need to redefine the relationship between maneuver and long-range strike, however, has significant implications for the long-range strike requirements. Ukraine would need one or two orders of magnitude more ground-based long-range strike munitions and many more long-range strike systems to be able to use ground-based long-range strike in the CAS and BAI roles described above. The provision of such systems would need to be tied to specific operational plans and would have to arrive in time to allow Ukrainian forces to begin setting conditions for maneuver operations.

Ukraine has already identified requirements for unmanned systems and electronic warfare that are likely adequate and appropriate for the approach proposed above. The United States, NATO, and other allies and partners must lean in to helping Ukraine meet those requirements.

Conclusion

The challenges before Ukraine and its Western supporters are enormous. They are not, however, insurmountable. Their solutions lie not only in the generation of more materiel and manpower, difficult as those tasks are, but also in the development and implementation of a new warfighting concept appropriate for the contemporary circumstances of this war. This task is feasible. It requires imagination, innovation, and iteration. It requires experimentation with battlefield concepts as well as with technology and tactics.

The Russians are not incompetent. They are serious and determined foes. Their ranks include many innovative people seeking to identify and solve the same problems identified above. ISW has followed their public discussions of these challenges and proposed solutions with great interest, in fact. It would be a terrible mistake to underestimate them.

Russia obviously benefits from many numerical advantages, moreover. But size alone has rarely determined the outcomes of wars. Frederick the Great's opponents outnumbered the Prussian Army at all times, yet Frederick prevailed. One could cite many other examples from history, but the point should be obvious—quality matters as much or more than quantity.

The long history of war makes clear that maneuver will ultimately be restored to the battlefield despite the current challenges. If Ukraine and its partners embrace a new warfighting concept based on the principles outlined above and resource it properly and over the long term then Ukraine can gain the advantage it needs to turn the tide of this war in its favor once more. The adaptations necessary to do so are feasible and some, indeed, are already underway piecemeal. A core challenge now is to develop and implement a new concept holistically and systematically and then improve iteratively through experimentation, simulation, and rigorous after action reviews taking advantage of the extremely rapid feedback loop the Ukrainian military has developed with Ukrainian innovators and industry.

Helping Ukraine accomplish this task is vital for Ukraine's supporters as well. Ukraine's success in this war is essential for the security of Ukraine's partners, on the one hand. Unlocking the secrets of effective warfighting in the modern era will point the way for the future development of the warfighting capabilities of the United States and its allies and partners around the world on the other.

This is the time for all Ukraine's supporters to lean into the effort to help Ukraine adapt and succeed.

Unlocking the secrets of effective warfighting in the modern era will point the way for the future development of American warfighting capabilities and those of its allies and partners.

Appendix A: Frameworks Charts

Levels of war – tactical, operational, strategic, and grand strategic. This framework is useful for articulating the linkages required to convert success on the battlefield (tactical) into meaningful strategic outcomes. The key concept we use and explore in this paper is the operational level of war – the linking together of battles in time and space – into campaigns to achieve interim objectives, and then the stringing together of campaigns and the achievement of multiple interim objectives to achieve a strategic goal.

Levels of War Framework				
Level	Tactical Level	Operational Level	Strategic Level	Grand Strategic Level
Definition	Includes all activities related to combat, including the planning and executing of battles, engagements, and activities to achieve military objectives.	Concerned with linking the tactical employment of forces to national and military strategic objectives through operational art. I.e. the creative design of strategies, campaigns, and major operations to determine how, when, where, and for what purpose major forces will be employed and to influence the adversary's disposition before combat.	Concerned with linking together operational level campaigns to achieve theater objectives, which include the political goals of the war in a given region.	Concerns the employment of the instruments of national power (diplomatic, informational, military, and economic) in a synchronized and integrated fashion across theaters to accomplish national objectives set by national or multinational leaders.
Example	Activities at Each Level of War in the Second World War			
	Omaha Beach Juno Beach Cherbourg	OPERATION OVERLORD (Invasion of Normandy) OPERATION COBRA (Breakout from Normandy)	Liberation of France Invasion of Germany	Victory in European Theater of Operations Victory in Pacific Theater of Operations

Sources: Army Doctrine Publication 3-0, *Operations*, July 2019, Section 1-2. https://armypubs.army.mil/epubs/DR_pubs/DR_a/ARN18010-ADP_3-0-000-WEB-2.pdf; Joint Publication 3-0, *Joint Operations* (Washington, DC: U.S. GPO, 22 October 2018), I-13–I-14. https://armypubs.army.mil/epubs/DR_pubs/DR_a/ARN18010-ADP_3-0-000-WEB-2.pdf.

