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Emergent Approaches to Combined Arms Manoeuvre in Ukraine

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Introduction

Since the start of Russia's full-scale invasion of Ukraine, there has been a debate as to the usefulness of various platforms on the contemporary battlefield and the implications of new technology for established concepts of combined arms manoeuvre.¹ There have also been extensive descriptions of how Russian and Ukrainian forces have adapted to these challenges.² It is not self-evident, however, that NATO forces – preparing their first echelon to fight a reclamation battle against Russia in 2028 – should adopt the practices of Ukrainian units which are optimising their third or fourth echelon to attrit Russian forces as part of an area defence in 2025.

This paper presents the conclusions of forces in Ukraine that are developing and experimenting with approaches to conducting combined arms manoeuvre under modern conditions. The paper is not an attempt to describe how most units are operating, other than highlighting the pressures that forces must manage in modern operations. Instead, it explores the concepts of operation being developed and successfully employed by a subset of units that have had disproportionate success. Because of the function they serve, these units are analogous to NATO battlegroups. The paper describes how these Ukrainian units combine the tools of modern war, and endeavours to highlight the specific utility of different capabilities and their complementarity.

The emerging concept presented in this paper envisages a contact battle within a demarcated geographic area bounded by open terrain. Beyond the contact battle area, Ukrainian forces describe a middle battle area from which enemy supporting fires and enablers operate, and a deep battle area where forces out of contact can assemble and be resupplied. Ukrainian forces work to survey the middle battle area while countering enemy sensor coverage of the contact battle area, before isolating the targeted sector from resupply and support. In turn, they systematically degrade the enemy's capabilities within the contact battle area, fix its elements, suppress the enemy and

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1. Phillips Payson O'Brien, 'War will Never be This Bulky Again', *The Atlantic*, 26 May 2022, <<https://www.theatlantic.com/ideas/archive/2022/05/ukraine-russia-putin-war/638423/>>, accessed 7 September 2025; Kevin D Admiral and Nicholas Drake, 'Steel in the Storm: Recent Wars as Guides for Armor Transformation', *War on the Rocks* blog, 21 July 2025, <<https://warontherocks.com/2025/07/steel-in-the-storm-recent-wars-as-guides-for-armor-transformation/>>, accessed 7 September 2025; Amos C Fox, 'Manoeuvre is Dead? Understanding the Conditions and Components of Warfighting', *RUSI Journal* (Vol. 166, No. 6–7, 2021), pp. 10–18.
 2. Franz-Stefan Gady, 'The Air Battle That Could Decide the Russia-Ukraine War', *Foreign Policy*, 23 July 2025, <<https://foreignpolicy.com/2025/07/23/ukraine-war-drone-air-battle-russia-technology-tactics/>>, accessed 7 September 2025; Jack Watling and Nick Reynolds, 'Tactical Developments During the Third Year of the Russo-Ukrainian War', *RUSI*, February 2025, <<https://www.rusi.org/explore-our-research/publications/special-resources/tactical-developments-during-third-year-russo-ukrainian-war>>, accessed 7 September 2025; *The Economist*, 'Russia's Summer Ukraine Offensive Looks Like its Deadliest So Far', 9 July 2025, <<https://www.economist.com/interactive/graphic-detail/2025/07/09/russias-summer-ukraine-offensive-looks-like-its-deadliest-so-far>>, accessed 7 September 2025.

close and clear the ground, before consolidating and maintaining overwatch over the open terrain bounding the contact battle area.

This paper is based on routine engagements with brigades holding the line of contact, and observations of the tactics, training and operations of three Ukrainian assault regiments/battalions (in the process of transition at the time of writing) that have taken different approaches to their tasks, two dedicated UAV regiments, and two non-standard brigades of the Armed Forces of Ukraine (AFU) that are pioneering the use of novel equipment. The research included interactions with personnel at platoon, company, battalion, regiment, brigade and operational levels, and interactions with associated offices for innovation and testing within the Ukrainian Ministry of Defence. Owing to the sensitivity of current and future operations, the names of the units involved have been omitted, as have specific numbers relating to the planning assumptions for the equipment needed.

The first part of the paper discusses which aspects of the emergent operating environment pose a challenge to how armies have practised combined arms manoeuvre over recent years. This includes a description of how Russian and Ukrainian forces have transformed in response to these challenges. The second part discusses the emergent concept of combined arms manoeuvre among Ukraine's higher-performing units. The third focuses on the utility and role of specific arms within this concept.

Challenges to Combined Arms Manoeuvre

The current concept of combined arms manoeuvre emphasises the concentration of armour, infantry and artillery at a point in time, surprising the enemy and thus fracturing their cohesion and enabling their defeat in detail. This was the concept of operation that Ukraine planned and trained (pictured in Figure 1) to carry out in its 2023 offensive. Combined arms manoeuvre can be [enemy-centric](#), placing the enemy in a position where they will suffer disproportionate losses if they continue to fight, or terrain-centric, whereby movement and fires undermine the enemy's ability to hold key terrain (usually framed as ['positional warfare'](#)). It is often held in contrast to attritional warfare,³ although this is unhelpful since all warfare is attritional. Instead, the appropriate question is how a force can, by using a combination of tools, maximise the enemy's relative losses.

3. Amos Fox, 'Setting the Record Straight on Attrition', *War on the Rocks* blog, 30 January 2024, <<https://warontherocks.com/2024/01/setting-the-record-straight-on-attrition/>>, accessed 7 September 2025; Amos C Fox, 'On Attrition: An Ontology for Warfare', *Military Review* (Vol. 104, No. 5, 2024).

Figure 1: Ukrainian Troops Train to Conduct a Combined Arms Obstacle Breach, Ukraine, March 2023



Source: The author, Ukraine, March 2023.

Several challenges to the established approach to combined arms manoeuvre have emerged in Ukraine. First, pervasive networks and sensors have made the ability to achieve surprise difficult: a phenomenon described as ‘[battlefield transparency](#)’. UAVs are, of course, the most evident example. In addition, widespread access to space-based communications and digital tools to process and analyse returns from dispersed electronic, acoustic and other sensors allows the enemy to see and anticipate tactical actions. It is difficult to manoeuvre a combat grouping into a position where the enemy lacks key tools to counter the force, since they too can redeploy dynamically in response to the threat. A pertinent example is how Ukrainian forces routinely deploy mines on anticipated axes of attack as the enemy is assembling.⁴

The second challenge, enabled by the first, is that the ubiquity of precision fires at all echelons makes concentrated forces vulnerable to rapid attrition. Moreover, because complex weapons enable combatants to engage moving targets at range, a force that begins with combined arms rapidly loses critical elements of the combination because the enemy can target individual elements over a significant distance. For example, engineering equipment which is critical to breaching risks being damaged or destroyed

4. Author interviews with brigade operations staffs planning intelligence-led distant mining operations, Pokrovsk direction, January 2025.

before it even approaches the line of contact.⁵ In addition, because non-line of sight weapons are ubiquitous, concentrating forces in one sector does not necessarily prevent troops in adjoining sectors from applying their fires across unit boundaries. As a result of these factors, a concentrated force may engage an isolated enemy, but instead meets an enemy which can [match a concentration of force with a concentration of effect](#).

