The Hague Centre
for Strategic Studies

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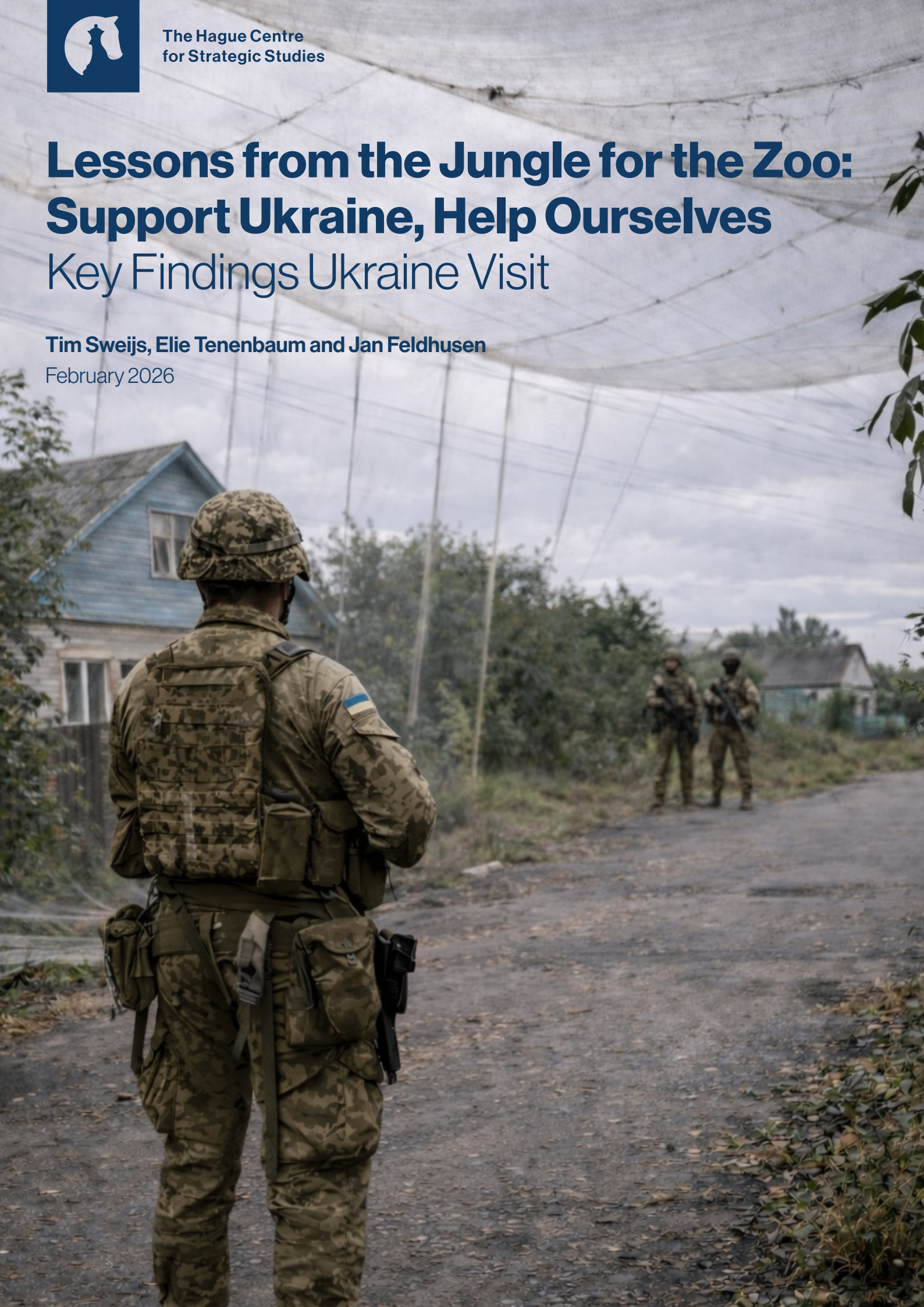
Key Findings Ukraine Visit

Tim Sweijs, Elie Tenenbaum and Jan Feldhusen

February 2026



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Executive Summary

Since Russia's large-scale invasion of February 2022, European states have offered financial and military support to Ukraine sufficient to sustain its defence against the Russian aggressor but not enough for Ukraine to push the Russians out of Ukraine and win the war.

Meanwhile, European countries increased their defence budgets to strengthen hollowed out armed forces and rebuild dilapidated defence industries. Yet, despite the sharp increase in defence budgets, the pace of European rearmament remains slow, and few lessons from the war are identified, let alone learned and implemented.

The slow pace of adaptation is visible throughout. Despite the fact that the war's character is clearly multidomain in nature, the materialisation of Multidomain Operations (MDO), a concept introduced almost a decade ago, stalls in many European armed forces, with conceptual and doctrinal development lagging, and technologies and training lacking. Ossified bureaucratic structures continue to inhibit adaptation and transformation both within the armed forces and in the wider defence ecosystem surrounding it. This includes underutilisation of (dual use) small and medium sized enterprises (SMEs) for defence tech innovation and production because of long lead times for defence orders, the absence of pre-order financing, and overall deficient funding structures. Persistent fear amongst European institutional investors such as pension funds that they violate environmental, social and governance (ESG) standards inhibits the necessary upscaling of European defence.

In short, Europe is not adapting to the changing character of war, neither transforming its defence and security ecosystem, nor scaling up sufficiently. It is still not adequately prepared for a large-scale conventional war with Russia. The question "how can Europe most effectively support Ukraine?" should therefore be complemented with the question "how can Europe learn relevant lessons from the Ukrainian experience to adapt its militaries, industries and societies to prepare for the challenge at hand?"

This report considers insights from Ukraine in its adaptation competition with Russia. These insights are subsequently used to assess required force models for Ukraine going forward and requirements for international support; as well as to deduct lessons for Europe to expedite its modernisation and transformation efforts. It is based on desk research and a visit to Kyiv in the autumn of 2025 where the authors met with a wide variety (28) of stakeholders: military operators, strategists and defence planners, policymakers, diplomats, mil-tech scouts, NGO representatives, and charity foundation representatives involved in funding the war effort.

The Adaptation Competition

The Russia-Ukraine War has been a contest in adaptation between two militaries, between the polities directing these militaries, and between the societies sustaining the war. Since the beginning of the Russia-Ukraine war, a significant and rapid evolution has taken place at all levels of war. In the competition of adaptation both sides have pioneered new tactics and engineered many system innovations. Sometimes innovation has resulted from centrally directed planning efforts—for example the development of deep precision strike by Ukraine, but

more often through decentralised trial-and-error experimentation with short feedback loops between frontline brigades and Research & Development and production ecosystems in the hinterland with successful innovations pushed out to other brigades.

Ukraine's Innovation Ecosystem

The quick rate of military-technological adaptation has been enabled by Ukraine's thriving defence and security ecosystem with fluid connections between various branches of the ecosystem. The situation in Ukraine can be compared to a jungle, where a large ecosystem of frontline operators, factories, NGO-consultancies, charity foundations, professionals and volunteers co-exist alongside the official system of the centralised government in Kyiv tied together through an intricate web of informal and formal connections. The centralised government still holds a pivotal role, not just in terms of determining the overall war strategy and policies, but also in terms of the certification of particular systems that have emerged bottom up, the reward of particular effective brigades, the allocation of budgets, the work on military systems that transcend the tactical and operational level, and the translation of operational needs and requirements into demands for Western support.

This is in stark contrast to Western European states, where, over the years, defence bureaucracies have sought to rationalise and streamline R&D efforts which take place into clearly delineated parcels behind demarcated fences while private initiatives and SMEs face high entry barriers. The current situation in the West is perhaps captured by the image of a zoo, with zoo caretakers (R&D managers) managing R&D processes (innovation) while the wild animals have been tamed, or otherwise exported back to their country of origin.

Societal Resilience and International Support

Beyond the military and industrial spheres, Ukrainian society has demonstrated remarkable resilience and adaptability in sustaining a prolonged high-intensity conflict. The population has adapted to living under constant threat while maintaining economic activity and social cohesion. Civil society organisations have mobilised to support the war effort through fundraising, logistics, and volunteer networks have complemented formal state structures. In addition to paying taxes, citizens also donate significant amounts of money to private foundations that channel money and sometimes even equipment to the armed forces directly.

International support, meanwhile, has been indispensable to Ukraine's defence. Partners have provided financial assistance, military equipment, training, and intelligence sharing that have enabled Ukraine to offset Russia's material advantages. Yet this support has often been reactive rather than proactive, calibrated to prevent Ukrainian defeat rather than enable Ukrainian victory. Understanding the interplay between military adaptation, industrial capacity, societal resilience, and international support is essential for drawing actionable lessons for Europe's own preparedness.

Ukraine's Theory of Victory

Ukraine will not be able to impose a decisive battlefield defeat on Russia. It should therefore double down on "strategic neutralisation" of its adversary, by suppressing Russian military power and denying Russia's ability to achieve its core objectives, steadily eroding its offensive

potential, and hardening Ukraine's resilience to the point where continued aggression ceases to offer Moscow any plausible path to strategic gain. Ukraine's theory of victory is not about a quick knockout blow, but about turning Russia's war into a long, costly, and ultimately futile enterprise. For Ukraine to succeed in such a strategy, multiple lines of effort are needed.

First, Ukraine must maintain the integrity of the state —its political leadership, critical infrastructure, and economic lifelines— under prolonged attack, including sustained strikes against the energy grid and urban centres.

Second, it must degrade Russian combat power faster than Russia can regenerate it, through continuous pressure on logistics hubs, ammunition depots, command and control nodes and critical enablers in occupied territories (including Crimea), and the Russian operational and strategic depth.

Third, it must prevent Russia from consolidating and legitimising occupation by keeping the theatre contested—through deep strikes, information operations, and resistance activities that raise the political and military cost of holding territory. Finally, strategic neutralisation assumes the long-term integration of Ukraine into Western defence-industrial and security networks: sustaining a qualitative edge in key capabilities and securing enduring external support so that Russia cannot simply outlast Ukraine.

If Ukraine's theory of victory rests on a denial strategy, the corresponding force model must be built for endurance, operational depth, and scalable strike rather than for a single, short-lived manoeuvre campaign. This is what ongoing Ukrainian reforms attempt to codify in a future force model being developed with allies through NATO's Security Assistance and Training for Ukraine mission, Capability Coalitions, and a growing web of bilateral security agreements. These structures are progressively moving from ad hoc equipment lists to multi-year capability roadmaps out to 2027, tying force design for the UAF (structures, C2, readiness) to long-term industrial and financial trajectories.

The Strategic Calculus for Europe

The outcome of the war in Ukraine will fundamentally shape European security for decades. NATO's New Force Model calls for 800,000 high-readiness troops and a significant increase in combat brigades to ensure long-term regional stability. Ukraine's current force of nearly one million personnel mirrors these structural requirements. Moreover, by tying up over 700,000 Russian troops, Ukraine is actively degrading the combat power that would otherwise be positioned directly against NATO borders. Collective Western support of about €80 billion per year sustains this force. The counterfactual is bleaker still: a Cold War-style deterrence posture against Russia advancing to NATO borders would cost an estimated USD $200-280 billion annually, while calculations show that a Russian victory could impose costs on Europe's largest economy Germany alone reaching twenty times current Ukraine aid contribution.

Europe's strategic calculus is clear: it can offer the required support for Ukraine's defence, in recognition of the fact that Ukraine bears the brunt of the cost, including in human lives; or it can face up to the far more expensive prospect of directly deterring or even fighting a Russian military that, without Ukrainian attrition, would retain the combat experience and equipment stocks to threaten NATO member states by the end of the decade. The EU's approval of a €90 billion loan to Ukraine backed by the EU budget in December last year, preventing Ukrainian bankruptcy and providing Ukraine funding for 2026-2027 falls €40 billion short of

the IMF's calculated €130 billion two-year funding requirement. To fully replace US aid, Europe must allocate 0.21% of combined GDP annually, more than double historical averages for major European economies.

Military Support Models

Military support to Ukraine has entered a new phase following the collapse of US aid in mid-2025. While US weaponry continues to flow through backfilled pledges, Europe is now the primary but struggling provider. Significant hurdles include the rising costs of second-hand US equipment, the exhaustion of old stock donations, and the slow scaling up of Europe's own defence industrial output. In addition, there remains significant idle capacity in Ukrainian defence industry. To address these gaps, the "Danish model" has gained traction, with European states funding production directly within Ukraine's adaptive defence industry.

Under this approach, European states provide funding to procure equipment directly from Ukrainian defence companies, enabling local production close to the front. The advantages are clear: Ukraine's defence tech ecosystem is highly adaptive, labour costs are lower, regulatory barriers are fewer, and production cycles are often much shorter. However, this model also has limits. Production sites remain vulnerable to Russian strikes, Ukraine's industry cannot yet produce many high-end systems at scale, and —critically— it does little to help European defence industries expand capacity or resilience. To combine the strengths of direct Ukrainian procurement and European industrial scaling, joint-venture (JV) models may be the way forward. The logic is to create European-Ukrainian industrial partnerships in which European firms may team up with Ukrainian counterparts, with contracts funded by European governments. This approach strengthens Ukraine's emerging DTIB while embedding it within European supply chains.

JV partnerships face their own obstacles, however. Intellectual property (IP) protection is a major concern on both sides. European firms often cite Ukraine's weak IP enforcement framework and fear technology leakage. Conversely, Ukrainian companies at the cutting edge of AI-enabled targeting and autonomous systems worry about losing control over their data sets and algorithms when partnering with large European primes. Potential solutions include the development of standardised, EU-backed IP and data-protection frameworks for wartime co-production; political risk-sharing mechanisms and insurance instruments to de-risk investment; and clearer pathways for Ukrainian firms' gradual integration into the European EDTIB rather than their marginalisation as temporary subcontractors.

Support Time Horizons

Overall, the central lesson of the past four years is that Ukraine support cannot be episodic. It requires persistent funding across different time horizons.

In the short term (0–12 months), the priority remains filling critical battlefield gaps: air and missile defence, ammunition, counter-UAS, and sustainment. Speed matters more than elegance, and political constraints should be judged against the cost of Ukrainian battlefield failure.

In the medium term (12–36 months), assistance must shift toward reforming Ukraine's force posture, regenerating units, and building an indigenous defence and technological industrial

base capable of sustained output. This is where Joint Venture models and European-funded co-production become strategically decisive.

In the long term (36–120 months), the objective should be to ensure Ukraine's survival as an independent, militarily viable state through a "porcupine" model: a mix of financial support, selective imports of advanced systems, dense domestic production of mass capabilities, and deep economic and industrial integration with Europe. Assisting Ukraine, in this sense, is not altruism. It is a direct investment in Europe's own security, credibility, and strategic autonomy.

A Two-Way Street: Learning from Ukraine

Learning lessons is a two-way street: train and assist missions are not only about supporting Ukraine but also about preparing Europe for the new realities of modern warfare. It is critically important to ensure that lessons from the war are not only identified but also disseminated to a larger group of stakeholders inside and outside defence organisations, to be learned and subsequently translated into policies and actions that will enable European armed forces and societies to adapt and transform. The main body of this report offers critical insights that European defence organisations can draw on.

A Ukraine Defence Observatory

To ensure this will be a continuing process, we recommend the establishment of a cross-European state Ukraine Defence Observatory with critical hubs in different European capitals as well as a foothold in Kyiv. The Observatory will be tasked to (1) capture frontline adaptations across tactical, operational, and strategic levels; (2) analyse developments within Ukraine's defence innovation ecosystem; (3) translate findings into recommendations for Western force development and defence ecosystem requirements; and (4) shape short, medium, and long-term international support models through practical policy recommendations. The ultimate objective is to accelerate Western adaptation while directly supporting Ukraine's fight for sovereignty.

1. Introduction

Since Russia's large-scale invasion of February 2022, European states have offered financial and military support to Ukraine to sustain its defence against the Russian aggressor but not enough for Ukraine to push the Russians out of Ukraine and win the war. European countries also increased their defence budgets to strengthen hollowed out armed forces and rebuild dilapidated defence industries. Yet, despite the sharp increase in defence budgets, the pace of European rearmament remains slow. And few lessons from the war are identified, let alone learned and implemented. A case in point is that after close to four years of war in which both sides have used millions of drones, European countries have failed to develop the necessary counter drone capabilities. Russia's dispatch of decoy drones into Polish airspace in the autumn of 2025 had to be countered with rockets costing USD $ 1.2 million each. Unmanned system task forces have only recently been set up in the West and often only as single service efforts. Extremely costly tanks, frigates and fighter jets still account for at least 90% of the development and acquisition investments, even though the war's dynamics in Ukraine and Russia showcase the effectiveness of cheap and expendable systems as an integral part of mixed arms packages in action.