Warfighting functions—“A warfighting function is a group of tasks and systems united by a common purpose that commanders use to accomplish missions and training objectives. Warfighting functions are the physical means that tactical commanders use to execute operations and accomplish missions assigned by superior tactical- and operational-level commanders. The purpose of warfighting functions is to provide an intellectual organization for common critical capabilities available to commanders and staffs at all echelons and levels of warfare. Commanders integrate and synchronize these capabilities with other warfighting functions to accomplish objectives and missions.” The joint warfighting functions are:

Warfighting Function Framework		
Warfighting function	Definition	Associated Tasks
Command and Control	Is the related tasks and a system that enable commanders to synchronize and converge all elements of combat power.	<ul style="list-style-type: none"> • Command forces • Control operations • Drive the operations process • Establish the command and control system
Information	Is the related tasks and systems that provide the capability to influence adversarial actors outside of lethality.	<ul style="list-style-type: none"> • Military deception • Information support operations • Cyberspace electromagnetic activities • Operations security
Movement and Maneuver	Is the related tasks and systems that move and employ forces to achieve a position of relative advantage over the enemy and other threats	<ul style="list-style-type: none"> • Move • Maneuver • Employ direct fires • Occupy an area • Conduct mobility and countermobility • Conduct reconnaissance and surveillance • Employ battlefield obscuration
Intelligence	Is the related tasks and systems that facilitate understanding the enemy, terrain, weather, civil considerations, and other significant aspects of the operational environment.	<ul style="list-style-type: none"> • Provide intelligence support to force generation • Provide support to situational understanding • Conduct information collection • Provide intelligence support to targeting and information capabilities
Fires	Is the related tasks and systems that create and converge [lethal and non-lethal] effects in all domains against the adversary or enemy to enable operations across the range of military operations.	<p>Execute fires across the five domains and in the information environment, employing—</p> <ul style="list-style-type: none"> • Surface-to-surface fires. • Air-to-surface fires. • Surface-to-air fires. • Cyberspace operations and electronic warfare. • Space operations. • Multinational fires. • Special operations. • Information operations. <p>Integrate Army, multinational, and joint fires through—</p> <ul style="list-style-type: none"> • Targeting. • Operations process. • Fire support planning. • Airspace planning and management. • Electromagnetic spectrum management. • Multinational integration. • Rehearsals.
Sustainment	Is the related tasks and systems that provide support and services to ensure freedom of action, extended operational reach, and prolong endurance.	<ul style="list-style-type: none"> • Military Deception • Information support operations • Cyberspace electromagnetic activities • Operations security
Protection	Is the related tasks and systems that preserve the force so the commander can apply maximum combat power to accomplish the mission.	<ul style="list-style-type: none"> • Logistics. • Financial management. • Personnel services. • Health service support.

Sources: Army Doctrine Publication 3-0, Operations, July 2019, Section 5-9, 5-11-5-19, 5-25. https://armypubs.army.mil/epubs/DR_pubs/DR_a/ARN18010-ADP_3-0-000-WEB-2.pdf; FM 3-13, *Information Operations*, iv; Army Techniques Publication (ATP) 3-13.1, *The Conduct of Information Operations* (Washington, DC: U.S. GPO, 4 October 2018), https://armypubs.army.mil/epubs/DR_pubs/DR_a/pdf/web/ARN13138_ATP%203-13xi%20FINAL%20Web%201.pdf.

DOTMLPF-P—this acronym represents a framework for incorporating new capabilities into armed forces. Introducing any new capability or technology in the armed force will require corresponding changes in Doctrine, Organization, Training, Materiel, Leadership, Personnel, Facilities, and likely Policy. Envisioning, planning, and executing these changes across the whole spectrum is necessary for successful adoption and institutionalization of that capability.