Third, the combination of the first two challenges means that a force, once committed, will remain in contact throughout its operational depth. The close fight necessarily involves a higher rate of materiel consumption, and maintaining progress depends on resupply. For the defender, however, it is often easier to target resupplying elements than to target the forces in contact, and so defenders systematically target ground lines of communication behind the contact battle area. The result is that manoeuvre forces outstrip the rate at which they can be supplied and therefore lose momentum. This prevents an exploitation phase from developing and allows the enemy time to reset their defences rather than lose cohesion, thereby preventing the defender's defeat in detail.

The impact of these dynamics is visible as of August 2025 in how Russia and Ukraine are conducting operations along much of the front. Both sides are adapting their operations in response to the failure of extant concepts. Russian forces are increasingly using their UAVs to systematically identify Ukrainian electronic warfare (EW) positions, radar, command posts, UAV pilots, artillery and hardened fighting positions. Russian forces thereafter deliberately target these with fires integrating strikes with artillery, multiple launch rocket systems (MLRS), powered bombs such as Molniya, fibre-optically guided first-person view (FPV) drones, and glide bombs. Russia's systematic targeting of the Ukrainian UAV enterprise aims to push Ukrainian UAV operators further from the forward line of own troops (FLOT) and thus reduce their range and the density of ISR orbits to create conditions for successful attacks. Russian EW and air defence units meanwhile work to both destroy Ukrainian ISR capabilities and protect the force from attack, so that Russian supplies and personnel can be moved forwards.⁶

During the preparatory fires described above, Russian units endeavour to infiltrate personnel close to Ukrainian positions. Russian soldiers usually infiltrate in groups of two to five Russian personnel, using thermal sheeting or tents that they hold away from their bodies with handles. The soldiers hang a radio around their necks and a torch between their legs to see their feet. The command post directs them, tracking their movement by UAV, to guide them to the position where they are expected to nest.

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5. Author review of data gathered by Armed Forces of Ukraine (AFU) General Staff Lessons department on breaching attempts, Ukraine, January 2025.
 6. Author observations of data at brigade level of patterns in Russian emissions and fires over several months, reviewed with brigade plans staff, Ukraine, August 2025.

Soldiers carry several days of supplies with them and may – depending on the conditions – be resupplied by UAV.⁷ This process of infiltration serves several functions. First, it acts as a means of reconnoitring Ukrainian positions and testing their strength. Second, it builds up a body of forces near Ukrainian positions that can disrupt their resupply and ability to provide mutual support. Third, it draws significant Ukrainian ISR efforts into scouring the area in front of their lines, allowing for Ukrainian pilots and equipment to be located and attacked. When conditions are considered propitious – once Ukrainian ISR has been degraded, their lines have been infiltrated and there is bad weather, giving greater freedom of manoeuvre – Russia sends groups on buggies, bikes and sometimes armoured vehicles to rapidly advance along the seams of Ukrainian units. These groups endeavour to go firm in protective terrain and then use fires to prevent counterattack. Axes are prioritised, which over time allow Russia to move its fires forwards, so that they can cover resupply routes to neighbouring Ukrainian units, forcing withdrawal of the Ukrainian line.⁸

The Russian approach to offensive action is becoming increasingly effective at inflicting casualties on Ukrainian forces, but it nevertheless remains inefficient. Russia's inability to support infantry – and indeed lack of interest in doing so – means that Russia fails to exploit the conditions it creates and thereby systemically underperforms its military potential relative to the means it applies on any given axis. Despite significant improvement in the application of fires and command and control (C2), Russia has maladapted during the conflict. Russia has become increasingly dependent on infantry to make progress, while it systematically degrades its infantry through under-training and a casual disregard for the life of its personnel, limiting the accumulation of experience and camaraderie within units.

Ukraine's response to the fragmentation of combined arms may be characterised as a ruthless prioritisation of means, driven by necessity. Following the [failure of its 2023 offensive operations](#), Ukraine moved onto a protracted defensive posture. The pressure on its force – considering the length of the front – and Russia's ongoing recruitment advantage meant that most units were fixed on the line, with a limited ability to rotate troops and hence train replacements or integrate new personnel. Furthermore, [political developments in Washington](#) interrupted the provision of military-technical assistance, disrupting Ukraine's ability to coherently plan the equipping of its forces with its international partners. As a result, Ukraine doubled down on a method which delivered results and was under its control: drones.

Ukrainian investment in UAVs and its use of them expanded immensely over the course of 2024. Ukraine put various bomber UAVs, FPV drones, loitering munitions and longer-range flying bombs into mass production. It next introduced uncrewed ground systems, which it increasingly used for logistics and resupply. In combination with

7. Author review of footage of Russian combat groups infiltrating positions, Ukraine, June and August 2025.

8. Author interviews with brigade staffs, Ukraine, August 2025.

massive efforts to expand the training of UAV pilots and roll out infrastructure on the front to maintain C2, Ukraine moved from building an ‘army of drones’ to fielding a ‘wall of drones’. It has imposed an attrition belt of approximately 30 km on the frontline, where it can systematically target Russian forces.

Ukraine’s use of UAVs has been effective. However, Ukrainian forces have leant on their advantages in UAV operations to compensate for the [growing shortage of other military systems](#), and most problematically, for the shortfalls in Ukrainian recruitment that have left its defences weakened – thereby enabling Russia’s infiltration tactics. And as Ukraine has narrowed the tools with which it operates, the operational problem for the Russians has been simplified. Russia has responded to Ukraine’s adaptations by mirroring Ukrainian UAV tactics, thereby reducing the advantage Ukraine derives from its UAVs. As a senior Ukrainian UAV officer noted in an interview, ‘their task is easier than ours because they set out to kill while we must kill and save our people’.⁹ Still, Ukraine has been aided by the fact that the onus is on Russian forces to overcome the wall of drones, because it is Russia that is on the offensive. Fortunately for Ukraine, Russia has not remedied the decline in its force quality – despite having the resources to do so – and has therefore not taken advantage of the increasing brittleness of Ukraine’s defence. Some Ukrainian commanders recognised the need to reform recruitment, training and the employment of the wider orchestra of war, and are now working to see whether Ukraine can once again build an advantage across a wider range of military tools.

In summary, Russia has largely failed to develop a concept of combined arms manoeuvre to overcome the tactical problems it faces, despite having the resources to do so. Ukraine has struggled to marshal the resources needed to buy the time and space to experiment, but as outlined in the next section, some parts of the AFU have begun to develop new concepts of operation that show promise.

