Tactical Developments During the Third Year of the Russo–Ukrainian War

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Royal United Services Institute

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Introduction

If a side does not achieve victory within the opening phases of a conflict, protracted warfare necessitates a continuous process of adaptation and counter-adaptation between the parties. The Russo–Ukrainian War has been consistent with this trend, such that the fighting in the first, second and third years of the war saw substantial changes in the composition of forces, equipment, tactics and relative competitive advantages of the combatants. The first year of the war was characterised by comparatively small groupings of well-equipped forces resulting in a mobile conflict. The second year saw the consolidation of areas of control and deliberate attempts to breach the line of contact, first by Russia and then by Ukraine. The third year was highly attritional, with the focus of both parties being the infliction of maximum damage on one another, rather than breakthrough. The available technology with which the war has been waged has also evolved over this period.

The authors of this paper have worked in Ukraine throughout the conflict, and documented the character of the fighting at intervals, noting tactical developments and their operational implications for Ukraine, for support provided by Ukraine's international partners, and for training and equipment programmes among NATO forces. This report builds on this work, providing an overview of tactical developments as they stand in February 2025 as the war enters its fourth year. The purpose of this paper is to describe the systems of fighting employed by Russian and Ukrainian forces and to identify where changes in how the forces fight reflect peculiarities of the current situation and where they suggest significant changes that will endure.

This is not an academic study. This paper constitutes research notes from fieldwork conducted in November 2024 and January 2025. As this work was written in Ukraine and under conditions consistent with operational security, it does not engage with wider commentaries on the current character of the war. That does not suggest any inadequacy in other studies, and the conclusions and observations in this paper should be read in parallel with similar work carried out by a range of esteemed colleagues. Please also note that this paper provides a discussion of tactics and not an assessment as to the likely outcome of engagements by sector. It does not set out to make predictions.

The observations contained in this report are based on interviews by the authors with staff and personnel from air assault brigades, a marine brigade, a jaeger brigade, a mechanised brigade, an artillery brigade and assault units holding key sectors on the Donetsk and Sumy fronts. The authors also spoke to air defence troops and observed Ukrainian mobile air defence groups, as well as being briefed by personnel of the Donetsk and Sumy Operational Commands, the Joint Strategic–Operational Command, officers of the Ukrainian General Staff, representatives of the Ukrainian Special Services and members of Stavka. Finally, the authors compared these observations with officers responsible for the provision of military technical assistance from Ukraine's international partners.

This paper is focused on tactical dynamics. The body of the report is therefore broken down into tactical functions including ground close combat, fires, engineering, reconnaissance, logistics and resupply, medical support and air defence. Some tactical functions such as aviation operations are not covered because these were not observed by the authors during

the period of study. This does not mean that other tactical functions lack importance. However, developments in these areas must be understood within a wider operational context and so the paper begins with a description of the operational situation extant at the time of writing. The paper then concludes with two sections of deductions, the first relating to implications for military technical assistance to Ukraine and the second relevant for NATO forces.

There is, of course, a wider political context unfolding, with President Donald Trump endeavouring to bring about a cessation of hostilities through economic coercion and diplomatic entreaties with Moscow. This falls beyond the scope of this paper, which is confined to military dynamics and therefore the assumption that fighting continues.

Operational Context

The strategic objective of the Russian Federation remains the political subjugation of Ukraine by forcing Kyiv to capitulate through military force. In pursuit of this objective, the Armed Forces of the Russian Federation (AFRF) are currently pursuing the destruction of the Armed Forces of Ukraine (AFU) through a firepower-intensive attritional fight over critical terrain in Donetsk Oblast as their main effort. Simultaneously Ukraine is holding Russian territory in Kursk Oblast, endeavouring to fix Russian forces away from Kharkiv and maintain leverage in the event of negotiations. The AFRF are endeavouring to evict the AFU from Russian territory.

The piecemeal capture of territory at great cost and the lack of broader or rapid movement on the frontline can give the appearance of a lack of any decisive effect. However, Russia's ground campaign has maintained constant attritional pressure on Ukraine throughout the war, with lost personnel requiring replacement, alongside materiel and munitions which must be regenerated or replaced. As Russia's mobilisation of its industry and population got underway, it has been able to stretch the AFU across an extended frontline, and at the time of writing, Russia has a viable but not assured pathway to achieving its main effort.

The Russian Operational Group of Forces attacking Ukraine currently consists of approximately 580,000 troops. Approximately 70,000 of these are fighting in Kursk Oblast, augmented by approximately 10,000 North Korean soldiers, with more DPRK units likely to arrive in before May 2025. A further 80,000 troops are currently operating on the Kharkiv axis, endeavouring to expand a bridgehead over the Oskil River. The largest grouping of Russian forces is in Donetsk and Luhansk Oblasts, comprising some 230,000 troops, advancing on a broad front with the immediate aim of isolating and then reducing Pokrovsk and attacking Konstyantynivka and Kramatorsk over the course of 2025. To the south, Russian forces have seized Velyka Novosilka and are likely to continue to slowly advance towards the border of Dnipro Oblast, bypassing the Ukrainian southern defence line.

Should the Ukrainian salient in Kursk be withdrawn, it is likely that the AFRF will divert capacity to expand its efforts to threaten Kharkiv Oblast. The AFRF also maintain a grouping of forces in Southern Ukraine of approximately 140,000 troops. At present, this group of forces is holding the line of contact on the southern front, with most of its efforts focused on garrisoning Crimea and fixing Ukrainian forces in Kherson and Zaporizhzhia

through strikes and a latent threat against Ukrainian shipping in Kherson and Mykolaiv. There are regular strikes across the Dnipro River and intermittent attempts to cross in small groups, though the size of the force does not threaten a larger operation at this stage. The effect is to fix Ukrainian forces. The AFRF are also continuing to conduct widespread and regular long-range strikes on Ukrainian training bases, airfields and critical national infrastructure. This campaign involves a combination of daily strikes using Geran-2 and Gerbera UAVs and periodic ballistic and cruise missile salvos. The campaign inflicts persistent damage but is highly unlikely to prove decisive this winter. Its greatest military impact is fixing Ukrainian air defence across the country and depleting Ukrainian and NATO air defence interceptor stockpiles.

To ensure the AFRF can continue these efforts, Russia contracted more than 400,000 additional troops in 2024, enabling the expansion of its forces despite a very high rate of casualties. Russia is anticipated to reduce its recruitment targets for 2025, but is still expected to recruit more personnel than it loses over this period. Russian forces were often suffering more than 200 personnel killed per day during 2024 with over 1,200 casualties per day towards the end of the year. A significant proportion of wounded are returned to service.