DOTMLPF-P Framework

Element	Definition
Doctrine	Fundamental principles that guide the employment of US military forces in coordinated action toward a common objective.
Organization	How US military forces are organized to accomplish missions, execute functions, and deliver, support, or sustain joint warfighting capabilities.
Training	How US military forces are trained to accomplish the full range of functions and missions.
Material	Capabilities required to overcome present and future challenges.
Leadership and Education	How US military leaders are prepared to lead the fight. I.e. professional development.
Personnel	Availability of qualified military or civilian individuals for missions, tasks, and activities in peacetime and wartime.
Facilities	Real property to be used to meet military objectives including command installations, and industrial facilities.
Policy	DoD, interagency, or international policy directing and assigning tasks, prescribing desired capabilities, and providing guidance.

Sources: Chairman of the Joint Chiefs of Staff Instruction, *Guidance for Developing and Implementing Joint Concepts*, August 2016, 3-a-3-h. https://www.jcs.mil/Portals/36/Documents/Doctrine/concepts/cjcsi_3010_02e.pdf?ver=2018-08-01-134826-593

Endnotes

- 1** Joshua Huminski, “The risks of learning the wrong lessons in Ukraine,” *Breaking Defense*, May 15, 2023, <https://breakingdefense.com/2023/05/the-risks-of-learning-the-wrong-lessons-in-ukraine/>; Sandor Fabian, “The Illusion of Conventional War: Europe Is Learning the Wrong Lessons from the Conflict in Ukraine,” *Modern War Institute*, April 23, 2024, <https://mwi.westpoint.edu/the-illusion-of-conventional-war-europe-is-learning-the-wrong-lessons-from-the-conflict-in-ukraine/>; William F. Owen, “False Lessons of Modern War,” *The British Army Review*, Autumn 2023, Issue #185, pp. 24-27, <https://chacr.org.uk/wp-content/uploads/2023/09/BAR-185-for-web.pdf>
- 2** Ibid
- 3** Pieter Garicano, Grace Mappes, and Frederick W. Kagan, “Positional Warfare in Alexander Svechin’s Strategy,” *ISW*, April 2024, https://www.understandingwar.org/sites/default/files/ISW%20Positional%20Warfare%20in%20Alexander%20Svechin%27s%20Strategy_4.30.24.pdf
- 4** Riley Bailey and Frederick W. Kagan, “How Delays in Western Aid Gave Russia the Initiative: From the Ukrainian Counteroffensive to Kharkiv,” *ISW*, May 22, 2024, <https://understandingwar.org/backgrounder/how-delays-western-aid-gave-russia-initiative-ukrainian-counteroffensive-kharkiv>
- 5** Riley Bailey et. Al., “Russian Offensive Campaign Assessment, July 10, 2024,” *ISW*, July 10, 2024, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-july-10-2024>
- 6** Riley Bailey et. Al., “Russian Offensive Campaign Assessment, June 27, 2024,” *ISW*, June 27, 2024, <https://understandingwar.org/backgrounder/russian-offensive-campaign-assessment-june-27-2024>