Emergent Concepts in Combined Arms Manoeuvre in Ukraine

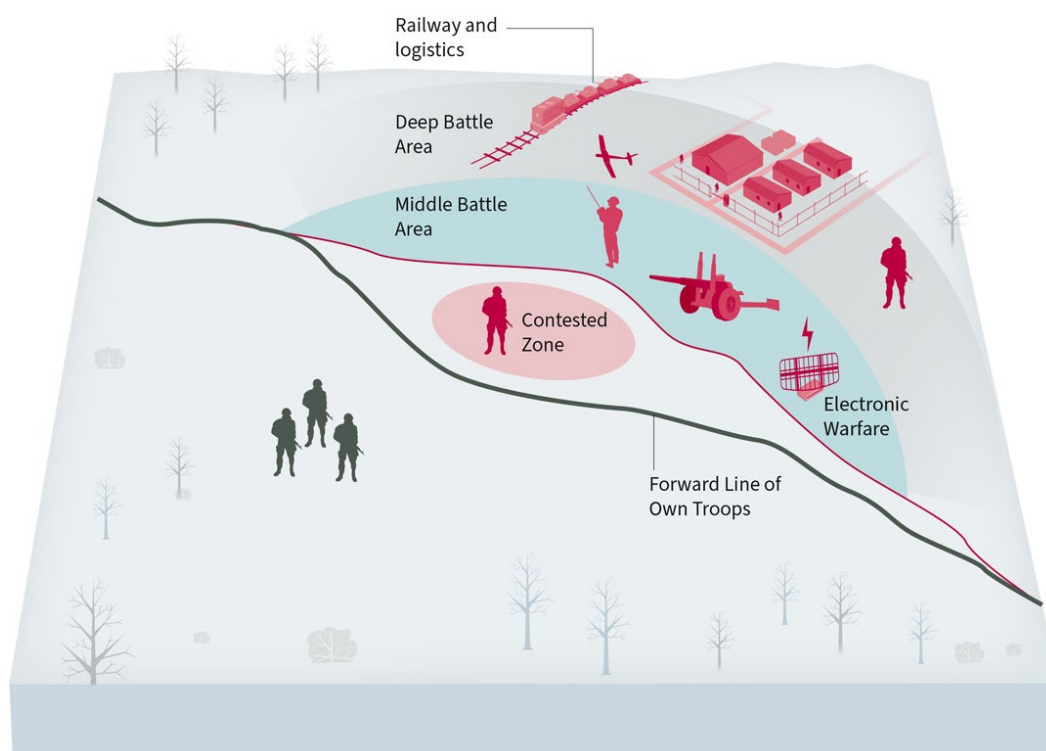
This section explores how some Ukrainian units are developing new concepts of operation to reclaim offensive manoeuvre as a viable course of action. This section focuses on describing how some Ukrainian commanders conceive of offensive action at the battalion level.

First, concerning battlefield geometry, Ukrainian officers have begun to adjust their conception of the battlefield. Instead of the close, deep and rear, delineated by the [depth of forces from the FLOT](#), Ukrainian planners now speak of a ‘contested zone’ or

9. Author interview with regimental chief of staff of an uncrewed systems regiment, Ukraine, August 2025.

‘grey zone’, which is usually bounded by open ground, where troops are exposed and within which forces are in contact. For troops to continue to contest this zone, they must be resupplied, and thus open areas across which resupply is difficult – such as rivers or open roads – often become markers of depth. Beyond the contested zone, Ukrainian commanders speak of the ‘middle battle area’, which they define as the area from which enemy systems can affect the contested zone. If the contested zone is usually 15 km across, the middle battle area extends up to approximately 30 km beyond the boundary of the contested zone, and it is from where enemy UAV orbits and artillery systems strike. Then, there is the ‘deep’, which Ukrainian commanders frame as the area where enemy reserves, logistics hubs, industrial targets or systems that cannot affect the contested zone but may do so in the future are situated.¹⁰ This new approach to battlefield geometry is illustrated in Figure 2.

Figure 2: Ukrainian Battlefield Geometry



Source: The author. Graphic design: Alex Whitworth Art & Design.

Ukrainian commanders have divided their operations to seize a contested sector into approximately seven phases, usually spanning five to 10 days of operations. This practice does not constitute doctrine but is rather a synthesis of how multiple officers described their approach to the author, although their exact language varied. To seize a contested sector, the force must survey it, isolate it, degrade the enemy, fix their forces,

10. Author discussions with regimental, battalion and brigade staffs on battlefield geometry, Ukraine, January and August 2025.

suppress them, close and destroy them, and then consolidate control of the sector. These phases are described below.

Phase 1: Survey

To successfully attack a contested sector, it is necessary to conduct detailed reconnaissance of the enemy systems protecting it in the middle battle area. Critical targets to identify include the routes by which the enemy conducts resupply and rotation, gun positions, air defence positions, UAV launch points and pilots, and EW equipment. Much of this information can be gathered using electronic intelligence and by examining historical counterbattery data for the area. Remaining questions must be answered through deliberate reconnaissance, while general detections of enemy activity must be refined to specific points. In Ukraine, this detailed reconnaissance work is generally conducted using UAVs, but to be effective, it is necessary to first carry out a battle against enemy reconnaissance, in case the enemy shoots down the UAVs conducting the survey and kills their operators. The survey phase therefore comprises the systematic attrition of enemy reconnaissance over the contested zone, saturation attacks to suppress enemy air defence systems, and then extensive reconnaissance orbits in the middle battle area.¹¹