Russia is also significantly increasing the production of ammunition and key classes of equipment, with over 70,000 unified gliding and correction modules (UMPK) glide bombs ordered for 2025. However, a large proportion of ammunition for artillery is currently procured from North Korea and is of low quality. Russia is also likely to face reduced availability of armoured vehicles over 2025 as it depletes stores of old vehicles and must depend upon newly produced platforms to replace losses. The primary tactical problems the AFRF imposes on the AFU, however, will be unaffected by these considerations, as will be discussed later in this paper.

The AFU continue to have to defend the entire 1,200-km line of contact. Although the Ukrainian Defence Forces – including police, border guards and other security functions – comprise some 800,000 personnel, most of these are fixed on tasks separate from combat operations. The available combat power of the AFU comprises less than 25% of the force. The need to defend such a broad front means that although in aggregate the force ratio between the AFU and Russian Operational Group of Forces is favourable, the actual force ratio between combat units in any given sector is between 1:2 and 1:6. This is because the Russian Operational Group of Forces does not include the security and whole support structure for the Russian Armed Forces, so a higher proportion consists of combat troops. In many sectors, the greatest challenge for the AFU is the shortage of combat troops. Although Ukraine is suffering heavy casualties, it does have reserves of manpower that can address this challenge. The biggest problems in achieving this, aside from equipment and armaments shortages, are training, personnel management and morale among troops who have been engaged in heavy fighting for three years and perceive a deteriorating tactical situation.

Ukraine is endeavouring to increase the costs on the AFRF through the attrition of its forces and an expanded deep-strike campaign against Russian revenue-generating centres (such as oil refineries), operational stockpiles of ammunition and defence industrial facilities. If sustained, these attacks will have a significant effect on Russia's ability to

sustain the current scale of recruitment and military industrial mobilisation. However, this will take time. It therefore remains critical that Ukraine can hold the front for long enough to reap the rewards of its deep-strike campaign and the persistent attrition of Russian forces.

Although Ukrainian political objectives – of bringing about a lasting peace – have many non-military dependencies as regards security guarantees and economic stability, the foremost military objective is the stabilisation of the front. For this to be possible, a range of tactical problems must be addressed which are currently enabling the AFRF to maintain a steady rate of advance. It is therefore essential that Ukraine and its international partners work to resolve the extant tactical problems to create the military conditions for a successful political conclusion of the conflict.

Ukrainian Air Assault soldiers advance.
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Tactical Context and the Russian Offensive Triangle

Much of the war is recognisable from early 2023, characterised by the artillery battle and layered defences of trenches and fortifications. Yet Russian adaptations have aggregated and become an offensive triangle of three primary combined arms that are creating competing dilemmas for Ukrainian forces. First, the AFRF continue to pin down Ukrainian ground forces on the line of contact with infantry and mechanised forces, much as in the second and third years of the conflict. Second, they prevent manoeuvre and inflict attrition with first-person view drones (FPVs), Lancet drones and artillery firing both high-explosive shells and scatterable mines. Although this was the case earlier in the conflict, the

scale of wire-guided FPV employment and density of persistent ISR has further exacerbated the tactical challenges to resupply, casualty evacuation and the concealment and protection of prestige equipment. Third, the AFRF has increased its use of UMPK glide bombs against Ukrainian forces who are holding defensive positions. Although these were used in 2023, the massive expansion of this tactic in 2024, set to increase further in 2025, creates a competing dilemma: should the AFU hold and invest in static defensive positions to reduce attrition from FPVs and drone-enabled artillery, or retain mobility to avoid destruction from glide bomb strikes, which have the explosive yield to demolish or bury even well-prepared fortifications?

The return of the Russian Aerospace Forces (VKS) is the primary dynamic driving broader changes to how the AFRF is inflicting attrition of the AFU on the frontline. Prior to the introduction of the UMPK glide bomb at large scale, the VKS was a powerful but latent threat that was unable to venture too close to the frontlines due to Ukrainian air defences' ability to inflict unacceptable losses on it. Should Ukraine's supply of air-defence munitions run dry due to the long-running strategic air campaign targeting Ukrainian critical national infrastructure with one-way attack (OWA) UAVs and cruise missiles, Russian crewed aviation would regain the freedom to penetrate deep into Ukrainian territory and inflict much greater damage than is possible with uncrewed strike systems. This made the provision of Western air defence a priority line of effort which, along with Ukrainian adaptation and use of less technologically advanced short-range air defence to provide local defence and complement long-range systems, has been a success story. In the interim, the VKS were limited for the most part to contributing to the strategic air campaign or providing sporadic fire support with lofting munitions on the front line.

Glide bombs gave the VKS teeth without the need to first achieve air superiority or gain the ability to penetrate Ukrainian airspace. A simple stand-off strike capability against which Ukraine has no effective countermeasures, the UMPK glide bombs comprises a conventional low-drag bombs modified with deployable wings and a cheap GNSS guidance kit. These are predominantly the FAB-500 and FAB-1500 aerial bomb, along with limited numbers of similar munitions of different yields. While these were initially considered individually dangerous but not game-changing, or even a sign of Russian desperation, their mass-producibility rapidly proved a key advantage. Due to the strength of Russia's integrated air defence systems, the VKS has been able to launch glide bombs across the frontline with the crewed launch aircraft remaining at a safe distance of between 30 and 90 km, depending on the size and thus the glide efficiency of the bomb.

The rise in UMPK glide bomb production from 40,000 units in 2024 to 70,000 units anticipated in 2025, has significantly increased the number of Ukrainian troops killed during defensive operations. This has had numerous knock-on effects for the different arms and services, as they have been pushed to completely avoid observation of their positions, to disperse or seek concealment underground, and to rely on uncrewed or autonomous systems to keep and kill the enemy at arm's length.

The AFU have imposed a different set of dilemmas on Russian forces. The AFU's approach to defence in depth and to imposing attrition at longer range has made it very costly for Russian forces to make gains. This has limited Russia's ability to build up tempo or to exploit breaches in defence lines. While Russia has found an effective formula for

inflicting heavy casualties on Ukraine, it has not found a successful formula for breaching defences without taking massive losses in equipment and personnel. Russia can still succeed on these terms owing to its greater mass, but it is evident that despite several experimental approaches to assaults, Russia lacks an effective concept of offensive action.