- 7** Mykola Bielieskov, “To defeat Putin in a long war, Ukraine must switch to active defense in 2024,” *Atlantic Council*, January 4, 2024, <https://www.atlanticcouncil.org/blogs/ukrainealert/paving-the-way-for-putins-defeat-ukraine-must-prioritize-defense-in-2024/>; Emma Ashford and Kelly A. Grieco, “How Ukraine Can Win Through Defense,” *Foreign Affairs*, January 10, 2024, <https://www.foreignaffairs.com/ukraine/how-ukraine-can-win-through-defense>
- 8** Riley Bailey et. Al., “Russian Offensive Campaign Assessment, June 30, 2024,” *ISW*, June 30, 2024, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-june-30-2024>
- 9** Riley Bailey et. Al., “Russian Offensive Campaign Assessment, June 30, 2024,” *ISW*, June 30, 2024, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-june-30-2024> Riley Bailey et. Al., “Russian Offensive Campaign Assessment, June 7, 2024,” *ISW*, June 7, 2024, <https://understandingwar.org/backgrounder/russian-offensive-campaign-assessment-june-7-2024>
- 10** Karolina Hird et. Al., “Russian Offensive Campaign Assessment, May 12, 2024,” *ISW*, May 12, 2024, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-may-12-2024>; Grace Mappes et. Al., “Russian Offensive Campaign Assessment, May 23, 2024,” *ISW*, May 23, 2024, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-may-23-2024>; Kateryna Stepanenko et. Al., “Russian Offensive Campaign Assessment, June 17, 2024,” *ISW*, June 17, 2024, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-june-17-2024>
- 11** Franz-Stefan Gady and Michael Kofman, “Making Attrition Work: A Viable Theory of Victory for Ukraine,” *International Institute for Strategic Studies*, <https://www.iiss.org/en/online-analysis/survival-online/2024/01/making-attrition-work-a-viable-theory-of-victory-for-ukraine/>; Seth G. Jones, Riley McCabe, and Alexander Palmer, “Ukrainian Innovation in a War of Attrition,” *Center for Strategic & International Studies*, February 27, 2023, <https://www.csis.org/analysis/ukrainian-innovation-war-attrition>
- 12** Michael Kofman, Rob Lee, and Dara Massicot, “Hold, Build, and Strike: A Vision for Rebuilding Ukraine’s Advantage in 2024,” *War on the Rocks*, January 26, 2024, <https://warontherocks.com/2024/01/hold-build-and-strike-a-vision-for-rebuilding-ukraines-advantage-in-2024/>
- 13** Kateryna Stepanenko et. Al., “Russian Offensive Campaign Assessment, May 20, 2023,” *ISW*, May 20, 2023, <https://isw.pub/UkrWar052023>; Kateryna Stepanenko et. Al., “Russian Offensive Campaign Assessment, May 21, 2023,” *ISW*, May 21, 2023, <https://isw.pub/UkrWar052123>; Riley Bailey et. Al., “Russian Offensive Campaign Assessment, May 26, 2023,” *ISW*, May 26, 2023, <https://isw.pub/UkrWar052623>
- 14** Karolina Hird et. Al., “Russian Offensive Campaign Assessment, June 6, 2023,” *ISW*, June 6, 2023, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-june-6-2023>