Phase 2: Isolate

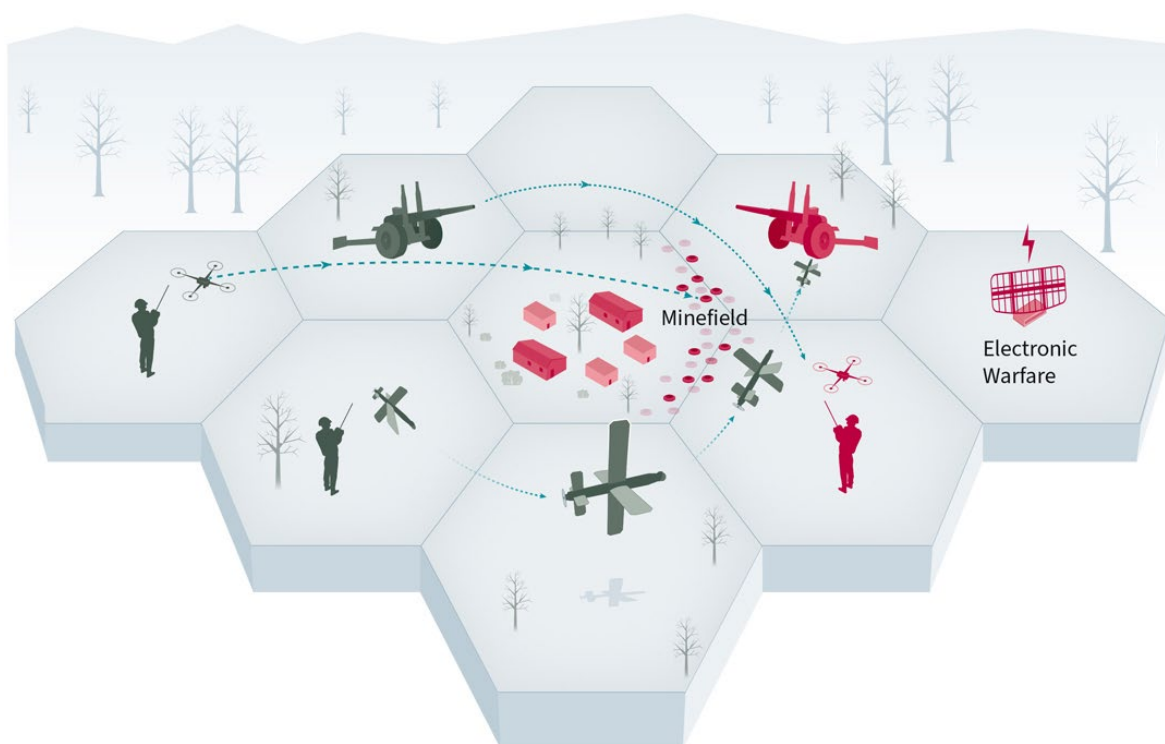
The isolation of the target sector involves two elements. The first is the conduct of ‘middle-strike’ operations to knock out key support systems. The counter-reconnaissance activity associated with the survey phase should have created conditions for artillery to be moved into firing positions. Middle strike can be divided into actions against two types of targets: soft and hard. Soft targets are often most efficiently destroyed by UAVs, since the object is vulnerable to fragmentation. Alternatively, 8–10 rounds from artillery are generally considered sufficient to assure destruction of such targets. However, UAVs generally lack munitions with enough kinetic energy or explosive to reliably destroy hard targets, which may include heavily protected sites (such as EW positions) or hardened sites such as dug-in UAV pilots. It is not that a UAV cannot be made to carry such a payload, but rather that its increasing cost and size makes the likelihood of interception high. By contrast, laser-designated artillery rounds have the necessary payload, energy and latency and are invulnerable to jamming, making them invaluable for this role.¹²

The second element of the isolation phase is to sever the targeted sector from resupply and rotation. Ukrainian forces achieve this by using UAVs to place anti-personnel and

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11. Author interviews with and observations of Ukrainian battalion and regimental commanders during operational planning for offensive action, and author discussions with plans staffs, Ukraine, August 2025.
 12. Author interviews with UAV operational planners and fires officers, and observations of fires headquarters, August 2025.

anti-vehicle mines, along with caltrops, along the routes to and from the sector. Roads are cratered with time-delayed fuze munitions. This is largely done using bomber UAVs. This is then followed up with persistent interdiction missions by FPVs, to prevent attempts to move equipment on foot or on light buggies. The isolation of the sector from both fire support in the middle battle area and from resupply/rotation sets the conditions for the absolute reduction of enemy forces among the defenders, as losses can no longer be replaced. To achieve such conditions, it is not necessary to interdict all movement into the sector, but simply to place the enemy in a position where successful rotation consumes as much as or more resource than it replenishes.¹³

Figure 3: Phase 2: Isolate



Source: The author. Graphic design: Alex Whitworth Art & Design.

Phase 3: Degrade

Once isolation has created the conditions for attrition of defensive positions, it becomes possible to focus targeting on enemy fighting positions inside the contested sector. During the previous phases, greater ISR attention on the contested sector should have allowed for the mapping of movement of enemy personnel and thus the building up of a heat-map of detections. This provides the basis for more detailed reconnaissance, to find command posts, emplaced weapons systems, ammunition

13. Author interviews with battalion and regimental plans officers, observation of the planning process, and observation of the preparation of munitions for the execution of this phase of operations, Ukraine, August 2025.

storage points and fighting positions. These targets can then be marked for strike. Ukrainian forces tend to prosecute these strikes with FPVs and bombers. Where the enemy has dug positions with overhead protection, Ukrainian forces use explosively formed projectiles, delayed impact fuzed penetrators, and incendiaries.

■ Phase 4: Fix

The first three phases will have lasted 24–48 hours each. The next three phases are initiated when conditions are propitious and take place in rapid succession. ‘Fixing’ the enemy is usually carried out by Ukrainian forces using FPV drones. Many of these FPVs will not have targets, but their persistent presence should prevent the enemy from redeploying and thus managing its losses during the degradation phase. In essence, the fixing phase freezes the defence so that information gathered about the enemy earlier in the operation remains extant during the assault.

■ Phase 5: Suppress

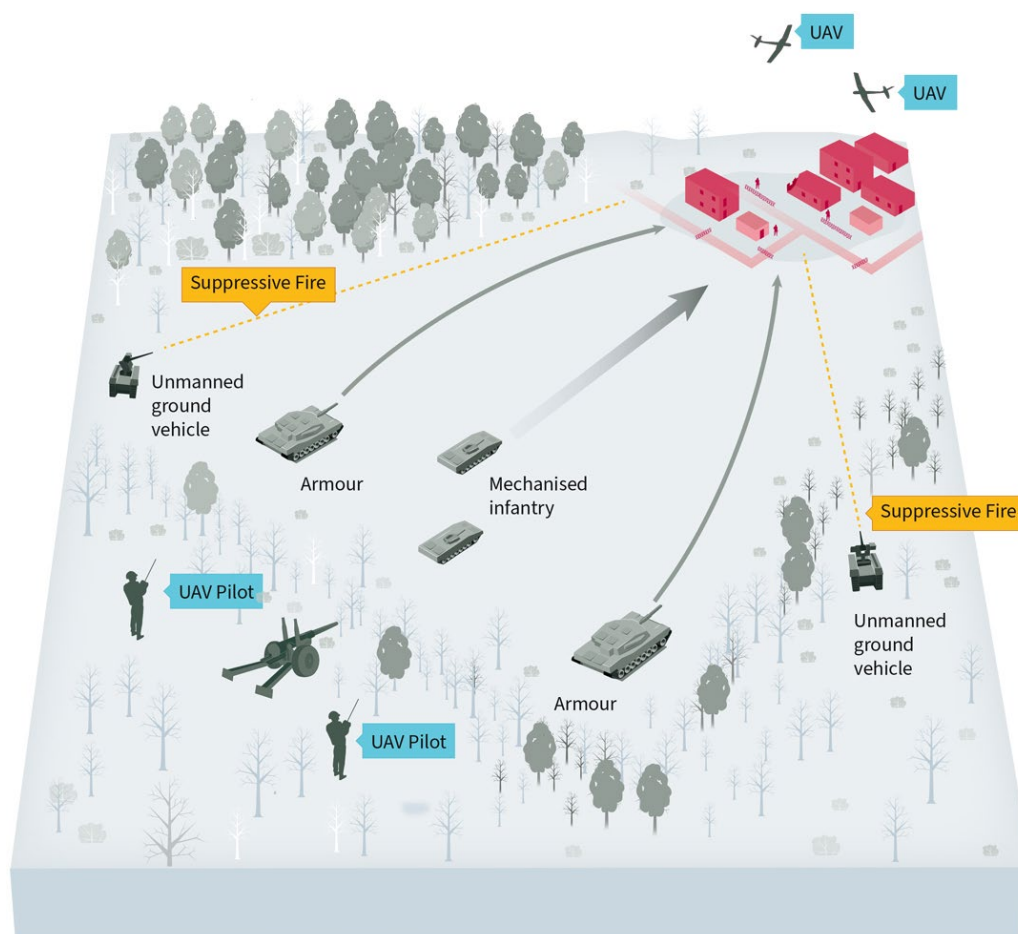
While the enemy is fixed, the attacking forces should infiltrate support weapons to give them line of sight to the enemy positions. Ukrainian forces have concluded that this is ideally done with weapons mounted on uncrewed ground vehicles (UGVs), as their sustained fire, delivered from outside prepared fighting positions, makes them vulnerable to strike. These systems should set up offset from the intended axis of attack so that they can continue to fire as friendly forces close with the enemy. They should not fire until the assault force is ready to attack.