Few lessons from the war are identified, let alone learned and implemented.

The slow pace of adaptation is visible throughout. Despite the fact that the war's character is clearly multidomain in nature, the materialisation of Multidomain Operations (MDO), a concept introduced already quite some years ago, stalls in many European armed forces, with conceptual and doctrinal development lagging, and technologies and training lacking. Ossified bureaucratic structures continue to inhibit adaptation and transformation both within the armed forces and in the wider defence ecosystem surrounding it. This includes underutilisation of (dual use) small and medium sized enterprises (SMEs) for defence tech innovation and production because of long lead times for defence orders, the absence of pre-order financing, and overall deficient funding structures. Persistent fear amongst European institutional investors such as pension funds that they violate environmental, social and governance (ESG) standards inhibits the necessary upscaling of European defence.

In short, Europe is not adapting to the changing character of war, not transforming its defence and security ecosystem, not scaling up sufficiently; and is still largely unprepared for a potential war with Russia. The question how Europe can most effectively support Ukraine should therefore be complemented with the question how Europe can learn relevant lessons from the Ukrainian experience to adapt its militaries, industries and societies to prepare for the challenge at hand. Supporting Ukraine is often framed, and legitimately so, as part of a commitment to international law, justice and order. But this support is increasingly becoming a matter of self-interest. Ukraine pins down Russia and degrades Russian forces. To side with Ukraine is to join forces with a battle-hardened fighting machine with hundreds of thousands of seasoned soldiers, and a strongly developed industrial base that can help European NATO allies grow and scale their military capabilities. That is, if Ukraine does not lose.

The Russia-Ukraine War, like other wars, has been a competition in adaptation between two militaries, between the polities directing these militaries, and between the societies sustaining the war. The Armed Forces of Ukraine (AFU) must constantly adapt to deal with

the relentless onslaught of Russian forces that can draw on a much larger resources pool. It has been extremely successful at this. Beyond the military and industrial spheres, Ukrainian society has also demonstrated remarkable resilience and adaptability in sustaining a prolonged high-intensity conflict. The population has adapted to living under constant threat while maintaining economic activity and social cohesion. Civil society organisations have mobilised to support the war effort through fundraising, logistics, and volunteer networks have complemented formal state structures. This societal mobilisation has been essential to Ukraine's ability to continue the fight. To take one powerful image: if a snail would have started out from Ukraine's eastern borders in February 2022, and traversed Ukraine's admittedly vast steppe-lands, it would have been deep into Poland by now.[1] Instead, the Ukrainians have kept up the fight, and over the past four years the Russians have conquered about twenty percent of Ukrainian territory against horrific losses. Yet, over the past few months, concerns about Ukraine's ability to keep up have grown. Russia has slowly started to annex more territory, while meeting its recruitment targets, and showing a stronger military regeneration ability than initially anticipated.[2] Meanwhile, US President Donald Trump has been putting enormous pressure on Ukraine to sign a ceasefire agreement, the outcome of which at the moment of writing is still unclear.

International support, meanwhile, has been indispensable to Ukraine's defence. Partners have provided financial assistance, military equipment, training, and intelligence sharing that have enabled Ukraine to offset Russia's material advantages. Yet this support has often been reactive rather than proactive, calibrated to prevent Ukrainian defeat rather than enable Ukrainian victory. Understanding the interplay between military adaptation, industrial capacity, societal resilience, and international support is essential for drawing actionable lessons for Europe's own preparedness.

In this report, we consider insights from Ukraine in its adaptation competition with Russia. These insights are subsequently used to assess required force models for Ukraine going forward and requirements for international support; as well as to deduct lessons for Europe to expedite its modernisation and transformation efforts.

To this purpose, we visited Kyiv in the autumn of 2025 and met with a wide variety (28) of stakeholders: military operators, strategists and defence planners, policymakers, diplomats, mil-tech scouts, NGO representatives, and charity foundation representatives (involved in funding the war effort). We gratefully acknowledge the invaluable support of our partner Ukrainian PRISM in this effort. Our aim was to gain insights in themes divided in four baskets, which also provide the section structure to this report:

1. **War and Adaptation.** What are the most important adaptations from the last 6-12 months for the tactical, operational and strategic levels of war, and what are lessons for Western defence organisations?
2. **Innovation, Industry, and Society.** What are the strengths and weaknesses of Ukraine's wider defence and security ecosystem, including society, and what are relevant insights for scaling up and transforming the European defence industrial and technological base (EDTIB)?

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1 Jonathan Moynihan, 'Russia's Advance Is Slower than a Snail, Says Former Chief of the Defence Staff', *Bfbs Force News*, 5 September 2025, https://www.forcesnews.com/ukraine/russias-advance-slower-snail-ex-chief-defence-staff-says.

2 Stephan De Spiegeleire and Hryhorii Pavlenko, *A Militarily Regenerated Russia as a Future Threat to NATO? Perspectives from Russia Itself* (The Hague Centre for Strategic Studies, 2025), https://hcss.nl/wp-content/uploads/2025/04/A-Militarily-Regenerated-Russia-as-a-Future-Threat-to-NATO-HCSS-2025.pdf.

3. **The Path to Victory and (Force) Requirements.** What are Ukraine's requirements to sustain the fight and survive as a sovereign nation?
4. **International Support.** What does this mean for international support and collaboration models, short-, medium- and long-term?

Before turning to our findings, a word on methodology and limitations. The insights presented in this report are derived primarily from extensive interviews with Ukrainian stakeholders, complemented by desk research and open-source analysis. We did not conduct direct observations on the front line, nor did we have access to classified operational data. Our interlocutors, while highly informed and often with recent frontline experience, necessarily provided perspectives filtered through their institutional positions, areas of responsibility and particular experiences. The resulting analysis should therefore be understood as synthesis of informed perspectives rather than a comprehensive assessment.

Part I.
War and Adaptation: Insights from Ukraine

Since the beginning of the Russia-Ukraine war, a significant and rapid evolution has taken place at all levels of war. For instance, ubiquitous battlefield transparency at the tactical level means that, along the frontline, both sides are able to practically hit 'everything, everywhere, all at once'. The classic kill chains with linear sensor-to-shooter paths that Western armed forces are accustomed to have morphed into distributed kill webs in which different sensors can cue many different effectors. Such an architecture is made possible through battle management systems (BMS) that fuse Intelligence, Surveillance, and Reconnaissance (ISR) feeds from various sources—Unmanned Aerial Vehicles (UAVs), signals intelligence (SIGINT), human intelligence (HUMINT)—into a common operational picture that can dynamically orient shooters—artillery, rocket launchers, loitering munitions, First-Person View (FPV) drones and special forces—against fleeting targets.[3]

In the competition of adaptation both sides have pioneered new tactics and engineered many system innovations. Sometimes through centrally directed planning efforts—for example the development of deep precision strike by Ukraine. Sometimes through decentralized trial-and-error experimentation with short feedback loops between frontline brigades and Research & Development and production ecosystems in the hinterland; with successful innovations pushed out to other brigades. Below we consider the most important adaptations in the close, rear and deep area, command and control, and operational effectiveness, and examine developments in the wider security and defence ecosystem.

Both sides are able to practically hit 'everything, everywhere, all at once'

[3] Kateryna Ostapenko, 'Ukraine's Kill Web: A Networked Revolution in Modern Warfare', The Gaze, 29 August 2025, http://thegaze.media/news/ukraines-kill-web-a-networked-revolution-in-modern-warfare.

2. The Close Area

2.1. From Line of Contact to a Kill Zone

The *front* is no longer a line of contact, but has expanded into a *kill zone*, with a depth of at least 10-15 kms and at some places up to 30kms, featuring a multitude of fires and infantry positions located in various degrees of depth. At the most forward deployed positions along the front, soldiers are hiding in very small groups of approximately five persons in fox holes covered by blindage. Due to the constant presence of UAV-coverage, climbing out of these fox holes, either for offensive action or for rotation back to the rear area, carries extremely high casualty risk. The massive dronification of the battlefield has by now been well documented.[4] Both sides rely on "carousels" of small dual use ISR UAVs, such as for instance DJI Mavics, that return to home base every 15 minutes because of limited battery power, typically after being replaced by another UAV.

2.2. Electronic Warfare against Unmanned Systems

Ukraine's widespread dissemination of unmanned systems in contested electromagnetic spectrum environments represents more than a simple substitute for ammunition shortages. While strike drones, particularly FPV systems, have indeed filled firepower gaps, they now account for 60-70% of all combat losses and serve as the primary sensors, relays, and effectors across the battlefield.[5] Electronic warfare (EW) has long been an area of strength for the Russian military, employed both to degrade enemy communications and to provide intelligence for target acquisition through signal triangulation. The proliferation of drone systems by both Ukrainian and Russian forces has dramatically intensified the incentives to deploy EW capabilities. Currently, EW systems operate at brigade and company levels, representing more an area of high-rate adaptation than fundamental technological innovation. Key electromagnetic activities include radio electronic suppression and jamming of drone control signals, signals intelligence (ELINT) for drone location and triangulation, and GNSS degradation that has rendered GPS-based navigation severely unreliable, leading users to declare that "GPS is dead" in contested areas.

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4 Vincent Tourret, *Design, Destroy, Dominate. The Mass Drone Warfare as a Potential Military Revolution* (Institut français des relations internationales, 2025), http://www.ifri.org/en/papers/design-destroy-dominate-mass-drone-warfare-potential-military-revolution; Gregory C. Allen et al., *The Russia-Ukraine Drone War: Innovation on the Frontlines and Beyond* (Center for Strategic and International Studies, 2025), https://www.csis.org/analysis/russia-ukraine-drone-war-innovation-frontlines-and-beyond.

5 Vincent Tourret, *Design, Destroy, Dominate. The Mass Drone Warfare as a Potential Military Revolution* (Institut français des relations internationales, 2025), http://www.ifri.org/en/papers/design-destroy-dominate-mass-drone-warfare-potential-military-revolution.

At the tactical level, EW now fundamentally constrains operations on both sides.[6] The electromagnetic spectrum is saturated with jamming, creating a dual problem. Ukrainian forces struggle to maintain communications and drone operations, while any electronic emission risks giving away their positions. The cluttered EW environment causes both reconnaissance and strike drones to drop from the sky constantly. In response, Ukrainian forces have increasingly turned to fibre-optic controlled drones, which provide immunity to jamming but come with their own operational limitations, such as range, altitude, and manoeuvrability constraints.[7] Simultaneously, there is growing demand for higher-quality wireless systems, such as SILVUS radios and datalinks, that offer EW-resilient communications through advanced frequency-hopping and anti-jamming capabilities, allowing forces to maintain the operational flexibility that fibre-optic tethers cannot provide.[8]

2.3. **AI-Enabled Autonomy**

The degradation of the electromagnetic spectrum has also been the primary driver for developing AI-enabled drones.

The degradation of the electromagnetic spectrum has also been the primary driver for developing AI-enabled drones. Ukrainian developers have responded with two key AI technologies. First, video navigation systems that enable drones to operate in heavily degraded electromagnetic environments, functioning without radio frequency links and without GNSS positioning. Companies like The Fourth Law (TFL) have been at the forefront of this innovation, creating autonomous navigation capabilities that rely on visual processing rather than vulnerable electronic signals. Second, "last mile targeting" solutions employ pixel-locking technology, where the drone's onboard system locks onto specific pixels of a pre-validated target and autonomously homes in on it even after losing connection due to enemy jamming.[9] Meanwhile, AI-enabled platforms like Avengers now automatically detect approximately 12,000 pieces of enemy equipment weekly.[10]These innovations have transformed Ukraine's unmanned systems from remotely piloted platforms dependent on constant communication into semi-autonomous weapons capable of completing strikes despite Russia's elaborate EW countermeasures.

2.4. **Russian Tactical Adaptation**

Russia's elite Rubicon unit, a top-secret Moscow-based centre for advanced unmanned technologies, has pioneered fibre-optic drones and integrated these capabilities with Russian forces across the front, creating what analysts describe as a "saturated drone operating environment" where larger formations become easy targets for aerial reconnaissance and

6 Brig Jaideep Agarkar, *Russia-Ukraine War: Lessons from an Electronic Warfare (EW) Perspective* (Centre for Land Warfare Studies, 2025), https://claws.co.in/russia-ukraine-war-lessons-from-an-electronic-warfare-ew-perspective/.

7 David Hambling, 'Fiber Optic Bird's Nest Heralds A Fiber Drone Summer In Ukraine', *Forbes*, 6 June 2025, https://www.forbes.com/sites/davidhambling/2025/06/06/fiber-optic-birds-nest-heralds-a-fiber-drone-summer-in-ukraine/; Marcin Frąckiewicz, 'Jam-Proof & Unstoppable: How Fiber-Optic Drones Are Rewiring the Future of UAVs', *TechStock²*, 17 June 2025, https://ts2.tech/en/jam-proof-unstoppable-how-fiber-optic-drones-are-rewiring-the-future-of-uavs/.

8 Silvus Technologies, 'Secure and EW Resilient Mesh Network Communications', February 15, 2024, *The Waveform Blog*, n.d., https://silvustechnologies.com/blog/resilient-mesh-network-communications/.

9 Kateryna Bondar, *Ukraine's Future Vision and Current Capabilities for Waging AI-Enabled Autonomous Warfare* (Center for Strategic and International Studies, 2025), https://www.csis.org/analysis/ukraines-future-vision-and-current-capabilities-waging-ai-enabled-autonomous-warfare.

10 Ministry of Defence of Ukraine, 'Kateryna Chernohorenko: 12 000 enemy targets are detected by the Ukrainian military weekly with the help of artificial intelligence', Ministry of Defence of Ukraine, 23 September 2024, https://mod.gov.ua/en/news/12-000-enemy-targets-are-detected-by-the-ukrainian-military-weekly.

strikes.[11] In this environment, Russian forces have adapted their infantry tactics by deploying small teams of just three to four soldiers to infiltrate Ukrainian positions, with Rubicon operators in the area to guide tactical decisions like movement windows and approach routes, as well as to interdict Ukrainian lines of communication and eliminate drone operators.[12] These lightly-armed teams operate in urban environments like Pokrovsk, sometimes crawling through gas pipes under rivers to avoid detection. Rather than traditional assault formations, they serve as the spearhead, systematically identifying Ukrainian firing positions and weak points through repeated small-unit probing attacks. Through this iterative process, Russian forces gradually establish protected positions closer to Ukrainian lines, stocked with ammunition and supplies, while preserving their more experienced assault infantry for exploitation once weaknesses are identified.

Ukrainian forces have responded by intensively searching for Rubicon forward bases and erecting nets to ensnare their drones. Meanwhile, Rubicon continues to expand its operations, now training other Russian drone units and developing AI-powered robotic systems that give glimpses of what the future of autonomous warfare could look like: "swarms of autonomous drones that overwhelm adversaries' defences, microdrones that are difficult to identify or stop, and drones that mimic birds, bugs or other wildlife."[13] One Ukrainian frontline operator we interviewed said: "They fight war in a very rational way." Given numerical asymmetries, "we need a kill ratio of 1:5 in order to survive" and faced with extensive Russian electronic warfare, "one day we lost 15 MAVIC reconnaissance drones."

2.5. **The Displacement of Armour**

The proliferation of unjammable fibre-optic drones has drastically decreased the effectiveness of Counter-UAV EW systems: pervasive transparency is maintained, rendering any movement much more dangerous as UAVs are now less vulnerable to electronic countermeasures.[14] As a result, both sides keep valuable assets including armoured vehicles and tanks out of range from the densest parts of the kill web, relegating them to subsidiary roles.

Tanks are still present on the battlefield but positioned farther from the frontlines. They function primarily as indirect fire support platforms rather than breach and exploitation tools that characterised their earlier doctrinal employment in Soviet and Russian doctrine.[15] They now operate according to what might be termed "shoot and scoot" tactics, functioning essentially as mobile field artillery that provide fire support before rapidly repositioning to avoid counter-battery fire and drone strikes.[16] Significantly, this fire support increasingly includes non-line of sight engagements. For this, Ukrainian forces use the specialised ARMOR system, a tactical-level system that provides firing calculations from covered firing positions by considering

11 Kostya Gak and Tim Lister, 'Russia's Drone Revolution Heaps Pressure on Ukrainian Defenses', *CNN*, 23 November 2025, https://edition.cnn.com/2025/11/22/europe/russia-rubicon-unit-drone-revolution-ukraine-intl-cmd.

12 Institute for the Study of War, *Russian Offensive Campaign Assessment, December 1, 2025* (Institute for the Study of War, 2025), https://understandingwar.org/research/russia-ukraine/russian-offensive-campaign-assessment-december-1-2025/.