Evolving Ground Close-Combat Tactics

Ground close-combat tactics differ considerably between Ukrainian and Russian forces. Russian forces have fixed combined-arms armies and divisions on key axes, with the regiments and battalions beneath rotated and replenished as they suffer losses. Russian units, upon entering the line, tend to conduct wide-ranging advances to contact in section strength, endeavouring to identify Ukrainian positions. First, they send sections/squads of poorly trained troops, perhaps eight personnel at a time (although some larger attacks consist of up to 30 personnel supported by one or two infantry fighting vehicles (IFVs)). These are ordered to advance towards where they assess Ukrainian positions to be, conducting reconnaissance by drawing fire. If the group encounters resistance, Russian commanders assess where they believe the best lines of approach are, and in particular, where the boundaries between defensive units lie. If Ukrainian positions are positively identified, sections are persistently sent forward to attack positions, which are further mapped and then targeted with artillery, FPVs and UMPK glide bombs. When rotation or disruption of the defence is achieved, Russian units aim to conduct more deliberate assault actions.

Russian assault actions consist of armoured vehicles or light mobility vehicles endeavouring to transport troops as close to Ukrainian positions as possible before the infantry rush the positions; battle drills, direct fire control and fire and manoeuvre are either primitive or absent. Russian troops that make it into cover will often lie low and await successive waves to follow until a critical mass of troops have entered the defensive positions, at which point they will rush to the defenders. Actions are rarely above section size, unless fog or peculiarities of the defence favour a larger attack, in which case, platoon actions are sometimes launched, followed up with attacks to clear the positions, utilising better trained and -equipped troops. The tempo of attacks tends to be high when the Russian unit initially deploys. One Ukrainian brigade outlined an average tempo of 27 section attacks per day along part of its sector. However, the tempo tends to diminish and become more deliberate as the unit suffers casualties, until it has taken 30% casualties and is rotated. The constant use of artillery, FPVs and UMPK glide bombs makes it very difficult for Ukrainian defenders to hold positions if they face an intact attack force. Ukrainian forces therefore seek to anticipate the routes to be used for attacks each day and lay anti-personnel (AP) and anti-tank (AT) mines and prepare fires to engage Russian troops before they engage the positions in direct fire.

Ukrainian troops report that North Korean troops operated quite differently when they originally entered the conflict. North Korean troops tended to conduct attacks in company or battalion strength on a single sector. The Ukrainians were able to inflict mass casualties during these attacks, but the North Koreans often overwhelmed the Ukrainian defenders' positions, which were sparse, optimised to counter Russian tactics. North Korean troops were reportedly fit, motivated and aggressive and had good internal unit cohesion. After

losing approximately a quarter of their initial force, however, they have begun to adopt and learn Russian tactics to better conserve their manpower.

The Russian troops' willingness to continue attacking even when they suffer heavy casualties appears to have a range of explanations. First, Russian troops are routinely threatened with being 'zeroed'/'nullified' or executed if they retreat from an attack. In practice, they are often punished by being assigned to future attacks under unfavourable conditions. It is therefore often safer for Russian soldiers to go to ground – rather than retreat – and await more Russian troops to arrive. Propaganda about treatment if captured has also driven some Russian soldiers to commit suicide rather than be captured when injured, though this is not a widespread phenomenon. North Korean troops have shown a much higher tendency to commit suicide to avoid capture or if seriously wounded, either with a grenade or by 'rolling onto the rifle'.

Both Russia and Ukraine rely on extensive digging and concealment to create uncertainty about where their main defensive strongpoints are, utilising many dummy and decoy positions. Russian platoons regularly occupy defensive positions dug to the specifications of a company position according to Russian doctrine. Frontages are covered by mixed AP and AT minefields, preventing enemy forces from manoeuvring or rapidly approaching. Russian formations seed minefields systematically, whereas Ukrainian forces – partly owing to limitations on supply – tend to seed mines on axes and terrain features where they anticipate the Russians will carry out deliberate attacks.

Ukrainian tactics, are premised upon extending the depth of their fires and dispersing their force to avoid casualties. The pervasive threat from fires causes units to dig extensively, by hand in the forward positions, and to reduce force density. There is admittedly variation by brigade and across different terrain. Some units favour greater concentration, relying on their ability to hide and employ decoys and reversionary positions to which they are able to relocate, while others revert to greater dispersion. The range for an infantry section's area of responsibility is 70–200 m, with troops often occupying fighting positions separated by approximately 50 m, in fireteams of two to three personnel. One brigade reported holding a 27 km-frontage with just four battalions. The exact design and layout of fighting positions, trenches and dug-outs vary from unit to unit and depending on available time, equipment and materials. The low density across the unit's frontage is partly made up for in depth, with an infantry company arrayed over 3 km of depth under a battalion in approximately 7 km of depth. The range of offensive engagements by the unit is often 10–15 km depending on its capabilities. The preference is to maximise attrition beyond line of sight.

Armoured vehicles are used for both indirect and direct fire, though the latter is currently preferred. The threat from enemy FPVs means that tanks and infantry fighting vehicles must be concealed and ideally dug in, usually within 3 km of the frontline if they are assigned to combat roles. Because of the high latency of FPV sorties, armoured fighting vehicles tend to sally forwards from these hides to engage in direct-fire missions to break up enemy assault actions. The vehicles then return to their protected hides before they can be targeted. Tank-on-tank engagements have increased in regularity because of these tactics. It is noteworthy that every Ukrainian brigade aims to field a company or battalion of tanks, with availability varying considerably between formations.

Ukrainian offensive tactics differ from those of the AFRF in that they tend to be very deliberate, with extensive intelligence collection and setting of conditions. For example, the offensive into Kursk involved up to a month of preparatory collection and shaping fires, even though the initial break-in comprised a two-point breach at a small scale. Ukrainian assault detachments conduct careful mission rehearsal and rarely operate in groups above 20 personnel. The assault troops trained and used for this purpose tend also be held in reserve and recovered when they have completed their combat task, to be replaced by ground-holding line infantry. All assault actions, however, must be enabled by fires.

Fires: Attrition in Depth

Shorter-ranged tactical fires have been shaped by Ukrainian improvements in electronic protection and the expanded use of FPVs by both Russian and Ukrainian forces. FPVs have been improved with autonomous terminal guidance and wire spools, which render them impervious to electronic disruption. While reports from Ukrainian operators indicate that this type of wired-control link comes with some downsides – including degraded flight performance, a comparatively limited range of approximately 10 km and running the risk of entanglement with obstacles – it provides a reliable means of penetrating areas of heavy jamming of GPS and radio frequencies which would otherwise make strikes impossible, and of overcoming tactical electronic countermeasures in the terminal attack phase.