- 15** Riley Bailey et. Al., “Russian Offensive Campaign Assessment, July 22, 2023,” ISW, July 22, 2023, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-july-22-2023>; Riley Bailey et. Al., “Russian Offensive Campaign Assessment, August 5, 2023,” ISW, August 5, 2023 <https://understandingwar.org/backgrounder/russian-offensive-campaign-assessment-august-5-2023>; Kateryna Stepanenko et. Al., “Russian Offensive Campaign Assessment, July 9, 2023,” ISW, July 9, 2023, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-july-9-2023>
- 16** Daniel Mealie et. Al., “Ukraine’s Operations in Bakhmut Have Kept Russian Reserves Away from the South,” ISW, September 17, 2023, <https://www.understandingwar.org/backgrounder/ukraine%E2%80%99s-operations-bakhmut-have-kept-russian-reserves-away-south>
- 17** Ibid
- 18** Karolina Hird et. Al., “Russian Offensive Campaign Assessment, June 8, 2023,” ISW, June 8, 2023, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-june-8-2023>; Karolina Hird et. Al., “Russian Offensive Campaign Assessment, April 23, 2023” ISW, April 23, 2023, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-april-23-2023> ; Riley Bailey et. Al., “Russian Offensive Campaign Assessment, September 26, 2023,” ISW, September 26, 2023, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-september-26-2023>
- 19** Riley Bailey et. Al., “Russian Offensive Campaign Assessment, June 21, 2023,” ISW, June 21, 2023, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-june-21-2023>; George Barros et. Al., “Russian Offensive Campaign Assessment, October 26, 2023,” ISW, October 26, 2023, <https://understandingwar.org/backgrounder/russian-offensive-campaign-assessment-october-26>
- 20** <https://isw.pub/UkrWar060823>
- 21** David Axe, “Disastrous Armored Assaults Taught The Ukrainian Army To Flank Russian Defenses Instead,” *Forbes*, September 6, 2023, <https://www.forbes.com/sites/davidaxe/2023/09/06/disastrous-armored-assaults-taught-the-ukrainian-army-to-flank-russian-defenses-instead/?sh=3f6bc63a2fb1>; Washington Post Staff, “In Ukraine, a war of incremental gains as counteroffensive stalls,” *The Washington Post*, December 4, 2023, <https://www.washingtonpost.com/world/2023/12/04/ukraine-counteroffensive-stalled-russia-war-defenses/>
- 22** Kateryna Stepanenko et. Al., “Russian Offensive Campaign Assessment, July 1, 2023,” ISW, July 1, 2023, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-july-1-2023>
- 23** Riley Bailey et. Al., “Russian Offensive Campaign Assessment, August 26, 2023,” ISW, August 26, 2023, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-august-26-2023>; Riley Bailey et. Al., “Russian Offensive Campaign Assessment, September 3, 2023,” ISW, September 3, 2023, <https://isw.pub/UkrWar090323>; Riley Bailey et. Al., “Russian Offensive Campaign Assessment, September 18, 2023,” ISW, September 18, 2023, <https://isw.pub/UkrWar091823>
- 24** Karolina Hird et. Al., “Russian Offensive Campaign Assessment, June 15, 2023,” ISW, June 15, 2023, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-june-15-2023>; Thomas Withington, “Jamming JDAM: The Threat to US Munitions from Russian Electronic Warfare,” *The Royal United Services Institute*, June 6, 2023, <https://www.rusi.org/explore-our-research/publications/commentary/jamming-jdam-threat-us-munitions-russian-electronic-warfare>
- 25** Michael Kofman, Rob Lee, and Dara Massicot, “Hold, Build, and Strike: A Vision for Rebuilding Ukraine’s Advantage in 2024,” *War on the Rocks*, January 26, 2024, <https://warontherocks.com/2024/01/hold-build-and-strike-a-vision-for-rebuilding-ukraines-advantage-in-2024/>; Valerii Zaluzhnyi, Modern positional warfare and how to win in it, *The Economist*, November 1, 2023, https://infographics.economist.com/2023/ExternalContent/ZALUZHNYI_FULL_VERSION.pdf; Dr Jack Watling and Nick Reynolds, “Stormbreak: Fighting Through Russian Defences in Ukraine’s 2023 Offensive,” *Royal United Services Institute*, September 4, 2023, <https://www.rusi.org/explore-our-research/publications/special-resources/stormbreak-fighting-through-russian-defences-ukraines-2023-offensive>
- 26** Eric Schmitt, Julian E. Barnes, Helene Cooper and Thomas Gibbons-Neff, “Ukraine’s Forces and Firepower Are Misallocated, U.S. Officials Say,” *The New York Times*, August 22, 2023, <https://www.nytimes.com/2023/08/22/us/politics/ukraine-counteroffensive-russia-war.html>; Missy Ryan, Isabelle Khurshudyan and Michael Birnbaum “Ukraine aims to sap