13 Kostya Gak and Tim Lister, 'Russia's Drone Revolution Heaps Pressure on Ukrainian Defenses'.

14 David Kirichenko, 'Fibre-Optic Drones Reshape Ukraine's Technological War', *The Interpreter*, 8 June 2025, https://www.lowyinstitute.org/the-interpreter/fibre-optic-drones-reshape-ukraine-s-technological-war.

15 Léo Péria-Peigné, *Char de combat: obsolescence ou renaissance?* (Institut français des relations internationales, 2025), http://www.ifri.org/fr/etudes/char-de-combat-obsolescence-ou-renaissance.

16 Steve Brown, '"Shoot and Scoot" – War in Ukraine Overturns Another Conventional Tenet of War', Ukraine, *Kyiv Post*, 15 June 2024, https://www.kyivpost.com/post/34300.

tank orientation, shell parameters, and meteorological data.[17] The volunteer-developed software solution running on commercial tablets has transformed tank-deployment, illustrating the distinctive character of Ukrainian military adaptation.[18]

2.6. **Unmanned Ground Vehicles**

The constraints imposed by fibre-optic drones have also driven demand for unmanned ground vehicles (UGVs). As Ukrainian access to forward positions has become significantly restricted, UGVs have emerged as a critical capability for maintaining operational effectiveness.[19] With unit costs around $20,000, these systems represent a cost-effective solution for sustaining frontline operations. UGVs are primarily employed across three mission categories: supply and ammunition delivery to forward positions; casualty evacuation operations that reduce risk to medics and wounded personnel; and direct fire support missions utilising, for example, .50 calibre machine guns or 40mm MK19 grenade launchers for both line-of-sight and non-line-of-sight engagements. Ukrainian firms such as DevDroid have emerged as key providers of these fire-support configured UGVs.

The constraints imposed by fibre-optic drones have also driven demand for unmanned ground vehicles (UGVs).

Western countries have also supplied Ukraine with several unmanned ground vehicle systems, led by Estonia's THeMIS—a modular tracked platform used for casualty evacuation, logistics, and combat that has received orders exceeding 150 units through Dutch funding.[20] Germany's ARX Gereon provides AI-enabled swarm capabilities and is now being manufactured on Ukrainian soil,[21] while British EOD robots like the QinetiQ TALON handle explosive ordnance disposal.[22] It is likely that UGVs will become more prevalent over the next twelve months as lessons from experiments are shared between brigades and production is scaled up, increasingly deployed on the front line to replace armoured units and support forward deployed infantry.

17 Viktor Putrenko and Nataliia Pashynska, 'Military Situation Awareness: Ukrainian Experience', *Applied Cybersecurity & Internet Governance* 3, no. 1 (2024): 122–46, https://doi.org/10.60097/ACIG/190341.

18 Orysia Hrudka, '"With Start of Invasion, Foreign Firms Started Selling Us Sh*t." How Ukraine's Top Military Charity Saves Lives Today', *Euromaidan Press*, 26 May 2022, https://euromaidanpress.com/2022/05/26/how-ukraines-top-military-charity-come-back-alive-foundation-saves-lives/.

19 Christopher John Chivers, 'A Harrowing Escape From the Drone-Infested Hellscape of Ukraine's Front Lines', *The New York Times*, 5 November 2025, https://www.nytimes.com/2025/11/05/magazine/ukraine-russia-war-drones.html.

20 Defence Procurement International, 'The THeMIS UGV Keeping Soldiers out of Harms Way in Ukraine', Defence Procurement International, 11 January 2024, https://www.defenceprocurementinternational.com/news/land/themis-unmanned-ground-vehicles-ugvs-being-used-by-ukrainian-armed-forces; Yusuf Çetiner, 'Milrem Robotics to Deliver Over 150 THeMIS Unmanned Ground Vehicles to Ukraine', Overt Defense, 13 October 2025, https://www.overtdefense.com/2025/10/13/milrem-robotics-to-deliver-over-150-themis-unmanned-ground-vehicles-to-ukraine/.

21 Olha Pokotylo and Roman Sudolsky, 'GEREON by ARX Robotics to Form the World's Largest "Connected UGV-Fleet" in Ukraine', Defender Media, 19 November 2025, https://thedefender.media/en/2025/11/arx-robotics-to-deliver-gereon/.

22 Zachary Kallenborn and Marcel Plichta, *Release the Robot Hounds: Providing Unmanned Ground Vehicles to Ukraine* (Center for Strategic and International Studies, 2023), https://www.csis.org/analysis/release-robot-hounds-providing-unmanned-ground-vehicles-ukraine.

3. The Rear and Deep Area

3.1. The Battle for Operational Depth: "The 40-400 Decisive Depth"

Beyond the tactical stalemate on the 20–30 km "kill zone" described above, the war is increasingly fought in the rear through the ability of each side to find, fix and destroy high-value targets tens to hundreds of kilometres behind the front (what one interviewee called the "40-400 decisive depth",[23] which broadly corresponds to what NATO doctrine defines as the "deep area"). High value targets include long-range rocket artillery systems (Tochka, HIMARS, etc.), mobile SAM batteries, radars, ammunition depots and logistical hubs.

Russian forces so far have had the upper hand in attacking in this depth, due to the use of a growing arsenal of glider bombs (KAB/UMPK-type) that can glide 40–70 km or more to their targets. It has combined these classic effectors with medium-range ISR UAVs like Supercam drones operating at 50–100 km and Lancet loitering munitions that systematically hunt Ukrainian artillery and air-defence systems. The Supercam S350, manufactured by Russia's Unmanned Systems Group, exemplifies battlefield adaptation through mid-range reconnaissance capabilities extending up to 100 km across different frequency bands.[24] With 210 to 300 minute flight endurance, speeds reaching 120 km/h, and all-weather resilience, the UAV delivers extended surveillance through modular, interchangeable payloads including gyro-stabilised cameras, thermal imaging, and optical zoom systems.[25] Russian forces adapted this civilian-designed platform for artillery fire correction and airstrike coordination, with real-time intelligence transmission enabling operators to relay target coordinates directly to artillery units, significantly reducing the sensor-to-shooter timeline.[26] This commercial-to-military adaptation illustrates how both sides have accelerated UAV integration to achieve tactical advantage through enhanced situational awareness and targeting precision.

Ukraine, by contrast, has proved less lethal in the operational rear than at the tactical level (or strategic level for that matter, see below): HIMARS/ATACMS, as well as air-launched (dozens of kilometres range) Hammers and Storm Shadow/SCALP cruise missiles have allowed it to hit a variety of targets including operational HQs and logistics and air-defence

23 Interview with military official, Kyiv, September 2025.

24 Army Recognition, 'Russia Deploys New Supercam S350 Aerial Drone in Ukraine to Enhance Real-Time Targeting Capabilities', *Army Recognition*, 2 January 2025, https://www.armyrecognition.com/focus-analysis-conflicts/army/conflicts-in-the-world/russia-ukraine-war-2022/russia-deploys-new-supercam-s350-aerial-drone-in-ukraine-to-enhance-real-time-targeting-capabilities; Supercam Unmanned Systems Group, 'Supercam S350', https://en.supercam.aero/catalog/supercam-s350.

25 Ibid.

26 RuAviation, 'Russian Army Uses High-Tech Supercam Reconnaissance UAVs in Ukraine – RuAviation', RuAviation, 11 December 2023, https://ruavia.su/russian-army-uses-high-tech-supercam-reconnaissance-uavs-in-ukraine/.

sites, but have all faced constraints in stockpiles. Likewise, Ukrainian mid-range UAVs production is much more complex and therefore has not been as vibrant as the short-range tactical drone industry, making it harder to sustain the same systematic pressure on Russia's operational rear.

Behind the front line in Ukraine's near rear, UAVs also pose a growing threat. Russia has developed and deployed a new technological capability described as a 'mothership UAV' which is a large reconnaissance drone that can carry and release smaller attack drones to target Ukrainian logistical routes and positions. According to the Institute of the Study of War, on August 22 2025, Ukrainian forces reported shooting down a Russian Orlan reconnaissance UAV for the first time that was carrying two first-person-view UAVs.[27] A Russian defence-industry source subsequently confirmed to the Kremlin outlet TASS that Russian forces are deploying Orlan-10 UAVs to transport loitering munitions, and that this new mothership capability extends the operational range of Russian drone strikes into Ukraine's rear areas.[28]

3.2. **Ukraine's Deep Strike Campaign**

Ukraine's deep strike campaign against Russian territory combines Western-supplied ballistic missiles and cruise missiles (ATACMS, Storm Shadow/SCALP) with a rapidly expanding arsenal of domestically produced drones and cruise missiles capable of reaching targets 3,000 km into Russia.[29] The campaign is characterised by systematic targeting of three categories: energy infrastructure (21 of Russia's 38 major refineries struck by late 2025),[30] ammunition depots (the September 2024 Toropets strike destroyed an estimated 30,000 tonnes of munitions),[31] and irreplaceable military assets (Operation Spiderweb in June 2025 destroyed or damaged at least 7 Tu-95 strategic bombers whose production lines closed in 1993). The strategic logic operates on multiple levels: economic warfare targeting the oil revenues that constitute a significant percentage of Russia's federal budget; asymmetric cost imposition where single strikes destroy months of accumulated materiel; and forcing Russian defensive adaptations, such as the relocation of 90% of strike aircraft beyond 300 km from Ukraine and redeploying air defences from frontlines to protect rear infrastructure.[32] The campaign has degraded Russian capabilities without achieving strategic paralysis, however.

By late 2024, 96.2% of Ukrainian UAVs were domestically produced.

By late 2024, 96.2% of Ukrainian UAVs were domestically produced, scaling to over 200,000 monthly by January 2025.[33] The Flamingo cruise missile, unveiled in August 2025, achieved a 3,000-kilometer range at roughly $500,000 per unit, exceeding Western equivalents while

27 Kateryna Stepanenko, *Russian Force Generation & Technological Adaptations Update, October 9, 2025* (Institute for the Study of War, 2025), https://understandingwar.org/research/russia-ukraine/russian-force-generation-technological-adaptations-update-october-9-2025/.

28 Ibid.

29 Bohdan Miroshnychenko, 'Ukrainian Flamingo Missile with 3,000-Km Range Appears in New Video', *Ukrainska Pravda*, 18 August 2025, https://www.pravda.com.ua/eng/news/2025/08/18/7526741/.

30 Amira Barkhush, 'Mapping Ukraine's Drone Campaign to Destroy Russia's Oil Empire', *UNITED24 Media*, 29 October 2025, https://united24media.com/war-in-ukraine/mapping-ukraines-drone-campaign-to-destroy-russias-oil-empire-12927.

31 Sasha Vakulina, 'What Was Stored at the Russian Arms Depot in Tver Region?', *Euronews*, 18 September 2024, http://www.euronews.com/my-europe/2024/09/18/what-was-stored-at-the-russian-arms-depot-in-tver-region-struck-by-ukraines-drones.

32 Kateryna Hodunova, 'Ukraine Struck Hundreds of Targets Deep inside Russia in 2024. What Did They Achieve?', *The Kyiv Independent*, 30 December 2024, https://kyivindependent.com/ukraine-struck-hundreds-of-targets-deep-inside-russia-in-2024-what-did-they-achieve/.

33 Stefan Korshak, 'Ukraine Drone Production Tops 2.5 Million a Year, Aircraft Numbers on Track to Grow', Ukraine, *Kyiv Post*, 10 February 2025, https://www.kyivpost.com/post/46892.

costing a fraction of the price.[34] Where Western provided ATACMS can reach only a fraction of militarily significant targets in Russia, Ukrainian weapons now threaten Russia without requiring permission from Washington or any other Western capital. Russia's response to deep strikes has largely been rhetorical paired with limited retaliation, a pattern that has discredited Moscow's "red lines."[35] Putin has warned repeatedly that Western authorisation would put NATO countries "at war" with Russia, and on the day of Ukraine's first ATACMS strike into Russian territory, he signed an updated nuclear doctrine lowering use thresholds.[36] Nevertheless France and the UK followed suit and authorised Ukraine to use SCALP-EG (France) and Storm Shadow (UK) long-range, air-launched cruise missiles for deep strikes.

Together, these drone, missile and sabotage operations constitute a strategic campaign designed to degrade Russia's war-fighting capacity

3.2.1. Energy Infrastructure and Economic Warfare

Within this broader deep-strike effort, energy infrastructure has become the central target set. Ukrainian drones have repeatedly struck refineries from the Baltic to the Black Sea, including major plants such as Afipsky in Krasnodar Krai and facilities around Moscow and Ryazan, contributing to spikes in global oil prices when large hubs or export terminals were briefly shut. According to Bloomberg data, Ukraine conducted at least 24 attacks on Russian energy infrastructure in December 2025.[37] Since late 2025, the campaign has expanded from fixed infrastructure to Russia's "shadow fleet" of oil tankers and key port facilities: naval drones have badly damaged sanctioned tankers such as Kairos and Virat in the Black Sea and temporarily halted exports from the Caspian Pipeline Consortium terminal at Novorossiysk, prompting protests from Turkey and Kazakhstan and raising insurance costs for Russian crude.[38]

3.2.2. Military Targets and Sabotage Operations

Parallel to economic targeting, Ukraine has launched deep strikes on airfields and other high-value military assets, most dramatically during *Operation Spiderweb* on 1 June 2025. In that operation, the Security Service of Ukraine (SBU) used drones covertly staged inside Russia to hit five long-range bomber bases. Ukrainian officials claimed that up to 41 strategic bombers were damaged or destroyed; US and independent estimates are more conservative (around 10–20 aircraft hit) but still regard the raid as one of the most serious blows to Russia's long-range aviation since 2022. At the same time, Kyiv has continued a *shadow war* of sabotage operations (railway explosions, factory fires, attacks on logistics hubs and command nodes) inside Russia and occupied territories. The Armed Conflict Location Event Database

[34] Ukrinform, 'Ukraine's Flamingo Missile Boasts Greater Range and Payload than U.S. Tomahawk', *Ukrinform*, 9 November 2025, https://www.ukrinform.net/rubric-defense/4056917-ukraines-flamingo-missile-boasts-greater-range-and-payload-than-us-tomahawk.html.

[35] Peter Dickinson, *Putin Is Becoming Entangled in His Own Discredited Red Lines* (Atlantic Council, 2024), https://www.atlanticcouncil.org/blogs/ukrainealert/putin-is-becoming-entangled-in-his-own-discredited-red-lines/.

[36] Mithil Aggarwal, *Putin Issues New Nuclear Doctrine in Warning to the West over Ukraine*, 19 November 2024, https://www.nbcnews.com/news/world/putin-nuclear-doctrine-us-ukraine-strike-russia-war-west-rc-na180740.

[37] Bloomberg News, 'Ukrainian Strikes on Russia's Energy Assets Hit a Monthly Record', *Bloomberg.Com*, 30 December 2025, https://www.bloomberg.com/news/articles/2025-12-30/ukrainian-strikes-on-russia-s-energy-assets-hit-a-monthly-record.

[38] Tom Balmforth and Max Hunder, 'Ukraine Hits Two Russian "shadow Fleet" Oil Tankers with Naval Drones', Aerospace & Defense, *Reuters*, 29 November 2025, https://www.reuters.com/business/aerospace-defense/ukraine-hit-two-shadow-fleet-tankers-with-drones-black-sea-security-official-2025-11-29/; Georgi Kantchev and James Marson, *Ukraine Goes After Russia's Shadow Fleet in International Waters - WSJ*, 2 December 2025, https://www.wsj.com/world/europe/ukraine-russia-energy-attacks-1cec032d; Anastasia Stognei et al., 'Ukraine Targets Russia's Shadow Fleet', *Financial Times*, 2 December 2025, https://www.ft.com/content/3e72db0d-077c-4f48-a4a5-a2b8683dae53.

(ACLED) notes hundreds of such incidents over the course of the war, with pro-Ukrainian actors increasingly active deep inside Russia and systematically targeting logistics, arms production and security installations.[39] Together, these drone, missile and sabotage operations constitute a strategic campaign designed to degrade Russia's war-fighting capacity, raise economic and political costs, and offset Kyiv's disadvantages on the front.

3.2.3. Maritime Unmanned Systems

Ukraine's deep strike campaign extends to the maritime domain through unmanned surface vehicles (USVs), notably the Magura and Sea Baby. These systems demonstrate sophisticated solutions for operating in EW-heavy environments through multi-layered navigation and communication redundancy, GNSS, inertial navigation systems (INS), and AI-powered visual terrain matching enabling autonomous navigation. Communication redundancy comes from dual Starlink satellite links, Kymeta backup antennas, mesh radio networking, and cellular connectivity, a design evolution directly prompted by an early 2022 mission failure when connectivity was lost near Crimea. The AFU is also exploring automation with these drones, including for the "last mile" of an attack where EW may interfere with communications. The operational effectiveness of these EW-resilient systems is evidenced by the destruction of approximately one-third of Russia's Black Sea Fleet, forcing the fleet to withdraw from Sevastopol to Novorossiysk. In December 2025, Ukraine managed to strike a Kalibr-missile carrying submarine in Novorossiysk with a submersed unmanned system (the first of its kind), showing that even there Russia's Black Sea fleet is vulnerable.