All Ukrainian formations field a mix of attack UAVs, ranging from light and heavy bomber drones to FPVs. Most brigades have a UAV company or battalion, and dedicated UAV units are allocated to support sections of front between 40 and 70 km wide. As Ukrainian forces do not yet widely employ wire-guided FPVs, the timing of when they can conduct strikes depends on gaps in electronic protection. These gaps can be induced through the suppression of enemy electronic warfare (EW) using artillery, or through planned pauses in friendly jamming to enable strike systems to get airborne. Generally, FPV and bomber operations are cued with intelligence and by quadcopter spotter drones, or by longer-range fixed-wing reconnaissance UAVs. FPV fire missions tend to be coordinated from battalion and brigade command posts. Different systems are optimised for different targets and times of the day. Bomber drones tend to deliver a heavier payload and so reliably do more damage to targets. However, their slow speed and need to hover above the target means they are predominantly employed at night.

Tactical UAVs have significant limitations. Between 60 and 80% of Ukrainian FPVs fail to reach their target, depending on the part of the front and the skill of the operators. Of those that do strike their targets, a majority fail to destroy the target system when striking armoured vehicles. The success rate in wounding infantry is high. Furthermore, there are long periods where either EW or the weather significantly degrades UAV operations. With FPVs that are remotely piloted by radio frequency, it is also difficult to concentrate multiple drones in time and space because they can interfere with one another's guidance systems. Despite these limitations, tactical UAVs currently account for 60–70% of damaged and destroyed Russian systems.

The above figure must be read in the appropriate context. During extended discussions with Ukrainian officers on multiple axes and from multiple brigades – two of which had an exceptionally high rates of efficiency with FPVs – the officers repeatedly reiterated that

they needed artillery. They emphasised that UAVs alone were inadequate and that they were most effective when used in combination with artillery. For example, artillery was effective at suppressing or displacing EW and air defences or suppressing infantry protecting key targets from bomber UAVs. Artillery was also able to defend the front in poor weather and was generally more responsive. Combined UAV and artillery operations often maximised the destruction achieved with, for example, an FPV immobilising a vehicle and artillery killing dismounts as they emerged. To give an example of the difference, a fires officer described the hours it had taken to plan and eventually immobilise a tank using FPVs, compared with an engagement where a platoon of Russian tanks were manoeuvring and, having located them with a drone, he fired five BONUS shells at them, knocking out all three tanks within two minutes. The pervasiveness of the threat of FPVs, however, which can hunt while their crews are relatively safe, makes them a persistent cause of attrition. Ukrainian commanders would like to inflict casualties on Russian forces from approximately 15 km from their defence lines, with the persistent threat of FPVs forcing the Russians to move quickly rather than deliberately and therefore making them more susceptible to canalisation from artillery- or drone-deployed mines, and thereafter broken up with artillery. Although these combined strikes are most effective, Ukrainian officers noted that they were rarely able to bring about this layered effect because of a scarcity of artillery.

One of the main reasons for such a high proportion of kills being caused by FPVs is the relative lack of artillery in Ukrainian units. A brigade responsible for defending 18 km of front noted that it had four working howitzers. 152mm- and 122mm-howitzer rounds are in very short supply. Although 155mm shells are available in considerably greater volume than earlier in the conflict, artillery officers noted that they had few guns and limited spares. They also often had shells, but few accompanying charges. It may be that ammunition and spares are being stockpiled to hedge against the risk of disruption of supply during the forthcoming political manoeuvring over negotiations, as higher formations appeared more comfortable with their level of supply. For the brigades, while shells were available, charge bags were far scarcer, so that few guns were equipped for engaging at long range. Units also almost exclusively had access to high-explosive shells and some artillery-deployed mines, with very occasional access to dual-purpose improved conventional munitions (DPICM), and almost no availability of BONUS shells or other specialised ammunition. The ability to fire proper groupings of shells was also inhibited by the fact that units were receiving propellent charges sourced from a wide range of countries, which varied considerably in composition and quality, and thus in accuracy. While updates to the Kropyva fire control application used by the AFU can include pre-loaded adjustments to account for common national variants, the persistent challenges introduce inefficiency into the provision of fire support and exemplify the second-order effects of piecemeal and uncoordinated industrial support. Taken together, these mean that artillery is currently significantly underperforming, even when it is available.

Ground combat brigades generally suffer particularly acute shortages of artillery munitions, as artillery brigades have remained the priority for resupply due to their more refined ability to coordinate and conduct targeting and fire missions in their respective areas of operation. While some of this is mitigated by artillery liaison officers posted to the ground combat brigades which they support, this nevertheless results in periodic delays in fire

support due to differing targeting priorities and views of where the expenditure of limited munitions supplies should be prioritised at different echelons.

Ukrainian brigade artillery delivers fires.
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Tactics for employing artillery have evolved considerably in response to the pervasive threat from UAVs. Both Russian and Ukrainian gunners separate guns by more than 500 m and keep ammunition caches concealed and separated from the firing position. Firing positions are dug in with protection on the sides and above, netting, and in some cases, plates mounted as a sheath around exposed components like barrels. Guns operate from hides with a cluster of prepared firing positions and associated decoy positions. The decoys are also redeployed when weather or other conditions allow. Guns tend to fire for a protracted period as the dug-in positions offer significant protection from counter-battery fire, the volume of which is itself reduced by the dispersion of guns. However, the guns move periodically to avoid being engaged by glide bombs, which are powerful enough to obviate the defences. Gunners note that the small payloads of UAVs can cause damage to their pieces, but they are usually repairable. This has led to a faster rate of barrel replacement than would arise from firing alone. Ukrainian forces have found it necessary to keep resupply vehicles much further back than pre-war doctrine suggests and to resupply ammunition when conditions are favourable, rather than in response to consumption.

Engineering and Fortification

Building defensive positions is fundamental to survivability on the battlefield for both Russian and Ukrainian forces, along all sectors of the frontline. Due to the fires threat,

excavation equipment is rarely brought closer than 7 km to the front, meaning that most defensive positions must be prepared by hand. For infantry soldiers manually moving large volumes of soil with picks and shovels, the work is arduous and time consuming. This has resulted in ground combat units often struggling to build adequate defensive structures. Incorporating overhead protection, whether hard cover or simply concealment from observation, has proven difficult to achieve at the correct scale, especially where there is limited foliage or other natural material to exploit. If units are rotated, they do not directly benefit from their labour, and in areas where multiple units have been rotated within a short time, this has been noted as disincentivising digging in, despite standing orders that make units responsible for making progressive improvements to the defences in any area in which they are deployed. These are of course longstanding and well understood issues, with historical precedent in most large-scale ground wars throughout the last century, but they have become particularly problematic given the overhead observation and fires threat on the current frontline. Ukrainian units often use separate troops to prepare positions back from the line of contact to avoid exhausting their infantry.