- Russia's defenses, as U.S. urges a decisive breakthrough," *The Washington Post*, July 18, 2023, <https://www.washingtonpost.com/national-security/2023/07/18/ukraine-counter-offensive-weapons-tactics/>; Jim Sciutto, "Western allies receive increasingly 'sobering' updates on Ukraine's counteroffensive: 'This is the most difficult time of the war,'" *CNN*, August 8, 2023, <https://www.cnn.com/2023/08/08/politics/ukraine-counteroffensive-us-briefings/index.html>
- 27** Nataliya Bugayova, "Reframing the US policy debate on a 'long war' in Ukraine," *ISW*, Apr 27, 2023, <https://www.understandingwar.org/backgrounder/reframing-us-policy-debate-%E2%80%98long-war%E2%80%99-ukraine>; Nataliya Bugayova, "Ukraine's Sustained Counteroffensive: Denying Russia's Prolongation of the War," *ISW*, July 24, 2023, <https://www.understandingwar.org/backgrounder/ukraine%E2%80%99s-sustained-counteroffensive-denying-russia%E2%80%99s-prolongation-war>; Nataliya Bugayova, "It's Time for the West to Embrace Ukraine's Way of War, Not Doubt It," *ISW*, September 25, 2023, <https://www.understandingwar.org/backgrounder/it%E2%80%99s-time-west-embrace-ukraine%E2%80%99s-way-war-not-doubt-it>; Frederick W. Kagan, Karolina Hird and Kateryna Stepanenko, "How the Ukraine Counteroffensive Can Still Succeed," *TIME*, August 3, 2023, <https://time.com/6300772/ukraine-counteroffensive-can-still-succeed/>
- 28** Washington Post Staff, "Miscalculations, divisions marked offensive planning by U.S., Ukraine," *The Washington Post*, December 4, 2023, <https://www.washingtonpost.com/world/2023/12/04/ukraine-counteroffensive-us-planning-russia-war/>
- 29** Riley Bailey et. Al., "Russian Offensive Campaign Assessment, April 20, 2024," *ISW*, April 20, 2024, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-april-20-2024>
- 30** Daniel Mealie, George Barros, and Frederick W. Kagan, "Ukraine's Operations in Bakhmut Have Kept Russian Reserves Away from the South," *ISW*, September 17, 2023, <https://www.understandingwar.org/backgrounder/ukraine%E2%80%99s-operations-bakhmut-have-kept-russian-reserves-away-south>
- 31** Lester W. Grau and Charles K. Bartles, "The Russian Reconnaissance Fire Complex Comes of Age," *Changing Character of War Centre, Pembroke College, University of Oxford With Axel and Margaret Ax:son Johnson Foundation*, May 2018, [The+Russian+Reconnaissance+Fire+Complex+Comes+of+Age.pdf](https://www.squarespace.com/The+Russian+Reconnaissance+Fire+Complex+Comes+of+Age.pdf) ([squarespace.com](https://www.squarespace.com))
- 32** Ibid
- 33** Ibid
- 34** Riley Bailey et. Al., "Russian Offensive Campaign Assessment, February 24, 2024," *ISW*, February 24, 2024, <https://understandingwar.org/backgrounder/russian-offensive-campaign-assessment-february-24-2024>
- 35** Mason Clark, "The Russian military's lessons learned in Syria," *ISW*, January 2021, <https://www.understandingwar.org/report/russian-military%E2%80%99s-lessons-learned-syria>
- 36** Jack Watling and Nick Reynolds, "Stormbreak: Fighting Through Russian Defences in Ukraine's 2023 Offensive," *Royal United Services Institute*, September 4, 2023, https://static.rusi.org/Stormbreak-Special-Report-web-final_o.pdf; Mykhaylo Zabrodskyi, Jack Watling, Oleksandr V. Danylyuk and Nick Reynolds, "Preliminary Lessons in Conventional Warfighting from Russia's Invasion of Ukraine: February–July 2022," *Royal United Services institute*, November 30, 2023, <https://rusi.org/explore-our-research/publications/special-resources/preliminary-lessons-conventional-warfighting-russias-invasion-ukraine-february-july-2022>; Jack Watling and Nick Reynolds, "Meatgrinder: Russian Tactics in the Second Year of Its Invasion of Ukraine," *Royal United Services Institute*, May 19, 2023, <https://static.rusi.org/403-SR-Russian-Tactics-web-final.pdf>
- 37** https://t.me/dva_majors/34635; https://t.me/dva_majors/28830; https://nvo dot ng.ru/armament/2024-01-18/7_1269_problem.html; Grace Mappes et. Al., "Russian Offensive Campaign Assessment, May 18, 2023," *ISW*, May 18, 2023, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-may-18-2023>; Riley Bailey et. Al., "Russian Offensive Campaign Assessment, November 29, 2023," *ISW*, November 29, 2023, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-november-29-2023>
- 38** Zachary Kallenborn, "InfoSwarms: Drone Swarms and Information Warfare," *The US Army War College Quarterly: Parameters*, May 18, 2022, <https://press.armywarcollege.edu/parameters/vol52/iss2/13/>; Jonathan B. Bell, "Countering Swarms: Strategic Considerations and Opportunities in Drone Warfare," *National Defense University Press*, October 24, 2022, <https://ndupress.ndu.edu/Media/News/News-Article-View/Article/3197193/countering-swarms-strategic-considerations-and-opportunities-in-drone-warfare/>
- 39** Many thanks to Matthew Creedican, CEO of Low Cost Disruptive Machines (LCDM), former Navy SEAL and unmanned systems expert, feedback to the authors, March 2024, for "low altitude air superiority" and "air superiority"