3.3. Russia's Long-Range Strike Campaign

Since late 2023, and accelerating throughout 2024-2025, the Russian long-range strike campaign against Ukraine has transformed in both scale and sophistication. The available estimates show a dramatic expansion: by the end of 2023, Russia had launched about 7,400 missiles and 3,900 Shahed drone strikes against Ukraine, compared to over 160,000 bomb, missile and drone attacks in 2025 alone.[40] This growth reflects a shift in Russia's industrial posture toward sustained wartime production, particularly of Shahed-136/131-type one-way attack drones, which have become the backbone of Russia's deep-strike strategy.

Early in the war, Russian attacks were defined by episodic missile salvos combining cruise and ballistic missiles, primarily targeting electrical infrastructure to impose societal pressure and degrade Ukraine's wartime resilience. From mid-2023 onward, and especially into the second winter of the war (2023-2024), Russia experimented with wave attacks combining Shaheds and cruise missiles, but these remained limited in density. The break occurred throughout the following winter, as Russia began to mount nightly Shahed attacks exceeding 50–80 drones per night. Those were designed to deplete Ukrainian air-defence ammunition, expose AD system locations, and create opportunities for follow-on missile strikes.[41]

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39 Nichita Gurcov, *Behind the Lines: How Ukraine Has Outgunned Russia in Sabotage* (2025), https://acleddata.com/report/behind-lines-how-ukraine-has-outgunned-russia-sabotage.

40 Institute for the Study of War, *Russian Offensive Campaign Assessment, December 28, 2023* (Institute for the Study of War, 2023), https://understandingwar.org/research/russia-ukraine/russian-offensive-campaign-assessment_28-11/; Anna Romaniv, 'Russia Carried out a Record Number of Missile and Drone Attacks on Ukraine in 2025', *The Ukrainian Review*, 31 December 2025, https://theukrainianreview.info/russia-carried-out-a-record-number-of-missile-and-drone-attacks-on-ukraine-in-2025/.

41 Igor Anokhin, *Monthly Analysis of Russian Shahed 136 Deployment Against Ukraine* (Institute for Science and International Security, 2026), https://isis-online.org/isis-reports/monthly-analysis-of-russian-shahed-136-deployment-against-ukraine.

By 2025, Russia's campaign evolved further based on a multi-axis strike architecture. Large Shahed swarms are launched with the aim to saturate point defences and force Ukrainian air-defence units to reveal their fire patterns. Once defences are engaged, Russia increasingly inserts a variety of mixed salvos blending cruise missiles, ballistic missiles (including Kinzhal), and in some cases glider bombs. These salvos often converge on high-value targets (e.g. Kyiv's energy grid, Odessa's port infrastructure, or major defence industrial sites) indicating a clear logic underlying Russian strike planning. While power infrastructure remains a recurring focus, the 2024–25 period demonstrates an expansion toward air-defence assets, maintenance facilities, Ukrainian industrial production, ammunition depots, and transport-logistics nodes. This suggests Russia's aim has broadened from coercive pressure on civilian morale to a wider strategy of eroding Ukraine's long-term warfighting capacity. Open-source information and Ukrainian statements confirm that Russia has intensified efforts to detect and neutralise Ukrainian Patriot, IRIS-T, and NASAMS batteries, often attacking radar sites or attempting to catch reload cycles of Ukrainian AD units.

3.4. Integrated Air and Missile Defence Architecture

Ukraine's integrated air and missile defence system operates through a sophisticated layered architecture coordinated by the Air Force Command in Vinnytsia, utilising the Krechet tactical air defence control system capable of tracking 250 simultaneous targets while synchronising disparate assets from Patriot batteries to mobile fire groups.[42] This structure spans seven operational tiers: long-range systems (Patriot, S-300, SAMP/T) protecting strategic assets; medium-range systems(IRIS-T, NASAMS) handling cruise missiles; tactical short-range coverage (Gepard, MANPADS); mobile ground teams; electronic warfare capabilities; and the newly established Unmanned Air Defense Forces branch deploying interceptor drones.[43] Central coordination proved vulnerable during the initial invasion. Russian cyberattacks on February 24, 2022, severed communications from Vinnytsia headquarters, exposing vulnerabilities that Ukraine continues to address through redundant networks.[44] Efforts include integrating the Krechet system into the Novator 2 armoured vehicle as a mobile command-and-control platform for coordinating anti-aircraft systems.[45]

42 'Ukraine Unveils Novator-2 Krechet: Mobile Command Hub That Can Track 250 Targets at Once', UNITED24 Media, 2 September 2025, https://united24media.com/latest-news/ukraine-unveils-novator-2-krechet-mobile-command-hub-that-can-track-250-targets-at-once-11317.

43 Army Recognition, 'Breaking News: Germany Delivers 10 IRIS-T Air Defense Missile Systems to Ukraine to Counter Daily Russian Air Strikes', *Army Recognition*, 8 May 2025, https://www.armyrecognition.com/news/army-news/2025/breaking-news-germany-delivers-10-iris-t-air-defense-missile-systems-to-ukraine-to-counter-daily-russian-air-strikes; Reuters, 'Ukraine Begins Mass Production of Interceptor Drones to Bolster Air Defence', Aerospace & Defense, *Reuters*, 14 November 2025, https://www.reuters.com/business/aerospace-defense/ukraine-begins-mass-production-interceptor-drones-bolster-air-defence-2025-11-14/; Army Recognition, 'Analysis: Lessons from Ukraine War How Small Arms and Advanced Systems Redefine Drone Defense', *Army Recognition*, 27 August 2025, https://www.armyrecognition.com/archives/archives-land-defense/land-defense-2024/analysis-lessons-from-ukraine-war-how-small-arms-and-advanced-systems-redefine-drone-defense.

44 Tom Cooper et al., *War in Ukraine Volume 6: The Air War, February-March 2022* (2024), https://www.helion.co.uk/military-history-books/war-in-ukraine-volume-6-the-air-war-february-march-2022.php.

45 Oleksandr Yan, 'Ukrainian Armor Has Developed the Krechet Air Defense Control Vehicle', *Militarnyi*, 2 September 2025, https://militarnyi.com/en/news/ukrainian-armor-has-developed-the-krechet-air-defense-control-vehicle/.

3.4.1. The Sensor Challenge

Mobile Anti-Aircraft Artillery (AAA) provides the last line of defence. It faces significant challenges in detecting small, low-flying UAVs. Traditional ground-based air-defence radars were never optimised for tiny radar cross-section, low-speed, nap-of-the-earth targets. Ukrainian operators report that Russian one-way attack drones often approach at 50–100 km/h and 50–100 m altitude, slipping below the coverage arcs of Soviet-era systems where terrain masking and clutter degrade tracking performance. To compensate, Ukraine is integrating upgraded Israeli-made RADA multifunction radars, modified specifically based on frontline feedback to improve detection of slow UAVs under heavy EW and jamming conditions.[46] In parallel, Ukrainian units are deploying acoustic detection grids, such as the Sky Fortress system—low-cost distributed microphone arrays capable of triangulating drone engine signatures even when radar coverage is limited or disrupted.[47] These acoustic systems, which can be rapidly deployed and operate autonomously, are particularly valuable in urban or forested terrain.

3.4.2. Mobile Air Defence Teams and Point Defence

According to various sources, Ukraine operates between 600 and 1,500 Mobile Air Defence Teams (MADTs), that Commander-in-Chief Syrskyi credits with approximately 40% of all drone interceptions.[48] These four-person teams operating ZU-23-2 cannons and MANPADS from pickup trucks represent cost-effective point defence.[49] Beyond improvised pick-up-mounted guns, Ukraine has also integrated more sophisticated but still relatively old short-range AAA systems such as the German-made Cold War era *Gepard*, whose radar-directed 35-mm cannons have proven exceptionally effective against Shaheds.[50] Newer systems, including Rheinmetall's Skynex or TetraTech's Terrahawk Paladin, offer automated fire control, programmable 35 mm airburst rounds, and high precision, at a price point still significantly below that of surface-to-air missiles.[51]

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46 Roman Pryhodko, 'Ihor Fedirko: Israel's RADA Updates Radars for Ukraine Based on Feedback From Front', *Militarnyi*, 8 November 2025, https://militarnyi.com/en/news/ihor-fedirko-israel-s-rada-updates-radars-for-ukraine-based-on-feedback-from-front/.

47 'Sky Fortress—Ukraine's Acoustic Detection System That Tracks Drones Cheap and Fast', UNITED24 Media, 1 July 2025, https://united24media.com/war-in-ukraine/sky-fortress-ukraines-acoustic-detection-system-that-tracks-drones-cheap-and-fast-9451.

48 Ukrinform, 'Zelensky: Ukraine Has 1,500 Mobile Fire Teams, but More Are Needed', *Ukrinform*, 17 December 2024, https://www.ukrinform.net/rubric-ato/3939044-zelensky-ukraine-has-1500-mobile-fire-teams-but-more-are-needed.html; Artem Dzheripa and Yevheniia Mazur, 'Shahed Interceptor Drones Are Almost Twice as Effective as Mobile Fire Groups', Politics, *LIGA.Net*, 22 June 2025, https://news.liga.net/en/politics/news/shahed-interceptor-drones-are-almost-twice-as-effective-as-mobile-fire-groups; Marina Makeeva, 'Понад 900 вогневих груп захищають критичну інфраструктуру України, майже 500 із них мобільні, - командувач Нацгвардії', Цензор.НЕТ, 27 December 2024, https://censor.net/ua/news/3527312/skilky-vognevyh-grup-vidbyvayut-ataky-ta-zahyschayut-infrastrukturu.

49 Valentyna Romanenko, 'Air Defence in Ukraine's North Will Strengthen with Mobile Fire Groups', Ukrainska Pravda, 10 March 2023, https://www.pravda.com.ua/eng/news/2023/03/10/7392815/.

50 David Axe, 'Ukraine Just Solved the Hardest Math Problem in Modern Air Defense – with a 1970s German Gun', Russo-Ukrainian War 2022-2025, *Euromaidan Press*, 20 July 2025, https://euromaidanpress.com/2025/07/20/ukraine-drone-defense/.

51 Vadim Kushnikov, 'Ukrainian Anti-Aircraft Gunners Practice Shooting with Skynex System', *Militarnyi*, 25 September 2024, https://militarnyi.com/en/news/ukrainian-anti-aircraft-gunners-practice-shooting-with-skynex-system/.

3.4.3. **Russian Counter-Adaptation**

To overcome the effectiveness of Ukrainian AAA, Russian long range One-Way-Attack UAVs have evolved to fly higher and faster. While standard Shahed-136/Geran-2 propeller drones cruise at 185 km/h,[52] the new jet-powered Shahed-238/Geran-3 variant achieves 300-600 km/h with dive speeds exceeding 700 km/h.[53] These speeds render traditional MADT ineffective. Altitude capabilities have also increased from 700-2,000m, with Geran-3 reportedly capable of flying at an altitude of 9,100m, placing it beyond the range of many point-defence systems.[54] Perhaps most innovative is Russia's confirmed use of Ukrainian SIM cards for navigation: since late 2023, downed drones have contained 4G modems with Ukrainian Kyivstar SIM cards enabling cell tower triangulation as GPS backup.[55] This represents Russian counter-adaptation to Ukraine's "Pokrova" nationwide GPS spoofing system, which successfully redirected drones into Belarus and Russia.[56] (On a personal note: the same system was so strong that it even made our Bolt taxi appear to be driving in Peru, just as Ukrainians experience more frequent automatic time changes on their smartphones.)

To overcome the effectiveness of Ukrainian AAA, Russian long range One-Way-Attack UAVs have evolved to fly higher and faster.

3.4.4. **Western Integration and Domestic Innovation**

The integration of Western F-16s into Ukraine's IAMD system created genuine identification friend-or-foe (IFF) challenges. Claims that half of the F-16s were downed by Ukrainian surface-to-air missiles are demonstrably false. Ukraine has lost four of 38+ F-16s received, none of them by confirmed friendly fire incidents.[57] However, real IFF gaps existed: Patriot batteries arrived in April 2023 without Link-16 datalinks since F-16s weren't anticipated, and neither fighters nor ground units initially used IFF protocols.[58] Ukraine resolved this critical vulnerability in June 2025 by signing NATO licensing agreements for the CRC System Interface, finally integrating Link 16 across F-16s, Mirage 2000s, and Patriot systems.[59]

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52 Francesco Salesio Schiavi, *Assessing Russian Use of Iranian Drones in Ukraine: Facts and Implications* (2022), https://www.ispionline.it/en/publication/assessing-russian-use-iranian-drones-ukraine-facts-and-implications-36520.

53 Francesco Salesio Schiavi, *Assessing Russian Use of Iranian Drones in Ukraine*.

54 Ibid.

55 Howard Altman, 'Shahed-136 With Cellular Modem Found In Ukraine: What It Means', *The War Zone*, 30 November 2023, https://www.twz.com/shahed-136-with-cellular-modem-found-in-ukraine-what-it-means.

56 Ellie Cook, 'Ukraine Found Way to Divert Russian Drones into Neighbor's Airspace—Report', World, *Newsweek*, 28 November 2024, https://www.newsweek.com/ukraine-russia-drones-belarus-spoofing-gps-1992969. Kateryna Hodunova, 'Ukrainian GPS Spoofing for Repelling Drone Attacks Could Indirectly Affect Smartphone Clocks, General Staff Says', *The Kyiv Independent*, 5 November 2024, https://kyivindependent.com/ukrainian-electronic-warfare-could-indirectly-affect-smartphone-clock-while-repelling-drone-attacks-general-staff-says/.

57 Ivana Kottasová and Daria Tarasova-Markina, 'Exclusive: Top Ukrainian Pilot Killed When US-Made F-16 Fighter Jet Crashed', *CNN*, 29 August 2024, https://www.cnn.com/2024/08/29/europe/ukraine-f16-crashes-intl/index.html; Kateryna Tyshchenko, 'Ukrainian-Piloted F-16 Downed by Russian Missile, BBC Ukraine Says', *Ukrainska Pravda*, 12 April 2025, https://www.pravda.com.ua/eng/news/2025/04/12/7507324/; Martin Fornusek, 'Ukraine "lost Contact" with F-16 during Combat, Pilot Ejected, Air Force Says', *The Kyiv Independent*, 16 May 2025, https://kyivindependent.com/ukraine-lost-contact-with-f-16-during-combat-pilot-ejected-air-force-says/; Andriy Perun and Pavel Polityuk, 'Ukraine F-16 Pilot Killed in Large-Scale Russian Attack, Zelenskiy Calls for US Help', *Reuters*, 29 June 2025, https://www.reuters.com/business/aerospace-defense/least-six-wounded-large-scale-russian-air-attack-ukraine-ukrainian-authorities-2025-06-29/.

58 Ivan Yatskov, 'Ukrainian Combat Jets Now Run on NATO Command Systems', Orbital Today, 6 June 2025, https://orbitaltoday.com/2025/06/07/ukrainian-combat-jets-now-run-on-nato-command-systems/; Reuben Johnson, 'Ukraine's Lost F-16: Debris and a Deadly Mission', *Breaking Defense*, 20 September 2024, https://breakingdefense.com/2024/09/debris-and-a-deadly-mission-the-vital-context-around-ukraines-lost-f-16/.

59 Ivan Yatskov, 'Ukrainian Combat Jets Now Run on NATO Command Systems'.

Ukraine's domestic innovation has produced two particularly significant interceptor systems that exemplify strategic adaptation. Bagnet (Bayonet), developed by the Ukrainian company Tenebris, is a high-speed interceptor drone with 40km range and 5km ceiling, deploying a 1kg shock-core warhead designed to destroy Shaheds while minimising falling debris, an important consideration given Russia's targeting of urban energy infrastructure.[60] The American-developed Merops system has destroyed over 1,000 Shahed-type drones using $15,000 "Surveyor" interceptor drones launched from ordinary pickup trucks—a cost-to-kill ratio of over 13:1.[61] Merops requires only four personnel with two weeks training and has garnered significant NATO interest, with Poland, Romania, and Denmark establishing training programmes for deployment on the eastern flank.[62] Both systems rely on autonomous target recognition to operate effectively under EW conditions, with single operators able to control multiple interceptors and other drones through emerging swarm coordination platforms like Swarmer AI. A next step could be the development of next-generation autonomous air defence systems capable of engaging faster threats like the jet-powered Geran-3 variants (300-600 km/h). Recent breakthroughs include the upgraded STING interceptor reaching 315 km/h.