At the operational level, Ukraine has increasingly depended on combat engineering for force protection, digging in and concealing headquarters, logistics depots and artillery positions. Much of this must still be conducted by ground combat units, due to the high level of threat. Construction of decoy and reversionary positions and hides is a major task. While much of this is conducted by different arms – for example, artillery units are responsible for many of their decoys and hides – combat engineers remain invaluable for their ability to quickly construct such positions with heavy mechanised equipment. Artillery positions and command posts often require significant excavation work, with all command posts buried to reduce the threat of observation and effective indirect fire. Although engineers cannot often move forward, they can help to prepare cages and steel nets that are erected over defensive positions closer to the line of contact to protect from strikes.

Combat engineers also have important functions within the ground combat units. The extensive use of mines has meant that mine clearing is an essential task for offensive action. Ukraine continues to use both hand clearing and mechanised breaching, with Vincent and line-breaching systems like UR-77, utilised where speed is required. The laying of mines is another area where engineers are widely employed, working closely with reconnaissance troops and intelligence staffs to judge the appropriate siting of mines, and then working with artillery and UAV troops to emplace them. Ukrainian forces tend to use mines to canalise attacks and slow down enemy tempo, thereby enabling them to inflict casualties on Russian units.

Ukrainian Soldier digs to improve his fighting position
© Air Assault Forces Command of the Armed Forces of Ukraine

Bridging also remains a persistent if thankless task for engineering units. Because of the pervasive observation on the battlefield, bridges are routinely struck. This has meant that ferries and watercraft have a critical function. Filling in minor gaps and shorter-term bridging solutions has proven vital for assault and resupply operations. In these cases, volume of equipment is critical – as it is lost and fixed in large quantities – but sophistication of equipment is largely redundant.

Reconnaissance: Mass Observation

The conduct of reconnaissance for both Russian and Ukrainian forces has been almost exclusively conducted by UAVs. Ukrainian artillery brigades field ISR battalions operating

long-range reconnaissance UAVs. Each ground combat brigade generally has an independent UAV company or battalion that is responsible for conducting deep reconnaissance as well as the fires engagements outlined above. In addition, each battalion is required to generate four to six orbits of UAVs to support its HQ, with four dedicated to combat management and two to conducting battlefield reconnaissance. Artillery batteries and infantry companies also field significant numbers of UAVs, both to maintain situational awareness and to search for enemy positions or observe trigger points for other activity.

Russian approaches to ISR are similar. Along with long-range reconnaissance from Orlan and Zala UAVs working at operational depth, Russian combat groups tend to endeavour to maintain five orbits of observation over an axis of advance. They also tend to keep UAVs above their own forces for combat management, in line with their top-down command structure and centrally directed approach to operations. Although FPVs and Lancet loitering munitions are not recovered, they can also be used to actively hunt for targets and confirm the position of enemy that they overfly, such that these strike systems provide a reconnaissance function. They also often prompt ground units to fire at them, revealing their positions. The aggregate consequence of this dense and overlapping network of UAVs is battlefield transparency within 3 km of the line of contact, with diminishing density of observation out to 15 km of depth. Beyond this, reconnaissance is more deliberate, with the picture depending on where commanders assign UAV orbits. However, commanders can generally task reconnaissance capabilities with reasonable fidelity and latency out to 40 km of depth. Beyond this range, satellite reconnaissance often cues areas of interest for longer ranged UAVs to be tasked.

The command and control of the reconnaissance screen has centralised at the battalion and brigade/regimental level in both Russian and Ukrainian forces. Generally, each UAV orbit will maintain a satellite uplink and stream its footage to the battalion and brigade command posts, where the intelligence officer, fires officer, and the commander's representative will assess what is observed, determine options and authorise actions to be taken in response to what is observed. Both Russian and Ukrainian forces, for reasons of doctrine and culture, do not generally use fire controllers in combat units.

The wider intelligence and surveillance enterprise is bolstered by the extensive use of electronic surveillance and the interception of communications by both sides. Ukrainian EW has matured and expanded over the course of the war. Tracking EW defences is an absolute requirement for successful UAV operations, as it affects the flight plan and the timing of when UAVs are launched. Direction finding is also used as a means of cueing UAV orbits. Interception of tactical communications is critical as an indicator of enemy intent and is therefore provided to most brigades staffs to assist in the conduct of operations within their sector of responsibility.

Medical Support and Casualty Evacuation

The ability to stabilise, evacuate and treat casualties not only is critical to a force's resilience as regards the recovery of combat troops and retention of experience within the force, but also often underpins the morale of units. The tactical problems described above have made the treatment and evacuation of casualties and recovery of the dead extremely

difficult. First, with a force density of sections covering up to 200 m of front, and individual battalions distributed through 7 km of depth, it is not viable to have medics persistently present on the fighting positions. Second, the distance between fighting positions, and the extent to which the intervening space is covered by precision fires from FPVs, makes it prohibitively dangerous for medics to reach wounded personnel.

The tactical response to this problem has initially been to train personnel on medical interventions so that they can stabilise their own wounds. The medic in this context often crews a radio and talks the casualty through the necessary procedures. It has been found that this function is critical, even when it is a medic who is wounded, because while shock often gives a casualty the ability to work on themselves for a period, it also significantly impairs decision making and judgement. It has also been found that having a medic centrally track timings, especially for the application of tourniquets, has helped to reduce the number of amputations required because of tourniquets being kept on for too long. Supplies of medical equipment have thereafter been delivered to casualties in place using UAVs.

The recovery of casualties can be achieved more safely if it is part of a deliberate operation and carried out under favourable conditions of fog and heavy rain, and at night. The evacuation procedure must be planned carefully and often requires the use of artillery and obscurants to suppress enemy artillery or divert their attention. This is achievable but means that the commander cannot recover casualties immediately in response to their being taken. The interval between someone being wounded and recovered can therefore be from a few hours if they are wounded under favourable conditions, up to a matter of days if weather and battlefield conditions make the tactical context for evacuation unfavourable. Where soldiers are badly wounded, comrades do often take significant risk to achieve an accelerated recovery, but while this comradeship is commendable, under most tactical situations, this tends to lead to multiple casualties being suffered. Experimentation has started with the recovery of the wounded on uncrewed ground vehicles (UGVs). At present, however, the reliability of these systems is insufficient for forces to be confident in such methods, and the use of such prototypes is limite. Once casualties are recovered, medical posts must be in the rear, dispersed, and hardened, so that surgery can be carried out safely.