- under 30,000 feet.” See also discussions of the air littoral in Ukraine, for example, Maximillian K. Bremer and Kelly A. Grieco, “Air denial: The dangerous illusion of decisive air superiority,” in *Airpower after Ukraine*, Atlantic Council, August 30, 2022, <https://www.atlanticcouncil.org/content-series/airpower-after-ukraine/air-denial-the-dangerous-illusion-of-decisive-air-superiority/>
- 40** Professor Justin Bronk and Dr Jack Watling, “Mass Precision Strike: Designing UAV Complexes for Land Forces,” *Royal United Services Institute*, April 11, 2024, <https://www.rusi.org/explore-our-research/publications/occasional-papers/mass-precision-strike-designing-uav-complexes-land-forces>
- 41** ADP 3-0, 2019
- 42** Karolina Hird et. Al., “Russian Offensive Campaign Assessment, June 8, 2023,” *ISW*, June 8, 2023, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-june-8-2023>; Riley Bailey et. Al., “Russian Offensive Campaign Assessment, September 8, 2023,” *ISW*, September 8, 2023, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-september-8-2023>
- 43** Thibault Spirlet, “Ukraine special forces say they helped destroy a Russian weapons system that was blocking satellite comms,” *Business Insider*, January 8, 2024, <https://www.businessinsider.com/ukraine-special-forces-claim-destroyed-russia-tirada2-electronic-warfare-system-2024-1#:~:text=Ukraine%20has%20previously%20targeted%20Russia's,of%20the%20special%2Doperations%20forces.> ; Clare Sebastian, “Ukraine makes new push to defeat Russia’s electronic warfare,” *CNN*, November 29, 2023, <https://www.cnn.com/2023/11/29/europe/ukraine-russia-electronic-warfare-intl-cmd/index.html>
- 44** Gen. David Allvin and Ryan Evans, “A conversation with Gen. David Allvin, Chief of Staff of the Air Force,” *War on the Rocks*, January 22, 2024, <https://warontherocks.com/2024/01/a-conversation-with-gen-david-allvin-chief-of-staff-of-the-air-force/>; Jake Epstein, “Air Superiority May Only Be Possible in Short Bursts: Top US Air Force Officer,” *Business Insider*, January 24, 2024, <https://www.businessinsider.com/air-superiority-only-possible-short-bursts-us-air-force-officer-2024-1>.
- 45** Charles Bartles and Lester W. Grau, “The Russian Way of War: Force Structure, Tactics, and Modernization of the Russian Ground Forces,” *Army University Press*, 2016, <https://www.armyupress.army.mil/Portals/7/Hot%20Spots/Documents/Russia/2017-07-The-Russian-Way-of-War-Grau-Bartles.pdf> Chapter 4: The Offence; David Glantz, *Soviet Military Operational Art: In Pursuit of Deep Battle*.
- 46** Demilitarization of Crimea to continue according to plan, Ukrinform, November 11, 2023, <https://www.ukrinform.net/rubric-ato/3785630-demilitarization-of-crimea-to-continue-according-to-plan-defense-in-tel-spox.html>; Nicole Wolkov, Daniel Mealie, and Kateryna Stepanenko, “Ukrainian Strikes Have Changed Russian Naval Operations in the Black Sea,” *ISW*, December 16, 2023, <https://www.understandingwar.org/backgrounder/ukrainian-strikes-have-changed-russian-naval-operations-black-sea>; Nicole Wolkov and Mason Clark, “Russian Offensive Campaign Assessment, Special Edition: Ukraine’s Strike Campaign Against Crimea,” *ISW*, October 8, 2023, <https://www.understandingwar.org/backgrounder/special-edition-campaign-assessment-ukraine%E2%80%99s-strike-campaign-against-crimea>
- 47** Michelle Nichols and Guy Faulconbridge, “Black Sea grain deal expires after Russia quits,” *Reuters*, July 17, 2023, <https://www.reuters.com/world/europe/black-sea-grain-deal-expire-monday-if-russia-quits-2023-07-17/>; Patrick Wintour, “What was the Black Sea grain deal and why did it collapse?,” *The Guardian*, July 20, 2023, <https://www.theguardian.com/world/2023/jul/20/what-was-the-black-sea-grain-deal-and-why-did-it-collapse>
- 48** Nicole Wolkov et. Al., “Russian Offensive Campaign Assessment, September 21, 2023,” *ISW*, September 21, 2023, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-september-21-2023>; Nicole Wolkov et. Al., “Ukrainian Strikes Have Changed Russian Naval Operations in the Black Sea,” *ISW*, December 16, 2023, <https://www.understandingwar.org/backgrounder/ukrainian-strikes-have-changed-russian-naval-operations-black-sea>; Nicole Wolkov and Mason Clark, “Russian Offensive Campaign Assessment, Special Edition: Ukraine’s Strike Campaign Against Crimea,” *ISW*, October 8, 2023, <https://www.understandingwar.org/backgrounder/special-edition-campaign-assessment-ukraine%E2%80%99s-strike-campaign-against-crimea>
- 49** Nicole Wolkov and Mason Clark, “Russian Offensive Campaign Assessment, Special Edition: Ukraine’s Strike Campaign Against Crimea,” *ISW*, October 8, 2023, <https://www.understandingwar.org/backgrounder/special-edition-campaign-assessment-ukraine%E2%80%99s-strike-campaign-against-crimea>; Kateryna Stepanenko et. Al., “Russian Offensive Campaign Assessment, May 21, 2023,” <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-may-21-2023> ; Angelica Evans et. Al., “Russian Offensive Campaign Assessment, October 18, 2023,” *ISW*, October 18, 2023,