The suppression phase should also draw on EW and conventional artillery, especially rocket artillery. Supersonic rockets are advantageous because the enemy does not hear them coming and so once the enemy knows they are present, they create a long-lasting psychological effect. The use of aggressive EW is also critical before and during the commitment of assault forces, to minimise the threat from UAVs and to add latency to enemy targeting. This use of EW, however, makes the efficient use of FPVs and other UAVs difficult because it interferes with their C2 frequencies. Unguided artillery therefore becomes disproportionately useful during this phase. UAVs should instead be used to suppress enemy fires in the middle battle area. Conventional artillery is also effective, because the larger payloads delivered can collapse fighting positions. Assault action is usually initiated during the period of thermal crossover (which degrades contrast in thermal imaging, which in turn degrades UAV performance, among other things) and if possible during bad weather, when the performance of both ISR and strike UAVs is degraded, but the effectiveness of conventional artillery against preregistered fighting positions is not.

Phase 6: Close and Destroy

While the enemy is being suppressed, it becomes possible for assault forces to be committed to deliberately clear enemy positions. This is best done supported by tanks and armoured personnel carriers (APCs). The value of armoured vehicles in this context is partly the firepower they offer, which allows them to kill the enemy in their fighting positions once they expose themselves. Armour generally also draws fire, thereby diverting threats away from infantry. With appropriate modification, armour can survive 10–15 FPV hits while suffering repairable damage. Meanwhile, APCs protect the infantry from enemy indirect fire. Ukrainian units generally field a mix of wheeled and tracked APCs. Wheeled vehicles are preferred because it is necessary to assemble at some distance from the objective, and their greater speed reduces their exposure. However, terrain often renders movement by wheeled vehicles impractical, and so tracked vehicles are kept available within the unit.¹⁴

Figure 4: Closing with the Enemy



Source: The author. Graphic design: Alex Whitworth Art & Design.

14. Author interviews with experienced assault infantry commanders and personnel, and with tank crews attached to assault units, along with review of footage of ongoing operations, Ukraine, August 2025.

Once the assault troops dismount, it must deliberately clear through the target positions with grenades. In an ideal scenario, this is conducted with vehicles in intimate support, so that if heavy resistance is countered, the vehicles can suppress the enemy with 30-mm cannon and kill the enemy in place.

■ Phase 7: Consolidate

The operation is not finished once attacking forces have captured the position; the attacking forces must consolidate. First, they recover their assault troops and replace them with fresh infantry. These troops should avoid occupying the existing positions and instead dig new ones. Equipment and materials for erecting positions with overhead cover can be delivered to the units by UAVs and UGVs. UGVs are disproportionately used for resupply in Ukraine. The attacking force can then transition to screening the approaches to the contested zone with direct fire, moving up defensive infrastructure and UAVs. Initially, the mines laid during the isolation phase can act as a defensive barrier against counterattack. The force can then plan to contest the next sector.

Not all Ukrainian units have the training or resources to carry out operations in the manner described above. The results for the units able to apply this methodology, however, speak for themselves. Ukrainian officers assess that successful attacks using these methods produce an approximate 5% loss rate in favourable terrain, and a 10% loss rate in unfavourable terrain – compared with up to a 50% loss rate for unsuccessful assaults where these methods are not applied. Because these operations can be halted at any phase if conditions are unfavourable, they rarely see a high rate of casualties.¹⁵

■ The Relative Merits of Ukraine's Arms

Having discussed the concept of operation for combined arms manoeuvre as it is emerging in Ukraine, this section covers the merits, contributions and limitations of the various weapons systems within Ukraine's arsenal. Although some of these systems are held at the brigade echelon, they are generally all made available for battalion and even company operations and used in combination.

■ ISR and Enablement UAVs

The single most transformative element of warfare in Ukraine remains the ability to maintain observation of the battlefield at all echelons, with feeds fused and analysed across the force. ISR UAVs vary considerably in form, range and robustness. Access to real-time information on enemy positions and movement is not only a key enabler of

15. These statistics come from two commanders who have developed and applied these tactics and have been involved in fighting since early 2022. Clearly, they come from a small sample size.

fires, but also critical for planning manoeuvre. Forces must assume that they will consistently lose ISR UAVs in moderate numbers to interception, and that while more expensive platforms can keep flying in adverse weather, endurance will decline significantly in strong wind. Between weather conditions and deliberate interception, it is possible to create localised gaps in adversary ISR coverage. ISR UAVs can also act as communications relays and laser designators for precision munitions.

ISR UAV teams, however, expose themselves and their equipment in the electromagnetic spectrum, and are targets. Their equipment weighs up to 1.5 tonnes,¹⁶ which means they cannot redeploy quickly. The placement of ISR assets relative to air defences and protective systems is therefore an important planning consideration.

Howitzers and Mortars

- Artillery pieces remain fundamental to Ukrainian operations. Howitzers and mortars have several advantages over UAVs for conducting strikes:
- Their engagements have a low latency between fire and effect.
- The kinetic energy and explosive payload they deliver increases the damage inflicted.
- A single system can fire multiple ammunition natures to deliver different effects. Howitzers can suppress enemy infantry with cluster munitions, destroy enemy fighting positions with high explosives, fire sensor-fuzed munitions to knock out moving vehicles or use laser-guided munitions to eliminate point targets.
- Howitzers and mortars do not lose their effectiveness in bad weather and can be brought into action when heavy EW is reducing the efficiency of UAVs.