Another important operation is the recovery of the dead. In some respects, although the recovery of the dead is easier – owing to it not having the same time constraints – the Russians have taken to booby-trapping bodies or keeping dead Ukrainians under observation. Thus, the mapping of the positions of the dead, confirmation through ISR of their condition, and recovery must also be a deliberate operation. The importance of this activity relates to morale. To be recorded as killed rather than missing in action, it is necessary for remains to be recovered. This difference affects eligibility for compensation to be paid to families, so soldiers see it as very important. This dynamic has increased the impact of glide bombs on morale, because they have enough explosive to entirely obliterate those caught in the blast and bury those in the vicinity, leaving no recoverable corpse.

It should be noted that Russian approaches to casualties differ to Ukrainian approaches, reflecting the motivation of their troops. While Ukrainian troops overwhelmingly refer to their duty to defend Ukraine and their families from Russian occupation as their reason for fighting, Russian prisoners of war largely describe their motivations as financial. Whereas

Ukrainian troops often leave their families worse off – as they receive less pay in the armed forces than in civilian employment – by joining the military, Russian troops receive bonuses, making fighting a lucrative endeavour. Moreover, the compensation for being killed paid to the family is high enough to give families an altered standard of living, though payments for being wounded are reducing. Russian troops appear less motivated to recover their wounded or their dead. Medical support is prioritised for those who can self-recover.

Logistics, Resupply and Rotation

Tactical resupply has become a major challenge for the same reasons as medical evacuation. Ukrainian brigades report that approximately 50% of their casualties are taken in the rear from Russian FPVs, artillery and glide bombs. Rotation of troops, pushing supplies forward and recovering damaged equipment all lead to personnel moving in the open and are risky endeavours.

The first tactical adaptation driven by the threat is to minimise the number of rotations, with troops spending over a month in their positions before being rotated. If the positions are appropriately built, commanders reported that this approach was more popular than endeavouring to rotate regularly, since the risks of rotation now outweigh the benefits of rest in rear areas. When rotations are conducted, it is the same deliberate operation as described in relation to medical evacuation, and is supported by fires and EW, while being executed at night and during periods of inclement weather or reduced visibility. There is a challenge in this because periods of reduced visibility are also favoured for Russian assault actions, and when the rotation is poorly managed, it can enable Russian troops to get into fighting positions. In several cases rotations allowed the flanks of neighbouring units to be turned, forcing the withdrawal of the line. For this reason, the Russians have preferred fixing their divisions and combined arms armies to axes, with the regiments rotating their battalions, such that the commanders have a protracted exposure to and understanding of the terrain. Ukrainian commanders argue for a similar approach, with higher echelons, with long-term familiarity with the geography, managing this process, given that problems are most acute when fresh units are endeavouring to take over positions. The announcement that Ukraine will establish Army Corps is partly aimed at resolving this problem.

Once troops are on the positions, the challenge of resupply is being partly addressed through the use of UAVs to deliver ammunition and rations forwards. It has even proven possible on occasion for a unit's chefs to prepare fresh food for units and for this to be delivered in packages via UAVs to dispersed elements of the force, thereby removing the risk of casualties during the operation. Weight is a limitation for this method – such that it is difficult to resupply heavy equipment to the forward positions – and another factor that caps the viable force density that can be sustained across a given area. UGVs may assist with the limitations on weight, but officers noted in interview that their reliability was a persistent problem.

For artillery and mortar ammunition and when reinforcement of a position must be carried out under critical conditions, the use of either HMMWVs (Humvees) or M113 armoured personnel carriers (APCs) is preferred by Ukrainian troops. Both are liked because of their speed and mobility on difficult terrain, reducing the period of exposure and enabling

survivability. For Russian forces, there is a similar division between the use of light utility vehicles and bikes to move supplies quickly, and Tigr-M, MRAP-type vehicles, or BMP or MTLB armoured vehicles for resupply, depending on the equipment available to the unit.

Another area of adaptation is the increasing of and changing approach to caching equipment. For artillery, Russian forces have begun to cache ammunition within a retrievable distance from their guns but separate from the firing position. Ukrainian personnel use similar methods. The advantage of this approach is that it allows heavy equipment to be brought forward by a larger vehicle when the weather permits, but for this equipment to then be accessible to the fighting units when there is a need for it.

Long-Range Strike, Air Defence and Electronic Protection

The air defence challenge must be broken down into the protection of forces and the protection of terrain.

The Protection of Forces

Each day in August 2024, Ukrainian air defenders reported that Russia was flying between 1,000 and 1,500 Orlan-10 and Zala reconnaissance UAV orbits deep over Ukrainian positions. By 2025, Ukraine had managed to reduce, though not eliminate, the density of these systems through the employment of networked radar and electro-optical guidance of interceptor UAVs that have inflicted steady losses on Russian ISR. Nevertheless, the density of observation has prevented Ukraine from pushing air defences forward. When this has been attempted, Russia has successfully found and engaged these targets, usually with 9M723 ballistic missiles. The short-ranged air defence that remain survivable offer some deterrent value against the VKS pushing further into Ukrainian air space. As detailed above, however, this does not prevent the VKS from delivering glide bombs from outside the engagement envelope of Ukrainian defensive surface-to-air missiles (SAMs).

Electronic protection of troops has become indispensable for both sides to reduce the exposure of units to strikes by UAVs. The Russian transfer to fibre-optical cable for guidance of FPVs may disrupt the approach to EW, but at present, navigational jamming is ubiquitous throughout the combat area. Jamming of command frequences is also widespread. Most vehicles entering the combat zone also carry jammers, primarily aimed at disrupting command links or video feeds to reduce the terminal accuracy of FPVs. EW is effective in significantly reducing the reliability of UAVs and disrupting the accurate fixing of targets to cue strikes. However, it is also causing widespread issues with deconfliction and fratricide causes friendly UAV operations to be periodic rather than continuous.

The Protection of Territory

This is a different matter. Russia has adopted a two-track approach to strikes. The first involves continuous harassment with Geran-2 and Gerbera UAVs. Some fly low, but mostly, the Russians fly high to make the means of interception as expensive as possible. These UAVs tend to be routed to strike airfields, training areas, transformer sub-stations and industrial facilities. The UAVs are usually sent in waves, with data pushed back from the first UAVs to inform the path taken by subsequent UAVs.