Ukraine's domestic innovation has produced two particularly significant interceptor systems that exemplify strategic adaptation.

60 Roman Kohanets, 'Ukraine Deploys New "Bagnet" Drone to Hunt and Destroy Russian Drones Midair', UNITED24 Media, 6 August 2025, https://united24media.com/latest-news/ukraine-deploys-new-bagnet-drone-to-hunt-and-destroy-russian-drones-midair-10526; dev.ua, 'Ukraine Has Created a "Bagnet" Interceptor Drone to Combat "Shaheeds"', Dev.Ua, 7 August 2025, https://dev.ua/en/news/v-ukraini-stvoryly-dron-perekhopliuvach-bahnet-dlia-borotby-z-shakhedamy-1754572796.

61 Ivan Khomenko, 'Secret Merops Counter-Drone System Behind 1,000 Shahed Kills in Ukraine', UNITED24 Media, 19 November 2025, https://united24media.com/latest-news/secret-merops-counter-drone-system-behind-1000-shahed-kills-in-ukraine-13574; Mike Morton, 'Bang for Your Buck: $200m Worth of Russian Drones Taken out by $15m Merops UAVs', *Bfbs Force News*, 10 December 2025, https://www.forcesnews.com/nato/bang-your-buck-200m-worth-russian-drones-taken-out-15m-merops-uavs.

62 Ibid.

4. Command and Control

4.1. Battlefield Connectivity and Digitalisation

In modern high-intensity warfare, C2 and battlefield connectivity have become as decisive as firepower itself. Operational success depends on the ability to see, decide and act faster than the adversary—linking every shooter to every sensor, and every echelon to the same coherent picture of the fight. Ukraine's experience since 2022 illustrates this transformation with clarity.

4.1.1. The DELTA Ecosystem

Conceived by the volunteers association *Aerorozvidka* as early as 2015 and formally adopted by the Armed Forces in 2022, the combat software DELTA evolved from a situational-awareness map into a full-spectrum battle management and data-fusion software system.[63] DELTA integrates streams from every sensor category—radar, video, text, HUMINT, SIGINT and even partner intelligence – into a single operational picture accessible from the Brigade to the General Staff level. In contrast to Russia's still largely centralised Automated Command and Control System (A*vtomatizirovannyye Sistemy Upravleniya* or ASU) system, DELTA underpins a uniquely horizontal, network-centric command culture. It empowers lower echelons to act autonomously while maintaining strategic coherence, thus bridging the concept of Western Mission Command with Ukraine's Soviet-inherited structures.[64]

Technically, DELTA functions as a cloud-based platform that can run both on mobile devices and command-post servers. Its interface resembles Google Maps, offering layered filters for sensor types, targets and regions of interest. It provides historical data over several months, enabling "pattern-of-life" analysis of Russian batteries or UAV activity, and it supports drone-strike mission planning by highlighting zones affected by electronic warfare. DELTA operates within a broader software ecosystem that includes Kropyva, used by an estimated 90-95% of Ukrainian artillerymen for ballistic calculations and tactical mapping,[65] which automates

63 Lara Jakes, 'For Western Weapons, the Ukraine War Is a Beta Test', World, *The New York Times*, 15 November 2022, https://www.nytimes.com/2022/11/15/world/europe/ukraine-weapons.html; Ministry of Defence of Ukraine, 'The DELTA combat system has been deployed across all levels of Defence Forces of Ukraine', Ministry of Defence of Ukraine, 6 August 2025, https://mod.gov.ua/en/news/the-delta-combat-system-has-been-deployed-across-all-levels-of-defence-forces-of-ukraine.

64 Kateryna Aniskina, *Combat Software in Service of the Defence Forces: Current State of the Combat-Software Sector, Problems and Challenges* (Decoy Analytics, 2025), https://decoy.army/.Gros, Philippe, Vincent Tourret, Yohann Michel, and Guillaume Garnier, *Enseignements de la guerre russo-ukrainienne.* Étude annuelle n°3. Paris: Fondation pour la recherche stratégique / Institut français des relations internationales, 18 November 2024.

65 Viktor Putrenko and Nataliia Pashynska, 'Military Situation Awareness'.

artillery fire coordination and compresses targeting time from 20+ minutes down to one;[66] Virazh-Tablet for air defence;[67] and ARMOR for armoured vehicle fire control.[68] DELTA has compressed kill chains dramatically. Ukrainian officials credit DELTA with identifying more than 2,000 Russian targets every day, and, over a year, "more than half a million verified destroyed and affected targets."[69]

By 2024-2025, DELTA had incorporated modules for live-video (UAS feeds) analytics, Target Hub for target management, and Mission Control for UAV operations. It had also undergone NATO-aligned cybersecurity certification, enabling secure hosting in allied clouds and integration with U.S. ATAK networks. This evolution made DELTA the de facto ISTAR hub of Ukraine's armed forces and the nucleus of a new C4ISR architecture in which tactical autonomy, AI-assisted data processing (Griselda, Palantir APIs), and cloud resilience converge.[70] DELTA now coordinates operations for over 90% of Ukrainian combat units, providing 24/7 situational awareness by aggregating real-time data from commercial and military drones, satellite imagery, sensor networks, radars, ground-based cameras, reconnaissance units, vetted civilians, and foreign intelligence partners into a unified cloud-based operational picture.[71] The system's effectiveness depends critically on SpaceX's Starlink satellite network, with up to 50,000 terminals operating throughout Ukraine, providing internet connectivity that enables Ukraine's network-centric warfare through real-time video feeds, encrypted messaging, artillery coordination, and medical evacuation requests.[72]

DELTA has compressed kill chains dramatically.

4.1.2. Connectivity Infrastructure and Strategic Dependencies

This proliferation of battlefield connectivity has transformed Ukrainian military operations at every echelon, ensuring that even basic tactical units maintain reliable communications under conditions that would previously have severed traditional networks. Ukrainian forces have adopted commercial encrypted messaging applications for coordination, bypassing the need for specialised military communication systems and dramatically accelerating information flow between units. The integration extends beyond simple communications into weapons systems control, where networked platforms can share targeting data and coordinate fires in near real-time.

However, this technological adaptation has created a strategic vulnerability: Ukraine's reliance on Starlink, a service controlled by a private American company, exposes critical

66 David Kirichenko, *Ukraine's Tech Sector Is Playing Vital Wartime Economic and Defense Roles* (Atlantic Council, 2023), https://www.atlanticcouncil.org/blogs/ukrainealert/ukraines-tech-sector-is-playing-vital-wartime-economic-and-defense-roles/.

67 Olena Kryzhanivska, 'Combat Software in the Service of the Armed Forces of Ukraine', *Ukraine's Arms Monitor*, 21 June 2025, https://ukrainesarmsmonitor.substack.com/p/combat-software-in-the-service-of.

68 ARMOR, 'ARMOR', ARMOR, 2026, https://armor.ua/.

69 Ministry of Defence of Ukraine, 'Cabinet of Ministers of Ukraine - DELTA Battlefield Management System Introduced at All Levels of the Ukrainian Defense Forces', 6 August 2025, https://www.kmu.gov.ua/en/news/boiova-systema-delta-vprovadzhena-na-vsikh-rivniakh-syl-oborony-ukrainy.

70 Kateryna Aniskina, *Combat Software in Service of the Defence Forces: Current State of the Combat-Software Sector, Problems and Challenges.*

71 Kateryna Bondar, *Does Ukraine Already Have Functional CJADC2 Technology?* (Center for Strategic and International Studies, 2024), https://www.csis.org/analysis/does-ukraine-already-have-function-al-cjadc2-technology; Lara Jakes, 'For Western Weapons, the Ukraine War Is a Beta Test'.

72 Oscar Rosengren, 'Network-Centric Warfare in Ukraine: The Delta System', Grey Dynamics, 30 August 2024, https://greydynamics.com/network-centric-warfare-in-ukraine-the-delta-system/.

military communications to the decisions of a single corporate entity and foreign government influence. This dependency underscores a broader tension in Ukraine's C2 transformation; pre-war status as a heavily digitalised society enabled rapid development of sophisticated software platforms, yet the infrastructure enabling their deployment remains subject to external control.

4.2. Command Structure Adaptation in the Land Domain

4.2.1. The Corps Transition

The ongoing transition from a brigade command structure to a corps-based system represents an ambitious attempt at military reorganisation during active combat operations.

The ongoing transition from a brigade command structure to a corps-based system represents an ambitious attempt at military reorganisation during active combat operations. Officially announced by Commander-in-Chief Oleksandr Syrskyi and President Volodymyr Zelensky in February 2025,[73] the reform has established 18 corps across four regional commands, comprising thirteen Ground Forces Army Corps, two Air Assault Corps, a Marine Corps, and two National Guard Corps, each containing five to seven brigades.[74]

Complementing this restructuring, Ukraine's Unmanned Systems Forces (USF), established in June 2024 as the world's first dedicated drone branch,[75] has assumed growing operational significance under Commander "Madyar" Brovdi. The reform aims to yield two major benefits: first, to make it easier to manage over one hundred brigades deployed across an extended frontline, including logistics, maintenance, supply, and the dissemination of lessons learned; second, to enable the AFU to scale up from the tactical to the operational level of war by streamlining command, bundling the fighting power of brigades rather than battalions, create the possibility of more synergetic effects, and increase the geographic reach into Russia's rear area.

4.2.2. Implementation Challenges

Ukrainian Corps are only partially consistent with the Western definition of army corps. According to NATO doctrine, corps are structures meant to command divisions, a unit that does not exist within AFU, where corps are directly commanding brigades.[76] The Corps-level transition has exposed critical shortfalls. The first is about command culture. According to various interlocutors and Kyiv Independent interviews with defence analyst Viktor Kevliuk, the intellectual challenge of overcoming "radianshchyna", the Soviet-style command culture characterised by tactical micromanagement rather than operational-level thinking, remains

73 Kateryna Hodunova, 'Nearly a Year on, Ukraine Army's Shift to Corps Command Struggles to Deliver', *The Kyiv Independent*, 13 October 2025, https://kyivindependent.com/despite-almost-year-long-overhaul-ukrainian-armed-forces-still-grapple-with-corps-reform/.

74 Hlib Parfonov, *Ukraine's Military Transitioning to Corps-Based Command Structure* (Jamestown, 2025), https://jamestown.org/ukraines-military-transitioning-to-corps-based-command-structure/.

75 Ministry of Defence of Ukraine, 'Unmanned Systems Forces', https://mod.gov.ua/en/about-us/unmanned-systems-forces.

76 NATO, 'Allied Joint Doctrine for Land Operations', February 2022, https://assets.publishing.service.gov.uk/media/62b45b2de90e0765cdf62e03/20220207-AJP3-2_EDB_Land_Ops.pdf.

ingrained in many AFU units.[77] Corps commanders, trained to control subordinate actions directly, struggle to coordinate five to seven brigades simultaneously while delegating tactical decisions to subordinates.[78]

Another key pitfall is the shortage of trained personnel, especially staff officers, confirmed in our own interviews: whereas in NATO doctrine Corps are normally commanded by high ranking generals (OF-7 to OF-8 in NATO parlance) and staffed with colonels and majors, Ukrainian corps are headed by colonels and staffed with lieutenants and captains, producing "centralized and slower decisionmaking" at corps headquarters.[79]

Capability gaps compound this problem: as Kevliuk noted, a fully functional corps requires mid-range air defence, as well as ISR and Target Acquisition capabilities and rocket artillery units to attrite the enemy in the deep area, capabilities that are present in AFU but in insufficient quantities to properly equip the fifteen Corps. Equally important, Army Corps also require a wide array of service support units (medical, MPs, engineers, logistics, maintenance and repair, etc.) that Ukraine simply cannot field in sufficient volumes while "we do not even have enough infantry on the front lines."[80]

Most critically, manpower asymmetries have reached what Zelensky described in November 2025 as a 8:1 Russian numerical superiority on the Pokrovsk axis.[81] Ukraine fields only 300,000–350,000 frontline troops against roughly 700,000 Russians, with some Ukrainian brigades at 30% strength and recruitment consistently falling short of targets.[82] Former Azov Commander Bohdan Krotevych characterised the reform as "an unfounded, hasty pseudo-solution," arguing that "none of the corps currently functions as a true operational unit."[83]

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77 Natalia Yermak and Francis Farrell, 'As Ukraine's Fate Hangs in the Balance, "Soviet" Command Culture Damages War Effort', *The Kyiv Independent*, 27 March 2025, https://kyivindependent.com/as-ukraines-fate-hangs-in-the-balance-soviet-command-culture-damages-war-effort/.

78 Hlib Parfonov, *Ukraine's Military Transitioning to Corps-Based Command Structure*.

79 Congressional Research Service, *Ukrainian Military Performance and Outlook* (Congressional Research Service, 2025), https://www.congress.gov/crs_external_products/IF/HTML/IF12150.html.

80 Kateryna Hodunova, 'Nearly a Year on, Ukraine Army's Shift to Corps Command Struggles to Deliver'.

81 Peter Dickinson, *Russia's Advance on Pokrovsk Exposes Ukraine's Growing Manpower Crisis* (Atlantic Council, 2025), https://www.atlanticcouncil.org/blogs/ukrainealert/russias-advance-on-pokrovsk-exposes-ukraines-growing-manpower-crisis/.

82 Yauhen Lehalau, 'With Desertions, Low Recruitment, Ukraine's Infantry Crisis Deepens', 10 August 2025, https://www.rferl.org/a/ukraine-infantry-crisis-military-army-war/33497989.html.

83 Kateryna Hodunova, 'Nearly a Year on, Ukraine Army's Shift to Corps Command Struggles to Deliver'.

5. Operational Effectiveness and Wartime Adaptation

5.1. Variation in Brigade Performance and Professionalisation Gaps

Ukraine's corps contain constituent brigades of widely varying quality.

The quality of Ukrainian military personnel and the performance of different brigades have become markedly uneven, revealing differences in operational effectiveness and organisational capacity. Research by the Royal United Services Institute found earlier that Ukraine's corps contain constituent brigades of widely varying quality, with some achieving casualty rates of 5-10% while others suffer up to 50% losses under similar conditions.[84] Commander-in-Chief Olseksandr Syrskyi acknowledged this disparity, noting that brigades with identical staffing and equipment produce vastly different battlefield outcomes.[85]

At one end of the spectrum, elite units like the 3rd Assault Brigade receive over 500 volunteer applicants monthly, provide basic training and brigade-specific drills, and maintain comprehensive personnel welfare systems including effective medevac, regular rotation schedules, and sophisticated recruitment and financing approaches.[86] The brigade even achieved the world's first documented enemy surrender to ground drones.[87] However, many other brigades perform significantly worse. For instance, the 155th Mechanized Brigade experienced over 1,700 desertions due to poor leadership, inadequate training, and insufficient equipment, with its commander eventually detained.[88]

84 Jack Watling, *Emergent Approaches to Combined Arms Manoeuvre in Ukraine* (Royal United Services Institute, 2025), https://www.rusi.orghttps://www.rusi.org.

85 Kyiv Post, 'Syrsky Announces Personnel Changes Among Brigade Commanders', Ukraine, *Kyiv Post*, 2 March 2024, https://www.kyivpost.com/post/28914.

86 Sasha Vakulina, 'Intense Training Draws Hundreds to Ukraine's Third Assault Brigade', Euronews, 3 July 2025, 298800, http://www.euronews.com/2025/03/07/intense-training-draws-hundreds-to-ukraines-third-assault-brigade; Martin Fornusek, 'Ukraine Investigating French-Trained Brigade after Reports of Desertions, Mismanagement', *The Kyiv Independent*, 3 January 2025, https://kyivindependent.com/ukraine-investigating-french-trained-brigade/; Serhii Filimonov, 'The Flaws in Ukraine's New Brigades and Foreign Training Programs', *The Kyiv Independent*, 17 January 2025, https://kyivindependent.com/here-are-the-flaws-in-ukraines-new-brigades-and-foreign-training-programs/.

87 Anna Fratsyvir, 'In Historic Feat, Ukraine's 3rd Brigade Captures Russian Troops Using Only Drones and Robots, Military Says', *The Kyiv Independent*, 9 July 2025, https://kyivindependent.com/ukrainian-assault-brigade-captures-russian-troops-using-only-drones-and-robots-in-historic-operation-military-says-06-2025/.

88 Matthew Loh, 'Ukraine's French-Trained Brigade Was Meant to Be a Flagship Project. Now Its Ex-Commander Is Detained with a $2.1 Million Bail.', *Business Insider*, 23 January 2025, https://www.businessinsider.com/ukraine-french-brigade-anne-kyiv-ryumshin-2-million-bail-2025-1.