However, the use of howitzers and mortars has changed markedly owing to the threat from UAVs. They are now almost always operated from closed positions – dug into the ground in tree lines – with mesh screens surrounding the pieces, which are then opened when the system moves forward to fire. Artillery pieces operate independently, rather than in batteries. In addition, fire missions are very rarely more than 10 rounds to complete the fire mission before the piece comes under observation. Before going into action, artillery crews check whether they are under observation from UAVs and only fire if not under observation – unless ordered to do so. Ammunition is stored away from the weapon,¹⁷ and resupply is generally done by UGV. Repositioning of guns is carried out periodically or when there is an indication that the firing position has been identified by the enemy and must be covered by other operations.

It should be noted that with these precautions, artillery and mortars can be highly survivable. Ukrainian analysts assess that the number of Russian artillery pieces

16. Author review of equipment for UAV teams, Ukraine, August 2025.

17. Author observation of Ukrainian artillery firing points and discussion with artillery officers, Ukraine, August 2025.

destroyed in Ukrainian UAV strikes is approximately 50% of what is publicly claimed, as many hits against artillery pieces damage rather than destroy their targets and the artillery is subsequently recovered and repaired.¹⁸

EW

EW is an integral part of all operations in Ukraine. Electronic intelligence (ELINT) is the most reliable passive means of tracking enemy positions, activity and the presence of UAVs. When augmented with distributed acoustic sensors, units can maintain reliable early warning as to the presence of UAVs. The interception of video feeds from enemy UAVs also allows for the coordination of countermeasures, because it reveals what the enemy is targeting. ELINT also enables the prioritisation of what is investigated by stand-in ISR.¹⁹

EW is equally critical to the protection of platforms and forces during manoeuvre. Navigational jamming is a crucial means of degrading enemy precision strikes. Jamming control frequencies and communications channels is also vital for the survivability of the force while manoeuvring. However, jamming simultaneously degrades the efficiency of friendly systems, and must be synchronised with other arms. When forces do not synchronise, fratricide is inevitable and can cause operations to fail. Deconfliction is often necessary even down to platoon level. A platoon of vehicles, for example, may have fitted electronic countermeasures that must be deconflicted from their own communications and those of the units they are supporting.²⁰

EW has largely moved away from using large, dedicated platforms to using distributed antennas and power units. Systems are now modular, can have components quickly replaced, and can be rigged to draw power from generators, vehicles or the grid.

Bomber UAVs

Bomber UAVs are one of the deadliest tools in Ukraine's arsenal, but also have a wider utility as logistics and engineering assets. Usually operating at night, due to their vulnerability to direct fire, these platforms are used to drop heavier munitions than FPVs can deliver. Bomber UAVs (shown in Figure 4 overlying the author) are highly precise at engaging point targets. They are also used to lay mines, deploy communications relays and deliver ammunition to assault troops, food, water and other consumables like fuel and batteries to fighting positions, and medical supplies to casualties.

18. Author review of battle damage assessments by Ukrainian intelligence, Ukraine, June 2025.

19. Author observation of electromagnetic monitoring of the battlefield from command posts, Ukraine, August 2025.

20. Discussion with personnel from an armoured vehicle platoon and observation of their protective tactics, techniques and procedures, Ukraine, August 2025.

Figure 5: A Bomber UAV Searches for Targets



Source: The author, Ukraine, August 2025.

■ Powered Bombs (One-Way Effectors)

UAVs adapted as powered bombs to conduct point attacks have become a key part of the ‘middle strike’ toolset of both Ukrainian and Russian forces. These tools may be considered distinct from FPV UAVs in that they are not actively piloted: they navigate through combinations of terrain elevation tracking, visual odometry, inertial navigation and GNSS, or by detecting the emissions of their intended victim. The overall view of these systems among Ukrainian units is that they have a low success rate, are easily intercepted, and rarely have the kinetic energy or payload to decisively destroy many classes of target.

Nevertheless, if the platform is sufficiently reliable in its navigation, then powered bombs are useful because they still impose a pervasive risk on the enemy. A force can afford to fire them in depth at targets which would not justify a conventional long-range strike, and as such, there are multiple classes of target against which they have a persistent shaping effect. For example, firing large numbers of powered bombs at high-value targets is not a reliable means of destroying them, but it is a highly effective way of locating associated air defences and depleting their interceptors. Powered bombs can therefore be a useful enabler for conventional middle-strike systems. The

key point is that there is a cost threshold below which and a magazine depth above which these systems are useful. Outside these boundaries, they are not.²¹

FPV UAVs

The mass employment of FPVs has had a significant and visually compelling impact on the battlefield. Their utility is clear. They are cheap enough to be used en masse and can be used to target individuals and systems over significant distances which would previously have fallen below the threshold to justify unmasking one's own positions. FPVs are also capable of engaging moving targets and are accurate enough to [disable many classes of military equipment](#).

Nevertheless, FPVs have tactically important limitations:

- Forces can easily protect positions from FPVs.
- EW can effectively deny a part of the battlespace from FPVs which use radio frequency control.
- FPVs do not function in bad weather, have too small a payload to engage numerous classes of targets, and are comparatively easy to shoot down.
- FPV pilots must have extremely low latency connections to fly FPVs and must be static while flying them. Pilots can be detected and struck, including pilots using fibreoptic cables. As offensive counter-UAV methodologies have started to expand, pilots have been forced further away from the front, reducing their effective range of flight. As a result, the majority of FPV kills occur between -3 km and 3 km from the forward line of Ukrainian fighting positions.²²

These limitations are precisely why these systems are most effective when combined with other types of fires, creating competing dilemmas for the enemy. Senior officers in Ukrainian UAV regiments emphasised in interviews that Ukraine employs FPVs in extremely inefficient ways because they lack alternative means, and that much more effective approaches would be possible if they had a more diverse toolkit at their disposal. Indeed, observing Ukrainian UAV operators immediately reveals that they can see far more targets than they can hit. Numerous observers have suggested automation as a means of overcoming some limitations, especially using '[pixel lock](#)' for terminal guidance. However, the feedback from Ukrainian operators has not been encouraging. As one experienced UAV commander put it, 'my pilots would never use pixel lock if they can maintain the video feed, because other than against specific classes of target, it leads to a massive reduction in effectiveness'.²³ The prevailing view

21. Author interviews with UAV regimental staffs, review of battle damage assessment on strike missions, and interviews with planners for Ukraine's extended strike campaign, Ukraine, April, June and August 2025.

22. Author review of aggregated statistics on weapons effects and engagements, compiled by the AFU throughout 2025.

23. Author interview, weapons officer, UAV Regiment, Ukraine, August 2025.

is that pixel lock has an added value when used against air defence systems, enemy UAVs and EW antennas, which have a relatively regular outline. Otherwise, FPVs are much better off relying on analogue video streaming.