Ukraine now has a dense network of EW effectors and passive sensors that can track the progress of air threats across the country. The most efficient means of shooting down Geran-2 and Gerbera UAVs flying at a higher altitude include helicopters and combat air patrols. Generally, Ukraine endeavours to wear down the waves of UAVs over a significant distance using a distributed defence, so that the point defences at the eventual target – ranging from self-propelled anti-aircraft guns and mobile fire teams with heavy machine guns, to man-portable air-defence systems (MANPADS) teams and SAM systems – have to engage as few targets as possible. These methods have proven successful, with the vast majority of OWA-UAVs intercepted.

The value Russia gains in conducting the OWA strikes is less about the damage inflicted than it is about the data gathered in mapping EW and air defence systems and forcing Ukraine to expend stocks. Russia is currently set to produce in 2025 more than 750 9M723 ballistic missiles and more than 560 Kh-101 cruise missiles, according to plans drawn up by the Russian Ministry of Defence. It will therefore continue to deliver salvos at intervals. When the authors reviewed the tracks of these engagements, it is evident that they are carefully planned. Russian cruise missiles are often routed to avoid EW defences before their terminal phase. They also move to avoid air defence positions and are often synchronised so that they approach the target in a short period of time from several directions. Russia has also made substantial improvements to the construction of systems. As well as adding a wider variety of warheads – including cluster warheads – to Kh-101, they have upgraded the camera and processing units such that it can perform much better visual terrain tracking, and thereby avoid disruption from EW during its terminal phase. The missile is also now dispensing countermeasures, which can be used to protect it when crossing the positions of MANPADS teams. The result is that although Ukraine does achieve many intercepts, Russia usually damages or destroys what it targets during these strikes. Nevertheless, Russia has not been able to strike frequently enough or exercise sufficient discipline in the target sets it engages to inflict critical damage.

Ukraine's long-range strike campaign against Russia has been constrained by having far fewer strike systems than Russia, but has been at least as sophisticated, if not more so, in its route planning and integration. Ukraine has become highly efficient at routing UAVs to bypass much of Russia's air defences. Russia has responded by placing SA-22 Pantsir SAM systems on towers around most critical targets. Nevertheless, Ukrainian planners have found that by firing a sufficiently large salvo of UAVs at a target, it is often possible to saturate the available air defence and – when available – sequence the use of cruise missiles or larger payload UAVs for later in the engagement, such that by the time more destructive munitions arrive, the air defences are depleted. This has led to a remarkably high success rate for Ukraine in damaging targets, though with a very high expenditure of UAVs.

Recommendations for Support to Ukraine

Although Ukrainian forces are successfully delaying Russian advances and inflicting significant casualties, this is being achieved at a high price in personnel, while Ukrainian force generation is failing to meet the requirements of the force. This is the foremost problem that must be addressed if Ukraine's defence is to be sustainable. There is no 'silver

bullet' solution. Some international partners are currently emphasising the extension of conscription to 18-year-olds, but this will not address the key problems. The recommendations that follow, therefore, constitute a package of measures aimed at addressing this issue, which requires work from both the Ukrainian government and its international partners to resolve.

The greatest risk to the AFU in the short term is a collapse in morale among the veterans of the core brigades. Currently, morale is low. There are four primary contributing factors to this.

First, many experienced troops are extremely tired and feel that they have sacrificed disproportionately compared with wider society. Recent increases in desertion have not been confined to mobilised troops, although many deserters have returned to the ranks in time, sometimes having transferred unit, but often simply having rested. The lack of rotation is a major issue. Rotating brigades off the line for rest and training would significantly improve morale and fighting power.

Second, Ukrainian troops feel increasingly powerless owing to the threat from glide bombs, against which no fortification offers adequate protection, and the AFU has limited means available at tactical echelons for shooting down either the bombs or the fighters launching them. This sense of being unable to improve the situation and lacking any tactical tools to ensure safety is corrosive to morale.

Third, low pay and the lack of compensation for unrecovered dead means that many soldiers see their families becoming poorer as a result of their service. For those contemplating joining the armed forces, volunteering is to not only accept significant personal risk, but also sacrifice the financial security of their family.

Finally, because experienced commanders and units are rarely rotated off the line, there is a tendency to have new units formed and then attached to existing brigades. This leads to experienced battalions being depleted, while new battalions lack the skills to fight effectively. Moreover, equipment often goes to the new units even though these units lacked the experienced officers and junior leaders to employ that equipment effectively, while veteran units often make do with sub-standard equipment. It is notable that cohered brigades where the battalions are organic to the unit consistently perform better on the frontline than composite units.

The recommendations to Ukraine to address this multifaceted problem are as follows.

- Ukraine's international partners should work with the Ukrainian Ministry of Defence to improve the pay offer to troops and ensure there is the finance to cover this.
- The legislation on compensation to families should be altered so that if a body can be photographed and geo-located, this is sufficient for compensation to be released, rather than there being a need to recover the body.
- Ukraine should stop forming new combat units and instead prioritise bringing existing units up to strength, with the priority being experienced units. This change is already being implemented but it must be accompanied with the rotation of units

off the line so that veterans can help to train replacements while also resting and carry out collective training away from the front.

Ukraine's international partners should shift to delivering training and advice in Ukraine on Ukrainian training areas, rather than trying to train Ukrainian troops outside of Ukraine. It is not realistic to move experienced units, with their equipment, to France or Germany, regardless of the theoretical advantages, so endeavouring to deliver collective training outside Ukraine will drive attempts to create new units who lack experienced troops.

International partners should also prioritise exploring solutions to the threat from glide bombs. The most likely means of achieving effects in this area are to resource Ukraine's long-range strike programme to target fuelling and rearming points and air bases of the VKS. International partners should also consider reducing the serviceability of Russian strike aircraft by further degrading Russia's aviation sector. Reducing the sortie rate of the VKS should be the priority. As this will take time to have an impact, improving the ability of units to detect and react to UMPK glide bomb releases would give personnel some capacity to adopt countermeasures. Options for intercepting glide bombs may be explored but are unlikely to be fieldable at large scale within a short space of time.

Morale is also underpinned by having competitive equipment. Although equipment levels – especially relating to 155 mm artillery ammunition – have improved over recent months, there are serious shortcomings in the equipment available to Ukrainian brigades, which should be prioritised for those providing military technical assistance.

First, the need to expand production of explosive energetics and shells remains. Ukrainian officials report that they received approximately 1.6 million 155 mm shells in 2023 and 1.5 million in 2024. As the availability and quality of shells on the international market decreases, more will need to come from production lines. Investment must be sustained in Europe to expand industrial capacity in this area. But Ukraine's ammunition availability is not relevant if it does not have serviceable artillery pieces. It is therefore also critical that industrial efforts in Europe are rationalised to ensure a supply of replacement barrels and other spare parts for donated fleets, and that the number of howitzers provided to the AFU is increased. In regards to fires, this should be done alongside the financing and increased scaling of UAV production, as the two capabilities are complementary. Both areas will be critical to European defence, so investing in this industrial capacity is a win-win for European security.