This variation stems partly from Ukraine's decentralised brigade recruitment model, in which units compete independently for personnel. Along Kyiv's boulevards, recruitment advertisements on billboards are a regular sight. Brigades such as the 3rd Assault Brigade have little trouble attracting new recruits because of their reputation. Soldiers that sign up know that the brigades are run by competent commanders who care about their lives; they know that if they are injured in battle, they will be medevaced and have access to medical care. Many brigades also have their own charity foundations that raise money to pay for additional equipment, provision, and personnel and employ national and international PR officers.

5.2. Learning Loops: Reporting, Lessons, and Gamification

The uneven distribution of capability extends beyond personnel quality to innovation capacity itself. At the tactical level, the rate and extent of adaptation have also varied quite considerably. Innovation is concentrated in certain forward-leaning brigades rather than being evenly distributed across the force. Units like the Da Vinci Wolves Battalion have established dedicated unmanned ground systems units that emerged from grassroots initiatives driven by those directly engaged in combat, pioneering new approaches and sharing knowledge horizontally across the Ukrainian Army.[89]

Such pockets of innovation have also adopted novel reporting mechanisms that blend gamification with data-driven accountability.

At the most basic level, one reporting mechanism concerns "battlefield poetry", a term used by an interviewee to describe the ways in which frontline operators could relay immediate observations in simple online shared documents that could then feed into the lessons learned process. Beyond such informal channels, more standardised and digitised approaches to collecting front line data have emerged, including through the gamification of the war effort. The drone unit of Robert "Maydar" Brovdi, a former agricultural businessman who transitioned to legendary drone unit commander during the defence of Kyiv in 2022,[90] rose to become one of the country's most effective drone formations by integrating feedback loops from the battlefield into design and training, with commanders bringing entrepreneurial mindsets of constant testing, adapting, and iterating, and treating the battlefield like a "marketplace of survival."[91]

Such pockets of innovation have also adopted novel reporting mechanisms that blend gamification with data-driven accountability. Ukraine's "Army of Drones: Bonus" programme requires drone crews to upload video footage of their strikes to DELTA, the military's situational awareness system, where an AI-assisted verification team reviews each hit before awarding points that can be exchanged for new equipment on the Brave1 Market platform.[92] As one drone company commander noted, this creates "additional internal psychological motivation for the

89 Kateryna Bondar, *Why Ukraine Is Establishing Unmanned Forces Across Its Defense Sector and What the United States Can Learn from It* (Center for Strategic and International Studies, 2024), https://www.csis.org/analysis/why-ukraine-establishing-unmanned-forces.

90 Stash Luczkiw, *Ukraine's Avengers: Every Nation Needs Its Superheroes*, 18 March 2023, https://www.kyivpost.com/opinion/14371.

91 David Kirichenko, 'How Ukraine's Data-Driven Approach Is Impacting the War Effort', *Vox Ukraine*, 20 October 2025, https://voxukraine.org/en/how-ukraine-s-data-driven-approach-is-impacting-the-war-effort.

92 Guillaume Ptak, 'Ukraine's Digital Battlefield: AI and Drones Rewrite the Rules of War', *Washington Times*, 31 October 2025, https://www.washingtontimes.com/news/2025/oct/31/ukraines-digital-battlefield-ai-drones-rewrite-rules-war/.

team in the form of a healthy competitive spirit."[93] Yet such crowdsourced approaches also create pressure: units must fight for attention in the rear to secure quality support, with one sergeant major writing that "we film burning armoured vehicles to raise money for drones. We display death on screens because without spectacle, there are no donations."[94]

Moreover, civil society organizations, notably the Boryviter Center of Excellence, serve as crucial facilitators in this learning ecosystem by bridging the gap between field experience and formal training. Boryviter provides structured Lessons Learned training aligned with NATO standards to thousands of service members, teaching them how to formulate observations and manage the Lessons Learned process. They have demonstrated enormous adaptivity, such as updating training programmes in just four days based on new electronic warfare insights drawn from field interviews and intercepted communications. By collaborating with the Ministry of Defence and General Staff, Boryviter helps build professional thematic communities and analytical networks that ensure first-hand combat experience immediately influences operational decision-making.

93 Ibid.

94 David Kirichenko, 'How Ukraine's Data-Driven Approach Is Impacting the War Effort'.

Part II.
The Enabling Ecosystem: State, Society, and Industry

6. Innovation and the Defence Ecosystem

The Ukrainian battlefield has been dubbed a live War Tech Laboratory – a hotbed for military technological innovation. However, the real change lies not so much in technological innovation per se, but in the novel application of existing technologies. Few systems currently seen on the battlefield are actual technological breakthroughs: UAVs have been around for a long time, so have C2 systems, space-based internet, optic fibre, etc. What stands out in the current war's adaptation competition is massive tactical experimentation, followed by widespread technological adoption by the armed forces in conjunction with quickly emerging tactical concepts. The contrast with the West, where large R&D-investments into emerging military technologies seldom reach the procurement, let alone the hands-on adoption/diffusion stage, is stark. Furthermore, innovation takes place in a wider security and defence ecosystem, featuring a wide range of startups, volunteers, and brigades that organise their own R&D and supply chains; alongside centralised planning efforts, a small number of big primes, international support, and a large contingent of international arms manufacturers and e-tech companies that are involved in the war fighting effort not only to support Ukraine but also to develop and test their own equipment.

The rate of military-technological adaptation is enabled by a thriving ecosystem with short lines between the frontline and the rear land.

6.1. The Jungle Model: A Thriving Innovation Ecosystem

The r ate of military-technological adaptation is enabled by a thriving ecosystem with short lines between the frontline and the rear land. This is again in stark contrast to Western-European states, where, over the years, bureaucracies have sought to rationalise and streamline R&D efforts which take place into clearly delineated parcels behind demarcated fences while private initiatives and smaller SMEs face high entry barriers. The current situation in the West, perhaps captured by the image of a zoo, with zoo caretakers (R&D managers) managing R&D processes (innovation) while the wild animals have been tamed, or otherwise exported back to their country of origin. Compare this to the jungle in Ukraine, where a large ecosystem of frontline operators, factories, NGO-consultancies, charity foundations, professionals and volunteers co-exist alongside the official system of the centralised government in Kyiv tied together through an intricate web of informal and formal connections.[95] The centralised government still holds a pivotal role, not just in terms of determining the overall war strategy and policies, but also in terms of the certification of particular systems that have emerged bottom up, the reward of particular effective brigades, the allocation of budgets, the

[95] We would like to thank Sergiy Koshman for this powerful metaphor that he shared with us during our insightful conversation.

work on military systems that transcend the tactical and operational level, and the translation of operational needs and requirements into demands for Western support.

Ukraine's defence and security ecosystem is extremely vibrant with fluid connections between various branches of the ecosystem that fund and facilitate production innovation, learning lessons, disseminating these lessons, production and advocacy at the central government level. In addition to paying taxes, citizens also donate significant amounts of money to private foundations that channel money and sometimes even equipment to the armed forces directly. Foundations such as Pritula and Come Back Alive have licenses to procure lethal equipment.[96] In 2025 alone, Come Back Alive had already raised 200 million euro. The entire "charity-for-the military" sector may amount up to one billion euro a year in total.

This is emblematic of a wider militarisation of society in which individuals and groups support the war effort, including through the production of small FPVs and other types of UAVs. The NGO Dignitas, spearheaded by the 'mother of drones' Maria Berlinska, has developed a massive open online course "Victory Drones" on how to make drones.[97] It trains civilians and military personnel in drone operation and related defence technologies, including offline training at military facilities. The course has been successfully completed by more than 140,000 individuals. Other foundations focus on dissemination of software, training, and advocacy for official certification. Aerorozvvidka, for instance, is involved in making sure brigades have access to the latest battlefield C2 software, offering training at the frontlines as well as advocating for official certification by the central government of certain systems back in the capital to facilitate more widespread adoption.

The platform compresses traditional R&D cycles through direct feedback loops between frontline users and developers.

6.2. Government Innovation Platforms and Procurement Reform

6.2.1. Brave1 and Accelerated Certification

At the intersection of state coordination and private initiative, government-backed platforms have emerged to channel and accelerate bottom-up innovation. Brave 1, established in April 2023 as a government-backed defence technology platform supporting 2,300+ manufacturers, provides defence tech actors with organisational, informational, and financial support to accelerate military technology development.[98] The platform compresses traditional R&D cycles through direct feedback loops between frontline users and developers. Brave1 also accelerates certification: while NATO Stock Number certification typically requires 2-3 years, Ukrainian companies achieve it in 2-3 months on average, enabling rapid procurement and battlefield integration.[99] This facilitates widespread procurement and integration. The September 2025 Defence Tech Valley conference in Lviv, attracting 5,000+ participants

96 Come Back Alive, '"Come Back Alive" Obtained a License to Purchase Lethal Weapons', Come Back Alive, 22 June 2022, https://savelife.in.ua/en/materials/news-en/come-back-alive-obtained-a-license-to-pu-en/.

97 Victory Drones, 'Victory Drones. Strengthening the Technological Capabilities of the Defense Forces', Victory Drones, 2026, https://en.victory-drones.com/.

98 Olena Kryzhanivska, 'Brave1: The Engine Behind Ukraine's Defence-Tech Community', *Ukraine's Arms Monitor*, 15 November 2025, https://ukrainesarmsmonitor.substack.com/p/brave1-the-engine-behind-ukraines.

99 Scott Douglas Jacobsen, 'Ukraine's Brave1 Is Racing to Redefine Warfare', *International Policy Digest*, 24 April 2025, https://intpolicydigest.org/ukraine-s-brave1-is-racing-to-redefine-warfare/.

from 50+ countries including 300+ investors, demonstrated Brave 1's success in positioning Ukraine as a global defence innovation hub.[100]

6.2.2. **The MoD Reform Support Office**

Another pillar in Ukraine's ecosystem that at the time of writing is part of the official system but runs as a forward innovation unit, is the MoD Reform Support Office. Created by Yulia Marushehvska, it employs about 25 people of a multitude of professional backgrounds out of a hipster office space in central Kyiv. They are involved in different innovation projects. These include technological innovations such as digital procurement systems DOT and DPA, and they played a role in pushing along DELTA and ISTAR. However, they are also involved in the bottom-up codification of best practices with frontline operators rotating out, drafting guidelines on tactical innovations which are then disseminated more widely.

6.2.3. **Digital Procurement: DOT and DPA**

DOT and DPA are two separate but interconnected agencies that form pillars of Ukraine's defence procurement reform. DOT (State Operator for Non-Lethal Acquisition) was established in December 2023 to procure non-lethal supplies (food, clothing, medical equipment, fuel, etc.). It has facilitated transparency and achieved savings exceeding UAH 26 billion, while reducing delivery times by a factor of four.[101] The DPA (Defence Procurement Agency) manages lethal procurement—weapons, ammunition, UAVs, and military equipment. The key innovation connecting them is DOT-Chain Defence, a digital marketplace for weapons that fundamentally changes the approach to supplying the Armed Forces.[102] Built on DOT's existing digital procurement system (DOT-Chain), it functions like an Amazon-style platform where frontline units can browse an online catalogue of pre-verified and contracted defence products and submit orders directly.[103]

6.3. **Gamification and Performance-Based Resource Allocation**

Ukraine's ability to adapt is rooted in a shift from traditional vertical Soviet structures toward informal, horizontal networks driven by a younger, multi-generational force. Since the 2014 Donbas War, this bottom-up culture has favoured rapid, decentralised knowledge exchange through personal networks and field-level interactions, allowing units to innovate with fewer

100 Digital State UA, '$100M+ Boost: Global Investors Back Ukraine's Defense Tech Breakthroughs: Results of Defense Tech Valley 2025', 19 September 2025, https://digitalstate.gov.ua/news/tech/100m-boost-global-investors-back-ukraines-defense-tech-breakthroughs-results-of-defense-tech-valley-2025.

101 Ministry of Defence of Ukraine, 'Synchronization of the DOT and the DPA: The Ministry of Defence is expanding the non-lethal procurement reform to include weapons', Ministry of Defence of Ukraine, 1 May 2025, https://mod.gov.ua/en/news/synchronization-of-the-dot-and-the-dpa-the-ministry-of-defence-is-expanding-the-non-lethal-procurement-reform-to-include-weapons.

102 Ministry of Defence of Ukraine, 'Weapon deliveries will accelerate as the government approves the launch of DOT-Chain Defence — a digital marketplace for weaponry | MoD News', Ministry of Defence of Ukraine, 27 June 2025, https://mod.gov.ua/en/news/weapon-deliveries-will-accelerate-as-the-government-approves-the-launch-of-dot-chain-defence-a-digital-marketplace-for-weaponry.

103 Kateryna Bondar, *How and Why Ukraine's Military Is Going Digital* (Center for Strategic and International Studies, 2025), https://www.csis.org/analysis/how-and-why-ukraines-military-going-digital.

bureaucratic constraints. The most successful units cultivate an openness to innovation and a critical attitude toward leadership.[104] To ensure battlefield insights are disseminated more widely and prompt structural innovation rather than just temporary adaptation, Ukraine is actively institutionalising its "Lessons Learned" methodology. This involves adopting NATO standards and doctrine, such as the use of After Action Reviews (AARs) and structured analytical cycles. Emerging institutional responses include the implementation of *Lessons Learned Officers* and dedicated analysis functions tasked with processing field data and disseminating validated *Tactics, Techniques, and Procedures* across the wider force. Digital infrastructure, such as the Lessons Learned Portal and the Delta situational-awareness system as described earlier, provides a systematic platform for collecting and codifying these observations.[105]

A distinctive feature of Ukraine's adaptation is the operational gamification of the conflict.

A distinctive feature of Ukraine's adaptation is the operational gamification of the conflict, where digital architectures allocate rewards and resources based on battlefield performance. In 2024, the need to collect drone strike footage to speed-up AI training for automatic target recognition algorithms has prompted Ukrainian military leadership to incentivise brigades to upload their drone feeds of confirmed killed. The massive pool of data stored on shared servers labelled "Avengers", has been used to identify best practices and reward the best kills. The Army of Drones Bonus programme has been designed to assign point values to verified strikes. Each target is attributed number of points (a Russian tank may be 10 points, a Russian FPV pilot 40, etc.), which units can then redeem for advanced equipment on the Brave1 Market, effectively creating a "military version of Amazon Prime".[106]

The Bonus point system is also used to stimulate competition among units. For instance, former businessman turned politician turned Unmanned Systems Force commander Robert Brody "Madyar" publicises the ranking of each of the brigades under his command each month. This gamified ecosystem extends to civil society through apps like eVorog, which allow citizens to report Russian movements, and browser games that contribute to cyber operations. These practices have raised both questions related to ethics, including about distinction between combatants and non-combatants, and to efficacy, including whether simple counts of destroyed units necessarily captures operational value. Proponents argue that these systems not only generate vital data but also allows for participation by wider swaths of society. In addition, it reorganises procurement processes to respond faster to operational needs than central bureaucracies can.

104 Stuart Dee et al., *Lessons Learned: Understanding the Role of Military Organisational and Adaptation Culture for the Future of Ukraine's Defence* (Rand Europe, 2025), https://www.rand.org/pubs/research_reports/RRA3833-5.html.

105 Mick Ryan, 'Military Training Lessons from Ukraine', *The Interpreter*, 29 October 2025, https://www.lowyinstitute.org/the-interpreter/military-training-lessons-ukraine; Joseph Wehmeyer, 'Gamified War in Ukraine: Points, Drones, and the New Moral Economy of Killing', *War on the Rocks*, 7 January 2026, https://warontherocks.com/2026/01/gamified-war-in-ukraine-points-drones-and-the-new-moral-economy-of-killing/.

106 Simon Shuster, 'How Ukraine Gamified Drone Warfare', *TIME*, 24 September 2025, https://time.com/7319847/7319847/.

6.4. The Dual Structure of Ukraine's Defence Industrial Base

Ukraine's defence industrial and technological base (DTIB) has a dual centralised and decentralised structure. This structure combines Soviet industrial legacy with Silicon Valley-style startup agility, creating both production resilience and unprecedented innovation speed under combat conditions. The Ukrainian Defence Industry (formerly Ukroboronprom) concerns traditional heavy production, employing 54,000 workers across 100+ enterprises in five specialised divisions: aircraft, precision weapons, armoured vehicles, shipbuilding, and radar/air defence systems.[107] However, the wartime transformation dramatically inverted the pre-war balance: where state-owned enterprises once dominated production, a majority of the defence industry is now in private hands.[108] Over 200 drone manufacturers and 300 electronic warfare companies operate from "small and discreet warehouses, converted barns, cellars, or even living rooms."[109] In 2025, drone production is expected to have exceeded 4.5 million, with over 2 million projected to be FPV drones. Firms like Wild Hornets and TAF Industries scaled from basement workshops to USD$ 100 million-dollar+ operations. The cottage industry particularly accounts for the revolutionary edge in tactical systems (e.g. drones, EW equipment, modifications), while state enterprises maintain capacity for strategic platforms like cruise missiles, tanks, and artillery systems.