■ Armour and Protected Mobility

The use of armour on the battlefield has declined over the course of the conflict. Between 1 and 24 August 2025, Ukrainian ISR detected a total of only 23 Russian tanks operating within 70 km of the frontline, compared, for example, with 470 tanks on the southern axis alone in May 2023.²⁴ Russia has since increased its use of armour in Ukraine, using them in deliberate attacks rather than routinely. Ukrainian forces continue to employ armour, and brigade commanders continue to emphasise its utility. Currently, Ukrainian forces have a company of armour per brigade. Large-scale use of armour is extremely difficult because of the complex logistics of these formations. At platoon size, however, armour has proven indispensable in the firepower it brings to clearing enemy positions and drawing fire away from infantry. One Ukrainian tank platoon observed by the author had been operating four captured Russian tanks for over a year, and while they conceded that they would be hit between two and 12 times per operation, the vehicles were still in good condition, even if their armour had to be regularly replaced.

Ukrainians emphasise mobility, endurance and repairability as critical attributes for armour. In contrast, they generally perceive Western tanks as overly heavy and hard to repair. Crews may appreciate their survivability, but commanders find their availability diminishes quickly. Battle damage to armour is considered an inevitable consequence of its employment. As a result, the speed at which it can be recovered and repaired is critical to maintaining the tempo of operations. Where repair is likely to be slow and difficult, commanders struggle to find use cases that justify exposing their armour.²⁵

Additional armour packs should not impair the mobility of the vehicle. For example, Ukrainian forces consider Russia's turtle tanks to be highly counterproductive, since their turrets are restricted in movement, effectively turning them into self-propelled guns. Instead, Ukrainian forces prefer to hang protection from the turret, allowing the turret to turn and the underlying hull to move freely.

Protected mobility is even more critical to Ukrainian forces than armour. Protection of troops from fragmentation and strike from above is invaluable. These vehicles are also critical for logistics and evacuations; during assaults, armour brings firepower, especially in urban terrain. Again, however, Ukrainian officers emphasise that these vehicles are persistently damaged. As a result, Ukrainian forces have started to favour

24. Survey of Ukrainian ISR detections reported to the General Staff as of 24 August 2025.

25. Author interviews with tank crews, Ukraine, August 2025.

locally produced armoured vehicles with modular armour, since these can be more easily repaired and maintained.

Infantry

Ultimately, the infantry hold ground and will continue to be the core of Ukraine's effective fighting forces. The low level of training in many Ukrainian units, combined with a Soviet legacy mentality in some parts of the AFU that infantry work is akin to unskilled labour and thus unimportant relative to other arms, means that for much of the war there has been a lack of a distinctive set of Ukrainian battle drills. Nevertheless, more proficient units are increasingly developing new infantry tactics, such as those being practised by the infantry shown in Figure 6.

Figure 6: Ukrainian Assault Infantry Fire and Advance



Source: The author, Ukraine, August 2025.

Infantry combat currently revolves around the section/squad. It is extremely rare that large numbers of infantry find themselves in contact within a given piece of geography. This is because of the dispersion of forces, caused by the challenges of resupply and concealment. The optimised Ukrainian section comprises seven soldiers, divided into two fireteams of three plus the section commander. When holding a position, a section will usually deploy one fireteam to cover enemy forces, supported by the section commander, and deploy the other fireteam to cover the air. When moving, the section divides, with two soldiers from each fireteam moving and firing to cover the enemy,

and the third covering the air. The section commander coordinates the bounds of the two fireteams. When taking enemy positions, the first fireteam moves through the position: the first man covers the trench, the second throws grenades, and the third covers the air. The second fireteam remains out of the position and protects the group which is in the trench. The standard load-out for a Ukrainian assaulter is 12–15 magazines and 4–6 grenades, with resupply carried out by UAV.²⁶

Infantry movements must be coordinated with EW, air defence and fires, and so it is normal for a UAV from the company command post to observe the movement of the troops and to coordinate activity. Once on an enemy position, troops will dig and conceal themselves in the tree lines in fighting positions of two to three people, creating overhead protection.

■ Medical Support and Resupply

Medical support is now often delivered more than 7 km away from the forward positions of Ukrainian forces. Wounded personnel are initially stabilised on the position and then evacuated at night when conditions allow. Most units prefer to do this evacuation by UGV. UGVs will be stationed 2–5 km from the forward positions and dispersed to cover several fighting positions. Their maintenance is carried out by a team which digs a position forward, but the vehicles are driven via remote connection from the brigade's rear. The latency problems which arise when piloting UAVs via reachback are not as significant for ground vehicles, since a UGV moving on the ground at 12–15 kmph will not suffer unduly if the driver experiences a two-second delay in their video, whereas an FPV pilot will probably crash with this level of delay.²⁷ Bomber UAVs can resupply water and food, but heavier materiel must be moved by ground vehicles such as UGVs. Resupply operations are planned during the day, drawing on the wider force's ISR, and executed at night. Planners will identify a drop-off point for the receiving unit, offset from its positions, to avoid revealing the infantry positions if the UGV is tracked. A UGV will be protected by air surveillance so that it can go static or pull into cover if it comes under observation. It often takes two to three hours for casualties to be brought to the medical post from the moment the UGV arrives at the rendezvous.

■ Air Defence and Counter Uncrewed Aerial Systems

The fusing of ELINT, acoustic and passive and active radar detection allows forces to track air threats across the brigade area of operations. Effective air defence requires a distribution of capabilities, with the appropriate system assigned to each target. For enemy reconnaissance UAVs flying slow and below the cloud base, Ukrainian forces find that FPVs are the most efficient means of destruction. For higher-flying powered

26. Author discussion with Ukrainian assault infantry and observation of battle drills, Ukraine, August 2025.

27. Author observation of forward staged UGVs and of medical evacuation by UGV, Ukraine, August 2025.

bombs, dedicated interceptor UAVs with radar guidance are efficient. For FPVs, EW and point defence turrets are used. For helicopters and cruise missiles, man-portable air defence systems are preferred. For fast air, dedicated air defences are held in reserve. The latter threat is rare in Ukraine today but could have a disproportionate impact, so air defences must remain available but uncommitted against lower-level threats.²⁸

The dispersion of the air defence enterprise throughout the brigade area of operations and its distinct C2 requirements must be carefully deconflicted from the needs of the manoeuvre force. The requirement for air defence positions to illuminate either radar or antenna for the control of interceptors also necessitates their regular displacement and repositioning. This can lead to competition for good positions between other units, because air defence units that illuminate draw interest from enemy ISR and fires to the area even after they displace, effectively denying it to others.²⁹

■ Signals and Engineers

Signals and engineering simultaneously are the ubiquitous enablers of all combat functions, and, because of the small force packets in which units operate, must often be double-hatted with other roles. UAV teams must prepare their munitions and troubleshoot their control systems. They must also emplace mines. Artillery positions must dig and set up their cover. UAV and air defence units often need assistance to build hardened positions from which they can operate. Armour must be able to plough mines from its route of advance. Logisticians must erect netting over key supply routes to enable rapid movement of materiel. On the one hand, nothing happens without engineering and signals expertise, but on the other, it is not possible to have large attachments of engineers and signallers below the battalion echelon. As a result, Ukrainian forces are both conducting upskilling within other arms and placing engineers and signallers in command posts, maintenance and support units, where they can offer remote guidance. Where these specialists are pushed forward, they must often operate as an independent element rather than an attachment, to avoid expanding the signature of the forward positions.