Mechanisation is also critical to battlefield survivability. Infantry fighting vehicles and lighter tanks are disproportionately valuable for the mobile reinforcement of sectors under pressure in the defence. APCs, meanwhile, are indispensable for logistics, medical support, troop rotation and offensive action. The number of vehicles required means that while modern infantry fighting vehicles are a significant combat multiplier, they are also overly expensive and complex for a large proportion of the tasks for which APCs are equally capable and much more affordable. Ukraine's international partners should therefore prioritise the continued mechanisation of Ukrainian units with both IFVs and APCs. The priority for both is serviceability.

There are several areas which are currently personnel-intensive but which could be significantly improved through automation. One is air defence and counter-UAS pickets.

Ukrainian experimentation has demonstrated that automated turrets are able to reliably engage UAS using very little ammunition, whereas humans have approximately 25% efficiency when defending the targeted position. Human capabilities in this area may be improved with better sights and more appropriate small arms, but automated turrets offer a very high level of interception and can be produced at a reasonable cost. The automation of weapons currently given to mobile fire teams also offers a means of improving point defence of targets against longer-range UAVs. International partners should also support expanding the capacity of automated resupply of the fighting positions through UAS, and the development of UGVs for casualty evacuation, with the added benefit that these capabilities will also have utility for Ukraine's partners.

Finally, as the fighting is currently progressing, Russia is slowly working its way through the Donetsk defence lines. The terrain behind these positions is largely flat, open and much less defensible. While it should be hoped that Ukraine can hold Russian forces in Donetsk, international partners should help with contingency planning on the erection of new defence lines, their proper siting, and planning for when Ukrainian forces move to these positions. Current efforts in this area by non-combat troops are inadequate, due to fragmented initiatives lacking coordination and often without the relevant military engineering expertise to inform contractors where and how to position fortifications and trenches. The best opportunity is to build pre-emptively, while the absence of high-density tactical observation and massed fires makes mechanised engineering possible. Digging major subterranean defences with overhead protection serves multiple purposes. It obfuscates precise Ukrainian force dispositions and creates uncertainty about where they are concentrated. It enables covered movement between forward positions and rear areas, and with sufficient structural reinforcement and multiple entries and exits can prevent troops being entombed by glide bombs if hardened fortifications are unfortunate enough to suffer close hits during combat.

Recommendations for NATO

It should be emphasised that although Russia is putting increasing pressure on Ukraine, it is also becoming more economically vulnerable domestically and is running low across several armoured vehicle fleets. The quality of Russian infantry also continues to decline. Continuing to support Ukraine to bring about a sustainable peace should therefore be the foremost priority of European NATO as a means of reducing the threat to Europe and thereby reducing the likelihood that Europe will have to fight in the future. A sustainable peace requires that Russia is deterred from recommencing hostilities and that Ukraine has a viable economy that cannot be coercively supressed by Russian threats.

Despite this, if the situation in Ukraine deteriorates, Europe must depend upon its conventional deterrence capabilities. Learning lessons from the Russo–Ukrainian War, therefore, is important. In the current phase of the war, several deductions can be drawn relevant to NATO militaries.

The disproportionate impact of the VKS, despite the generally poor performance of Russian airpower, validates the importance placed on air power across NATO, and this area of competitive advantage should be sustained. Increasing stockpiles and the capacity to

produce long-range air-to-air munitions and stand-off strike weapons at as low a cost as possible should be critical priorities for the force.

The ability to expand the duration and complexity of long-range strike capabilities is also highly desirable. This means that investing in the production of jet engines, rocket motors and guidance and navigation units in Europe to initially provide to Ukraine's long-range strike programme would subsequently leave Europe with the industrial capabilities to sustain large-scale strike operations against Russian logistics and infrastructure in the event of war.

It is also evident that counter-UAS capabilities are an all-arms requirement for survivability, and appropriate equipment and doctrine must be issued throughout NATO forces. The priority must be economical and sustainable engagements, with the reprogramming of Remote Weapon Stations (RWS) the easiest immediate means of improving protection. Without counter-UAS capabilities, NATO militaries risk seeing high quality troops and equipment rapidly suffering losses for want of protection, when such effective protection is eminently achievable. This must be considered an all-arms concern. For infantry, for example, counter-drone nets and other simple stocks should be available alongside traditional stores like corrugated-iron or timber that can be used for augmentations to fortifications.

The scale of IFV and APC production is severely limited by an over-emphasis on quality over quantity. Although IFV optics and other sensors are valuable, there is a need to improve the level of mechanisation and the sustainability of mechanised units. For this reason, European defence industry should be incentivised to expand the capacity to build drive trains and armoured hulls. In the UK, the maintenance of the Ajax production facility and a replacement for Bulldog should be industrial, as much as military, priorities. Training of close-support logistics units with armoured vehicles should be a priority, alongside tactics like containerisation, caching and UAV resupply for logistics troops organic to combat units.

Maximising the stand-off firepower of tactical formations should be a priority. In the first instance, scaling the use of wire-guided strike UAS within formations is sensible, but this should not be done at the expense of conventional artillery. European militaries should also carefully consider their commitments against the production and use of cluster munitions and should regenerate the ability to deploy AT and AP mines. Without these, they risk lacking both the required lethality to fight effectively, and the ability to reduce enemy mobility sufficiently to allow that lethality to be brought to bear. Explosive counter mobility capabilities may be achievable in a manner that is consistent with existing treaty obligations, due to technological advances, though some alterations to treaties to reflect technological advances may also be worth exploring. Stockpiling specialist munitions like BONUS shells is also a priority. Nevertheless, artillery will be damaged in war, and ensuring the industrial capacity to sustain an artillery capability is vital.

Tactically, one of the areas of greatest importance for NATO militaries is the update of medical doctrine. Put simply, existing medical doctrine is not executable under modern combat conditions. Military medics are not equipped or prepared either for the scale of casualties involved in high intensity combat or the challenges of evacuating casualties and treating them in a rear area that is under persistent observation and the threat of strike. This

is an area that could seriously degrade morale, even among highly professional troops, without preparing personnel with realistic expectations and appropriate drills, and should be prioritised for experimentation.

As the character of the threat continues to evolve, it is important that NATO militaries ensure that they are adapting to meet the challenges of tomorrow, rather than perfecting the execution of past doctrine.

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