Consolidation of the scattered landscape is required to create more mass.

The dual nature of Ukraine's DTIB is reflected in the origin of sources of funding. Three out of ten UA defence manufacturers' main source of funding comes from the brigade level. Four out of ten of UA defence manufacturers report the central MOD as the main source of funding. In total, there are nineteen different procurement agencies next to city councils.

6.5. The Scaling Challenge and Future Trajectory

While the current ecosystem has proven remarkably adaptive, sustaining and scaling it presents fundamental tensions. On the industrial side, consolidation of the scatte red landscape is required to create more mass. In addition, producing greater numbers of systems to sustain the current war effort, where there remain acute shortages, mass is necessary to start churning out more advanced equipment that will allow Ukraine to reverse Russia's recent gains and destroy Russia's systems in the rear and deep area. In short, one of the key challenges for Ukraine over the 12-18 months is how to further scale its efforts both on the military and the industrial side, while preserving the advantages derived from its decentralised, bottom-up organisation.

107 Ukroboronprom, 2026, https://ukroboronprom.com.ua/en/pro-koncern.

108 Ukrinform, 'Defense Official Says Most of Ukraine's 900 Defense Industry Enterprises Are Privately Owned', *Ukrinform*, 7 August 2025, https://www.ukrinform.net/rubric-defense/4022634-defense-official-says-most-of-ukraines-900-defense-industry-enterprises-are-privately-owned.html; Hanna Arhirova, 'Ukraine Ramps up Spending on Homemade Weapons to Help Fight Russia', Politics, *PBS News*, 27 March 2024, https://www.pbs.org/newshour/politics/ukraine-ramps-up-spending-on-homemade-weapons-to-help-fight-russia.

109 Economichna Pravda, 'Ukrainian UAV Production Surges; over 200 Companies Involved in the Sector in 2023', *Ukrainska Pravda*, 1 February 2024, https://www.pravda.com.ua/eng/news/2024/02/01/7439866/; Tereza Pultarova, 'Ukrainian Startups Are Reinventing Electronic Warefare to Suppress Deadly Drone Attacks', 27 October 2025, https://electronics360.globalspec.com/article/22898/ukrainian-startups-are-reinventing-electronic-warefare-to-suppress-deadly-drone-attacks; GlobalData, 'Ukraine's Drone Production Ramps up', Airforce Technology, 13 March 2024, https://www.airforce-technology.com/analyst-comment/ukraines-drone-production-ramps-up/.

6.5.1. Indigenous Long-Range Strike Capabilities

Ukraine's ability to strike Russian military assets in the deep area has emerged as a critical capability requirement, largely dependent on Western systems like ATACMS and Storm Shadow that carry political constraints requiring approval for each strike into Russian territory. However, the Ukrainian defence industry has rapidly developed indigenous alternatives. The Long Neptune cruise missile, an evolution of the original R-360 anti-ship platform developed by Luch Design Bureau, has achieved verified combat strikes at 1,000 km range, with over fifty successful engagements documented in 2024 alone. Complementing this, the Flamingo heavy cruise missile, developed through partnership with Denmark on solid-fuel propulsion, offers a claimed 3,000 km range and 1,150 kg warhead. It entered serial production earlier in 2025, reached about 50 units per month by October, and aims to scale up to around 210 missiles per month by the end of the year. Most significantly, Ukraine has revived its Soviet-era ballistic missile expertise through Pivdenmash in Dnipro (the former Yusmash complex that once produced over 120 ICBMs annually), successfully testing the Sapsan/Hrim-2 ballistic missile mid-2025. Together, these programmes eliminate Ukraine's strategic dependence on Western approval for deep strikes and establish indigenous production independent of shifting international aid commitments.

7. Resilience, Society and Governance

After four years of high-intensity warfare, Ukraine's political resilience is fragile. An extraordinarily robust civil society continues to sustain the war fighting effort through decentralised volunteer networks, and Zelensky remains determined to stay the course and end the war on terms favourable to Ukraine. Yet, the overall population is increasingly war-weary; while recurring governmental corruption scandals threaten Western support. These dynamics converged dramatically in late 2025 when the Trump administration's peace proposal coincided with the largest corruption case of the Zelensky presidency.

7.1. Civil Society and Volunteer Networks

Ukraine's survival substantially depends on a decentralised ecosystem of NGOs, many established after the first Russian intervention in 2014, now operating at scales rivalling government programmes. When Russia launched its full-scale invasion in February 2022, this infrastructure proved critical: in the first six weeks, nearly all humanitarian assistance came from local volunteers before international organisations could mobilise. Over 1,700 spontaneous volunteer groups emerged alongside 150 established NGOs.[110]

These organisations now operate at huge scale. Come Back Alive, Ukraine's widely trusted charity founded in 2014, has raised approximately $360 million since the full-scale invasion.[111] It has procured over 43,000 FPV drones and other infantry equipment, becoming the first Ukrainian charity licensed to purchase lethal weapons.[112] The Serhiy Prytula Foundation raised $16 million in a single campaign to lease a Finnish reconnaissance satellite within a broader fundraising campaign totalling approximately $350 million.[113] The government's UNITED24 platform has collected over $1.4 billion from 137 countries.[114] The Hospitallers Medical Battalion, founded in 2014 by then-18-year-old Yana Zinkevych, evacuated over

110 Nicholas Noe, *Looking Forward: The Alliance of Ukrainian CSOs* (Refugees International, 2025), https://www.refugeesinternational.org/reports-briefs/looking-forward-the-alliance-of-ukrainian-csos/; Nicholas Noe, *Localizing the International Humanitarian Response in Ukraine* (Refugees International, 2022), https://www.refugeesinternational.org/reports-briefs/localizing-the-international-humanitarian-response-in-ukraine/.

111 Come Back Alive, 'Who We Are', Come Back Alive, 2026, https://savelife.in.ua/en/about-foundation-en/.

112 Come Back Alive, 'Who We Are'; Come Back Alive, '"Come Back Alive" Obtained a License to Purchase Lethal Weapons'.

113 Serhiy Prytula Charity Foundation, 'Safety for Ukrainians - Serhiy Prytula Charity Foundation', Serhiy Prytula Charity Foundation, 2026, https://donate.prytulafoundation.org/.

114 Amira Barkhush, 'UNITED24 Raises $1.4 Billion in Three Years of Global Support for Ukraine', UNITED24 Media, 5 May 2025, https://united24media.com/latest-news/united24-raises-14-billion-in-three-years-of-global-support-for-ukraine-8101.

19,000 wounded using 500 volunteers operating independently of military medical chains.[115] Research by Refugees International found Ukrainian NGOs deliver aid 15.5% more cost-effectively than international counterparts, demonstrating how this sophisticated network of local intermediaries has become a strategic asset.[116]

7.2. **Public Sentiment**

Public willingness to fight is fluctuating after close to four years of attrition warfare. Gallup researchers saw support for fighting until victory drop from 73% in 2022 to just 24% in July 2025, while those favouring immediate negotiations rose from 22% to 69% over the same period.[117] More recent polling by the Kyiv International Institute of Sociology in December 2025, however, shows that 63% of Ukrainians are ready to endure war as long as necessary.[118] At the same time, Ukrainians draw a critical distinction between accepting a frozen conflict and legitimizing Russian conquest. When the Kyiv International Institute of Sociology specified that "territorial concessions" meant formal de jure recognition of Russian sovereignty over occupied territories, only 24% supported such concessions, with 67% opposed.[119] This nuanced position was further clarified in December 2025 polling: 72% of Ukrainians indicated readiness to approve a peace plan that would freeze the situation along the current front line with security guarantees for Ukraine, but crucially, without officially recognising the occupied territories as part of Russia. At the same time, 75% reject a plan that would include withdrawal of troops from Donbas, put restrictions on the Ukrainian army, and lack specific security guarantees.[120]

Ukrainians draw a critical distinction between accepting a frozen conflict and legitimizing Russian conquest.

The November 2025 Trump peace plan exploited this war fatigue while demanding precisely what Ukrainians refuse to concede. The leaked 28-point proposal would recognise Russian control over Crimea and Donbas, require Ukraine to withdraw from "neutral demilitarized buffer zones," cap its military at 600,000 personnel, and enshrine NATO exclusion in its constitution.[121] In exchange, Ukraine would receive a US security guarantee and $200 billion in reconstruction funding.[122] Zelensky's response captured the stakes: "Ukraine may face a very difficult choice: losing our dignity or losing a key partner."[123] The drafting process without

115 Maria Kuchapska, 'Inside the Lives of Hospitallers, the Ukrainian Combat Medics', UNITED24 Media, 6 December 2024, https://united24media.com/war-in-ukraine/inside-the-lives-of-hospitallers-the-ukrainian-combat-medics-4268.

116 Refugees International, *Passing the Buck: The Economics of Localizing Aid in Ukraine* (Refugees International, 2024), https://www.refugeesinternational.org/reports-briefs/passing-the-buck-the-economics-of-localizing-aid-in-ukraine/.

117 Gallup, 'Ukrainian Support for War Effort Collapses', Gallup.Com, 7 August 2025, https://news.gallup.com/poll/693203/ukrainian-support-war-effort-collapses.aspx.

118 Kyiv International Institute of Sociology, 'Opinions and Views of Ukrainians on Issues of War and Peace, Trust in Western Partners, and the Internal Situation: December 2025', 15 December 2025, https://www.kiis.com.ua/?lang=eng&cat=reports&id=1569&page=1.

119 Interfax-Ukraine, 'Most Ukrainians Oppose Territorial Concessions in War with Russia – KIIS Poll', Facts, *Interfax-Ukraine*, 9 October 2025, https://en.interfax.com.ua/news/general/1110968.html.

120 Kyiv International Institute of Sociology, 'Opinions and Views of Ukrainians on Issues of War and Peace, Trust in Western Partners, and the Internal Situation: December 2025'.

121 Paul Kirby, *What We Know about Leaked US Draft Plan to End Russia's Ukraine War*, 24 November 2025, https://www.bbc.com/news/articles/cde6yld78d6o.

122 Ibid.

123 Sasha Vakulina, 'Zelenskyy: Ukraine Faces Choice between "loss of Dignity" or Losing Key Ally over US-Russia Plan', *Euronews*, 21 November 2025, https://www.euronews.com/2025/11/21/ukraine-facing-very-difficult-choice-of-dignity-or-key-partner-over-us-russia-plan-zelensk.

full Ukrainian input reinforced a sense of betrayal. December 2025 polling puts trust in the US at 21%, down from 41% in December 2024.[124]

In subsequent negotiations, key provisions have since been revised. By late December 2025, Ukraine and the US had condensed the framework to 20 points, raising the military personnel cap to 800,000, removing the constitutional NATO ban and automatic war crimes amnesty, and strengthening security guarantees by a coalition of European states ultimately backed up by the US, with a European leaders stating in mid-December they "will assist in the regeneration of Ukraine's forces, in securing Ukraine's skies, and in supporting safer seas, including through operating inside Ukraine" and "take measures to restore peace and security in the case of a future armed attack" including "armed force".[125] At a December 28 meeting at Mar-a-Lago, Trump and Zelensky announced 90% agreement on the framework, but territorial control, particularly Russia's demand for Ukraine's full withdrawal from Donetsk, remains a key sticking point.[126]

7.3. **Governance and Corruption**

While external peace negotiations strained Ukraine's relationship with its most critical ally, internal governance failures threatened to undermine Western support altogether. The largest corruption crisis of Zelensky's presidency exploded in November 2025 when investigators uncovered Operation Midas, a $100 million kickback scheme involving state nuclear company Energoatom.[127] Energy Minister Herman Halushchenko and Justice Minister Svitlana Hrynchuk were fired, former Deputy Prime Minister Oleksiy Chernyshov was detained, and, most consequentially, chief of staff Andriy Yermak, described as the most powerful figure in Ukraine after Zelensky, resigned November 28 after investigators searched his residence.[128] The scandal followed a troubling pattern: a January 2024 artillery shell theft involving $40 million in missing munitions,[129] a January 2023 procurement scandal that contributed to Defence Minister Reznikov's dismissal,[130] and a November 2024 case where $1.6 billion allocated for protective bunkers around electricity substations resulted in none being constructed during sustained Russian infrastructure attacks.[131]

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124 Kyiv International Institute of Sociology, 'Opinions and Views of Ukrainians on Issues of War and Peace, Trust in Western Partners, and the Internal Situation: December 2025'.

125 European Council, 'Leaders' Statement on Ukraine', 15 December 2025, https://www.consilium.europa.eu/en/press/press-releases/2025/12/15/leaders-statement-on-ukraine/.

126 Kevin Liptak, 'Takeaways from Trump's Meeting with Zelensky in Florida', *CNN*, 29 December 2025, https://www.cnn.com/2025/12/28/politics/trump-zelensky-florida-meeting-takeaways.

127 National Anti-Corruption Bureau of Ukraine, 'Operation "Midas": High-Level Criminal Organisation Operating in Energy Sector Exposed', National Anti-Corruption Bureau of Ukraine, 11 November 2025, https://nabu.gov.ua/en/news/operatciia-midas-vykryto-vysokorivnevu-zlochynnu-organizatciiu-shcho-diiala-u-sferi-energetyky/.

128 Centre for Eastern Studies, *Hell Has Frozen over: Head of the Office of the President of Ukraine Andriy Yermak Resigns* (Centre for Eastern Studies, 2025), https://www.osw.waw.pl/en/publikacje/analyses/2025-12-01/hell-has-frozen-over-head-office-president-ukraine-andriy-yermak.

129 Christian Edwards et al., 'Ukraine Says It Uncovered $40 Million Corruption Scheme in Weapons Procurement', *CNN*, 28 January 2024, https://www.cnn.com/2024/01/28/europe/ukraine-weapons-procurement-corruption-shell-intl.

130 Martin Fornusek, '$18 Million Embezzlement — Anti-Graft Agencies Shed Light on Military Food Procurement Scandal, Press Charges', *The Kyiv Independent*, 2 April 2025, https://kyivindependent.com/anti-graft-agencies-press-charges-in-military-food-procurement-case/.

131 Maxim Tucker, 'Energy "Corruption" Leaves Ukrainians Facing a Deadly Freeze', 23 November 2024, https://www.thetimes.com/world/russia-ukraine-war/article/energy-corruption-leaves-ukrainians-facing-a-deadly-freeze-9b9tb7gwx.

Ukraine's anti-corruption architecture, particularly the National Anti-Corruption Bureau (NABU) and Specialized Anti-Corruption Prosecutor's Office (SAPO), has achieved significant results despite political pressure, uncovering misdeeds involving senior state officials, state enterprise heads, judges, and members of parliament throughout the full-scale invasion.[132] When Zelensky attempted to limit their independence by placing NABU and SAPO under Prosecutor General control in July 2025, the EU responded by cutting €1.5 billion from Ukraine's aid tranche, forcing revision of the proposal.[133] The Energoatom scandal's timing, coinciding with Trump peace plan negotiations, demonstrates how corruption scandals threaten the Western support that Ukraine's horizontal civil society, despite its remarkable effectiveness, cannot replace.

[132] National Anti-Corruption Bureau of Ukraine, 'NABU, SAPO Showcase Strong Results in the Second Half of 2023', National Anti-Corruption Bureau of Ukraine, 21 February 2024, https://nabu.gov.ua/en/news/nabu-sap-pokazaly-potuzhn-rezul-taty-u-drugomu-p-vr-chch-2023-roku/.

[133] Alena Koroleva, 'Top Ukraine Energy Officials Face Corruption Trial', *OCCRP*, 6 August 2025, https://www.occrp.org/en/news/ukraine-nabu-charges-eight-in-33m-transformer-procurement-fraud.

Part III.
The Path to Victory and (Force) Requirements

8. Theory of Victory and Capability Requirements Ukraine

8.1. Strategic Neutralisation: Ukraine's Denial Strategy

Any sound military strategy must rest on a "theory of victory", a practical concept of how the use of force, combined with other instruments of power, might compel the adversary to accept outcomes it would otherwise reject. A theory of victory aptly links political aims, military possibilities, and strategic mechanisms into a coherent causal chain: if a given pattern of operations is conducted, then it will shape the enemy's will and capability in ways that produce the desired political end-state.