■ Conclusion

Based on the emerging concepts outlined in this paper for the application of new tools to the modern battlefield, clear deductions emerge as to how Ukraine can improve the quality of its combat units. The conclusions below also include recommendations for

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28. Author observation of Air Defence Command Posts at battalion, brigade and regional task force level, and observation of interceptor teams and mobile fire groups on the ground, Ukraine, August 2025.
29. Author observation of deconfliction issues in selecting positions between air defence and manoeuvre forces, Ukraine, August 2025.

Ukraine's partners on how best to support Ukraine's combat effectiveness, and for NATO on how best to develop its own readiness to fight under modern conditions.

Recommendations for Ukraine

Make the corps responsible for the collective training of recruits.

To have forces able to execute the concepts described in this paper, significant levels of collective training and combined arms exercises are necessary. This requires units to have access to training areas, and their enablers to be available for training beyond the combat area. If Ukraine wishes to realise the potential of its forces, it needs to reform its training system. Considering that it is likely to be difficult to significantly improve training at Ukraine's training centres, and that training carried out by the brigades is difficult to conduct at sufficient scale, a reasonable compromise would be for Ukraine to organise collective training at the new 'corps' level. If the corps can manage a training rotation and hold some enablers and capabilities in reserve to properly train and cohere new recruits into its combat units, this could provide a mechanism to steadily improve the capabilities of units.

Spread best practices laterally between headquarters.

Ukraine's corps have an uneven level of quality among their constituent brigades. There is a need to transfer knowledge laterally from the more capable headquarters to the less capable ones. Using officers from the more capable brigades to conduct collective training with subordinate elements from the less capable ones should facilitate knowledge transfer. It would also improve the efficiency of the whole corps to have officers in less capable staffs spend time in more capable headquarters.

Increase the intake of recruits.

At present Ukraine's recruitment challenges mean that the demand for battlefield replacements for under-strength units makes it hard to have sufficient personnel in reserve to conduct enough collective training. Adjustments to the process of recruitment will not fix this problem quickly. What is needed is a large influx of new personnel. To generate a large number of recruits in a short space of time requires an explanation by Ukraine's political leadership as to why such a measure is necessary.

It should also be emphasised that Russia believes it can degrade the AFU to a point where it will struggle to hold the front. The mobilisation of additional troops would essentially invalidate Russia's battlefield theory of victory and demonstrate that Russia would have to pursue the war beyond 2026 if it wishes to achieve its goals through military means. A significant increase in recruitment, therefore, is a measure that – if conducted early enough – could shape Moscow's calculus as to what it can gain from a ceasefire.

Recommendations for Ukraine's International Partners

Continue to provide a diverse array of military equipment.

The reduction in military–technical assistance provided by the US risks leading to a precipitous decline in the provision of critical defence materiel to Ukraine over the last quarter of 2025. While the provision of powered bombs and other UAVs is high, the delivery of artillery, armoured vehicles, conventional ammunition and spare parts is trending downwards. Ensuring that these needs are met must be a priority for Ukraine's international partners. It is also necessary to reduce the dependence of European defence materiel on US export control regimes, including the [International Traffic in Arms Regulations](#) (ITAR), to stabilise the delivery of European support to Ukraine.

Prioritise the delivery of munitions optimised for striking targets in the middle and deep battle areas.

Ukraine can produce UAVs to conduct strikes in contested zones and for isolating sectors, but it is struggling to manufacture munitions with a sufficient payload or terminal accuracy to engage all relevant targets in the middle battle and deep battle areas. Ukraine's international partners should prioritise the provision of precision munitions that can compensate for shortages in Copperhead 155-mm rounds and guided MLRS previously provided by the US. In the case of the deep battle, technology transfer of non-ITAR guidance systems for Ukrainian built cruise missiles is also a priority.

Encourage R&D through Ukrainian brigades partnering with companies.

Although the creation of joint ventures with the Ukrainian Ministry of Defence (MoD) to attain large-scale production of materiel is desirable, R&D relationships between partner companies and the AFU are best managed at the brigade level. The best results would be achieved by companies signing R&D contracts with brigade R&D shops and funding their operations in exchange for the data generated. This would provide the most rapid and accurate data to inform the refinement of programs to be built at scale for the Ukrainian MoD and would leave the brigades in a better financial position to develop adaptations in response to emerging battlefield requirements.

Recommendations for NATO Forces

Review the concept of battlefield geometry.

There are concepts emerging in Ukraine that bear scrutiny by NATO militaries. First, there is an ongoing debate among NATO armies about the distinction between the

division and corps deep.³⁰ Some are dividing it by distance, others by target type, and others by effect. Ukraine's concept of middle strike – which concerns systems that can immediately affect the ongoing battle – versus its concept of deep strike against targets that will have an impact on the battle in the future, appears to be a functional way of breaking down the capabilities required at echelon. Ukrainian echelons do not correspond to NATO ones, but within NATO, the logic that the brigade should fight the contact battle, the division the middle battle, and the corps the deep battle is compelling.

Examine the capabilities that should be organic within the combat team and battlegroup.

The second aspect emerging from the battlefield that is of utility to NATO is understanding the composition of the combined arms team. This paper has refrained from laying out exactly what capabilities are held at each echelon because of concern for operational security for the AFU. Nevertheless, the concept of operation described does allow for an understanding of what must be organically controlled by the commander overseeing offensive action. The observation which immediately takes form is that the number of arms that need to be coordinated has increased, and the level at which C2 must be exercised by the brigade headquarters has moved down an echelon. At the same time, the force has become rebalanced between manoeuvre and fires, with the latter expanding to enable the former. Across the formation, if a battalion has a company conducting an operation, it will likely require an entire battalion of support assets to enable that company, while its other manoeuvre companies are then cycled through to take subsequent objectives. Thus, battlegroups become regimental-sized forces.

Examine future AFV design with repairability and maintenance in mind.

NATO forces should examine the repairability and maintainability of their armour as a key requirement for future armoured vehicle design and procurement. This probably suggests moving away from some fads of contemporary AFV design, including rubber tracks, and towards a more modular approach to sensors and armour.

Many aspects of the fighting in Ukraine are reflective of a moment in time and the conditions of the fight today. There are good reasons, however, for believing that the conceptual approach described in this paper will endure, and mastering the new combined arms approach therefore appears to be a valuable starting point for the modernisation of European land power.

30. Author participation in NATO working groups on division of function by echelon, London, Poland, Germany and the US, January, March, May and June 2025.

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