<https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-october-18-2023>

- 50 George Barros et. Al., “Russian Offensive Campaign Assessment, January 2, 2023,” ISW, January 2, 2023, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-january-2-2023>; Riley Bailey et. Al., “Russian Offensive Campaign Assessment, June 14, 2023,” ISW, June 14, 2023, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-june-14-2023>; Riley Bailey et. Al., “Russian Offensive Campaign Assessment, June 14, 2023,” ISW, June 14, 2023; Kateryna Stepanenko et. Al., “Russian Offensive Campaign Assessment, November 2, 2023,” ISW, November 2, 2023, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-november-2-2023>
- 51 Grace Mappes et. Al., “Russian Offensive Campaign Assessment, February 17,” ISW, February 17, 2023 2024, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-february-17-2024>.
- 52 US Army Maneuver Center of Excellence, ATP 3-21.8, Appendix H - Breaching Fundamentals (army.mil)
- 53 James W. DeLony, “Tactical Mobility and the In-Stride Obstacle Breach: Impossible, Probable, Futuristic?” *School of Advanced Military Studies, United States Army Command and General Staff College*, Fort Leavenworth Kansas, 1988.
- 54 David Glantz, *From the Don to the Dnepr: Soviet Offensive Operations December 1942 – August 1943*, describes the fascinating series of Soviet operational maneuvers following the completion of the encirclement of German forces at Stalingrad. Glantz narrates the progress of Soviet experiments with different balances between penetration and exploitation forces, the optimal approach to conducting exploitation maneuvers, and, most interestingly, the challenge of determining how far to set the objectives of the exploitation. Glantz observes of the first post-Stalingrad attack, Operation Little Saturn, (p. 80) that “Subsequent Soviet analysis of the operation indicated that the mobile corps were assigned unrealistically distant objectives and were expected to achieve inordinately high rates of advance...” The Soviets applied those lessons to future operations from which they also continued to learn and adapt.