In the case of Ukraine, and given the current military situation, such a theory of victory could be framed as a strategy of "denial", or what former Ukrainian Defence minister Andrii Zagorodnyuk recently called "strategic neutralization." Instead of assuming that Ukraine can quickly inflict a decisive battlefield defeat, strategic neutralisation aims to make Russia's war operationally pointless: denying it the ability to achieve its core objectives, steadily eroding its offensive potential, and hardening Ukraine's resilience to the point where continued aggression ceases to offer Moscow any plausible path to strategic gain. This converges with the European Union White Paper on Defence which called for a "steel porcupine" strategy for Ukraine. In this perspective, victory is defined less by a single culminating offensive and more by the cumulative effect of attrition, denial, and adaptation over time – an "unwinnable war" for Russia that leads, eventually, to political adjustments in Moscow and a negotiated settlement on substantially better terms for Kyiv.

Strategic neutralisation aims to make Russia's war operationally pointless.

To succeed in such a strategy, multiple lines of effort are needed. First, Ukraine must maintain the integrity of the state—its political leadership, critical infrastructure, and economic lifelines—under prolonged attack, including sustained strikes against the energy grid and urban centres. Second, it must degrade Russian combat power faster than Russia can regenerate it, through continuous pressure on logistics hubs, ammunition depots, command nodes and critical enablers in occupied territories, Crimea, and the Russian rear. Third, it must prevent Russia from consolidating and legitimising occupation by keeping the theatre contested—through deep strikes, information operations, and resistance activities that raise the political and military cost of holding territory. Finally, strategic neutralisation assumes the long-term integration of Ukraine into Western defence-industrial and security networks:

sustaining a qualitative edge in key capabilities and securing enduring external support so that Russia cannot simply "outlast" Ukraine. In short, Ukraine's theory of victory is not about a quick knockout blow, but about turning Russia's war into a long, costly, and ultimately futile enterprise.

8.2. The Future Force Concept

If Ukraine's theory of victory rests on a "denial strategy", the corresponding force model must be built for endurance, operational depth, and scalable strike rather than for a single, short-lived manoeuvre campaign. This is precisely what ongoing Ukrainian reforms attempt to codify in a "future force model" being developed with allies through NATO's Security Assistance and Training for Ukraine (NSATU), the eight Capability Coalitions and a growing web of bilateral security agreements. These structures are progressively moving from ad hoc equipment lists to multi-year capability roadmaps out to 2027, tying force design (structures, C2, readiness) to long-term industrial and financial trajectories.

8.2.1. Ground Forces: The Challenge of Corps and Operational Depth

On land, the most visible manifestation of Ukraine's future force logic is the move to a corps-based structure with a roadmap through 2027 (see above 'Corps Reform'). The aim is to create operational-level formations capable of planning and conducting sustained corps-sized operations, integrating fires, manoeuvre, logistics, and territorial defence forces within clearly defined sectors. Strategic neutralisation makes operational depth a central requirement for these corps. Ukrainian forces must be able not only to hold or retake front-line positions, but also to consistently strike Russian rear areas—logistics trunks, ammunition depots, repair bases, command posts, air bases, and transport nodes—well beyond the immediate contact line. This implies robust stocks of precision and area-effect munitions for systems such as HIMARS-class launchers and long-range ballistic or cruise missiles (ATACMS or functional equivalents), on the order of tens of thousands of guided rockets and hundreds of long-range missiles over a multi-year horizon, rather than sporadic "boutique" deliveries. Long-range UAVs, loitering munitions, and land-attack naval drones complement this portfolio by enabling continuous pressure on depth targets and maritime lines of communication.

Severe attrition occurs throughout the incorporation pipeline.

8.2.2. The Manpower Constraint

Manpower remains a structural constraint even as the force becomes more unmanned and, progressively, more semi-autonomous. Current Ukrainian planning assumes that roughly 30,000 new personnel per month would be needed to sustain the force model under existing attrition and rotation rates, whereas actual monthly inflows are closer to 20,000–25,000. Of these, only around 10,000–15,000 ultimately pass medical, performance, and integrity screens to be inducted—due both to genuine health issues and to last-minute "wavers" often linked to corruption or social pressure. Severe attrition occurs throughout the incorporation pipeline: the 155th Brigade, as discussed, mobilised fewer than 2,000 of its planned 5,800 troops and subsequently lost approximately 1,700 to desertion before seeing combat. Health screening failures, medical exemption fraud involving bribes of $3,000-$15,000, and systematic corruption in Territorial Recruitment Centres further reduce the number of recruits who

reach operational units. Bridging this gap will require not only legal reform and improved mobilisation practices but also increased productivity per soldier: more ISR per unit, more fires per crew, better integration of robotics and decision-support tools, and a mobilisation system that cycles veterans and specialists back into the force in smarter ways. The time horizon of the force model will determine whether these numbers are remotely sufficient.

8.2.3. Air Domain: Layered Defence and Offensive Counter-Air

In the air domain, Ukraine's central challenge will be to build a coherent and integrated air-and-missile-defence architecture capable of denying Russia's combined missile and one-way-attack (OWA) drone threat through sustainable and economically viable solutions. This means expanding layered ground-based air defence (GBAD) while integrating, for the first time, a substantial air-to-air component built around F-16s and, potentially down the line, Gripen or even Rafale aircraft. These fixed-wing assets are expected not only to perform traditional air-defence and SEAD roles, but also to intercept cruise missiles and OWAs—missions that will require advanced sensors, rapid reaction, and highly disciplined airspace management.

The main operational risk will come from deconfliction. Ukraine will have to orchestrate engagements across multiple generations and standards of systems: legacy Soviet-era GBAD, legacy Western GBAD transferred in emergency conditions, emerging Ukrainian-developed systems, and the new fighter fleet. Without a unified C2 and air battle management system, the risk of fratricide, wasted interceptors, or "dead zones" between systems will be significant. Moreover, as Fabian Hoffmann has argued, a strictly defensive posture is not viable in the long run: even the most efficient GBAD architecture becomes economically prohibitive when absorbing sustained large-scale missile and drone salvos. Sustainable air defence therefore requires a complementary offensive–counter-air and counter-launch capability, including deep strikes against Russian missile storage, launch platforms, and C2 nodes. In other words, "denial alone won't do:" air defence must be paired with offensive disruption to reduce the volume of threats that reach Ukrainian airspace.

8.2.4. Maritime Domain: From Denial to Sea Control

At sea, the future requirement goes beyond the remarkable denial posture Ukraine has already achieved against the Black Sea Fleet. The next step is to maintain continuous pressure on Russian naval assets in Crimea and along the Russian coastline while moving from denial to securing sea lines of communication (SLOCs) to the Bosphorus. Doing so will require a mix of coastal anti-ship missiles, long-range strike against naval infrastructure, maritime domain-awareness networks, and an expanded ecosystem of unmanned surface and subsurface vessels. The objective is not to generate a traditional navy, but to preserve freedom of navigation for Ukrainian grain and trade flows, backed by the ability to impose cost on Russian maritime operations at will.

8.2.5. **Space Domain: Resilient SATCOM and ISR**

In space, Ukraine's force model must secure resilient SATCOM and autonomous ISR, both of which have become indispensable to its kill-cycle. Starlink remains central today, but strategic autonomy requires diversification through European alternatives such as OneWeb or future EU sovereign constellations. Similarly, Ukraine needs sustained access to space-based ISR—electro-optical, SAR, and electronic intelligence—under arrangements that are not exclusively dependent on the political configurations of U.S. support. Space resilience, redundancy, and multi-source data fusion will be essential to maintaining tempo in deep-strike operations and in countering Russian electronic attack against Ukrainian C2.

While Ukraine's main challenges rest on the ground forces, these air, sea, and space requirements reflect the logic of strategic neutralisation: forcing Russia to operate under constant threat, reducing its offensive potential at the source, and ensuring that Ukraine's own critical functions—air defence, SLOCs, and C2/ISR—remain survivable over the long war.

Part IV.
Implications for European Security Policies

9. Implications and Take Aways

Ukraine has become a central pillar of Europe's forward defence against Russia.

Ukraine has become a central pillar of Europe's forward defence against Russia. How the war ends (or fails to end) will shape Europe's security environment for decades. NATO's 2022 New Force Model (NFM) established an 800,000-troop requirement across three readiness tiers (100,000 at 0-10 day readiness, 200,000 at 10-30 days, and 500,000+ at 30-180 days),[134] while SACEUR's classified Minimum Capability Requirements demands expansion from 6 to 15 warfighting corps, 24 to 38 division headquarters, and 82 to 131 combat brigades, requiring roughly 245,000 additional ground troops and a 400% increase in air defence systems.[135] Against these requirements stands Ukraine's actual force: 880,000-980,000 active personnel organized into 100+ brigades, with planned reorganisation into 18 corps. This is remarkably close to NATO's own structural requirements (even though the break-down by domains differs greatly, and NFM would rely on more advanced forces and lean on a stronger air power component). In a way, Ukraine's rough numbers validate the NFM which has been designed to defend Europe against the bulk of Russian forces, which is exactly what Ukraine has been doing.

At the same time, this Ukrainian force currently ties down approximately 700,000+ Russian troops (50+% of Russia's actual military strength), and has inflicted casualties estimated at over 1,000,000 while destroying 20,000+ pieces of equipment, degrading Russian combat power that would otherwise threaten NATO directly.[136] Collective Western support of about € 80 billion per year sustains this force, whereas achieving the minimum capability requirements would cost hundreds of billions upfront, plus comparable annual operating expenses thereafter. These figures overshadow current expenditure and might well exceed what European nations are willing to spend on their own militaries. The counterfactual is bleaker still: a Cold War-style deterrence posture against Russia advancing to NATO borders would cost the alliance an estimated $200-280 billion annually,[137] while the Kiel Institute calculates that Russian victory could impose costs on Germany alone reaching twenty times current Ukraine expenditure.[138]

The strategic calculus is clear: Europe can sustain support for Ukraine's defence at current levels, in recognition of the fact that Ukraine bears the brunt of the cost, including in human lives; or it can face up to the far more expensive prospect of directly deterring or even fighting

134 Finn-Ole Albers, *Key Takeaways from the 2022 NATO-Summit in Madrid* (Warsaw Institute, 2022), https://warsawinstitute.org/key-takeaways-2022-nato-summit-madrid/.

135 Thorsten Jungholt, 'Absicherung Gegen Russland: Nato Fordert 49 Weitere Kampftruppen-Brigaden', *Die Welt*, 10 June 2024, https://www.welt.de/politik/deutschland/article253847236/Absicherung-gegen-Russland-Nato-fordert-49-weitere-Kampftruppen-Brigaden.html.

136 The Economist, 'Russia's Latest Big Ukraine Offensive Gains next to Nothing, Again', *The Economist*, 17 October 2025, https://www.economist.com/interactive/europe/2025/10/17/russia-latest-big-ukraine-offensive-gains-next-to-nothing-again.

137 Jan Kallberg, *Think Ukraine's Expensive? Wait for the New Cold War* (Center for European Policy Analysis, 2023), https://cepa.org/article/think-ukraines-expensive-wait-for-the-new-cold-war/.

138 Johannes Binder and Moritz Schularick, *The Costs of Not Supporting Ukraine* (Kiel Institute for the World Economy, 2024), https://www.kielinstitut.de/fileadmin/Dateiverwaltung/IfW-Publications/fis-import/2a62f762-49a1-410a-8225-ca50193faa38-KPB_179_EN.pdf.

a Russian military that, without Ukrainian attrition, would retain the combat experience and equipment stocks to threaten NATO member states by the end of the decade.

From a European perspective, three possible future paths lie ahead.

1. Failure to act: assistance erodes, political fatigue sets in, and no credible new security arrangements are put in place. In this scenario, Ukraine is likely to falter, either through protracted attritional fighting or through an imposed ceasefire framed as neutralisation, unavoidably followed by renewed Russian pressure, whether through coercion or resumption of a large-scale offensive once Ukraine has been strategically weakened. One way or another, this would mean Europe will face a closer, more acute Russian threat, combined with the profound political shockwave and moral hazard generated by the loss of Ukraine despite repeated pledges to support it "as long as it takes."
2. Establishment of solid security guarantees for Ukraine in the context of a negotiated ceasefire with Russia, including the deployment of a multinational force to demonstrate such a will – any failure to do so would inevitably come back to either the first or the third path.
3. Continued, sustained budgetary and military assistance aimed at enabling Ukraine to defend itself and gradually rebalance the war.

The remainder of this section examines what pursuing these latter two paths—which, rather than being mutually exclusive, can usefully complement each other—would entail in practice. We begin with the Coalition of the Willing framework and the strategic paradox it currently faces (9.1), before turning to the broader implications for international support to Ukraine (9.2), and finally to the practical support arrangements and mechanisms that could underpin a sustained commitment (9.3).

9.1. Implications for the Coalition of the Willing: Promise and Paradox

Since early 2025, European leaders have sought to explore security guarantees for Ukraine outside the NATO framework through a "Coalition of the Willing" (COTW) as a flexible political format designed to bypass NATO consensus constraints and prepare for a potential Multinational Force Ukraine (MNFU). The coalition brings together more than thirty states, with France and the United Kingdom clearly identified as "willing and able" leaders, supported by a larger group of "willing but constrained" European and transatlantic partners. The MNFU concept, as currently sketched, would be deployed "the day after" a ceasefire and focus on three pillars: securing Ukrainian airspace, supporting Black Sea maritime security, and regenerating Ukraine's land forces through training, logistics, and sustainment. A potential fourth leg, land demonstration forces, has remained disputed at best.

On 6 January 2026, Macron, Starmer, and Zelensky signed a trilateral declaration of intent which would pave the way for the deployment of French and British troops in Ukraine.[139] According to Starmer, "following a ceasefire, the UK and France will establish military hubs

[139] The Presidential Office of Ukraine, 'Importantly, the Coalition Now Has Substantive Documents in Place: A Joint Declaration by All Coalition Countries, and a Trilateral Declaration by France, the United Kingdom, and Ukraine – The President', President of Ukraine, 1 June 2026, https://www.president.gov.ua/en/news/vazhlivo-sho-sogodni-ye-gruntovni-dokumenti-koaliciyi-ohochi-102317.

across Ukraine."[140] Macron further clarified the goal of such a land demonstration force being "to provide reassurance after the ceasefire," and not direct engagement with Russian forces should Moscow relaunch an invasion of Ukraine.[141] He noted that the force would be stationed "a long way behind the contact line."[142] However, the COTW is currently stuck in a strategic paradox. The explicit precondition of a ceasefire before any deployment has become a blocking factor rather than a catalyst. From Moscow's perspective, any credible promise of a future European military presence in Ukraine (especially one involving NATO members, not to mention the two independent European nuclear powers France and the UK) strengthens Vladimir Putin's reluctance to sign a ceasefire in the first place. In other words, the "day after" logic may in fact delay or prevent the very ceasefire it is meant to underpin. Russia has been explicit in its opposition to any Western military footprint in Ukraine, and the prospect of deploying a post-ceasefire MNFU risks being perceived in Moscow as the very materialisation of what it has sought to prevent for years if not decades.

For the time being Europe will continue to focus on what has effectively been Plan A since 2022: sustained military assistance to Ukraine.

The only plausible way out of this deadlock would be to repurpose the COTW format toward pre-ceasefire measures that incrementally alter the military balance and political calculus. Two pillars stand out as adapted to such a purpose. The first is a "Safe Skies" approach, building on the existing Ukraine Sky Shield initiative. Russian drone and missile incursions into Polish and Romanian airspace have already demonstrated both Ukraine's growing competence in counter-UAS operations and the artificiality of stopping Russian uncrewed systems only once they cross into NATO territory. Extending elements of air policing or integrated air defence coverage over western Ukraine would not only protect critical infrastructure but also align with NATO members' own airspace security interests. The second pillar is "Regeneration": gradually moving European training activities back into Ukraine, at least in its western regions, rather than conducting them exclusively in Poland or Germany.

Such steps could, paradoxically, create an incentive for Russia to rush toward a ceasefire to prevent a steadily expanding European military footprint on Ukrainian soil. The problem is Europe's persistent risk aversion and fragmented political will. While there are signs of a more flexible posture emerging within SACEUR/USEUCOM regarding compatibility between a COTW-led effort and NATO's Deterrence and Defence of the Euro-Atlantic Area (DDA) family of plans and possible US military enablement of a European MNFU, Europeans would still have to lead decisively and accept real political and operational risk. The recent rift in the Transatlantic relationship over Greenland likely will serve as a further impediment for the near future. As of now, appetite for such a "reasonably bold" approach can therefore be expected to remain limited. If this does not change, continued emphasis on the COTW risks becoming performative rather than strategic. This suggests that for the time being Europe will continue to focus on what has effectively been Plan A since 2022: sustained military assistance to Ukraine.

140 Shaun Walker, 'UK and France "Ready to Deploy Troops" to Ukraine after Ceasefire', *The Guardian*, 6 January 2026, https://www.theguardian.com/world/2026/jan/06/uk-france-ready-to-deploy-troops-to-ukraine-after-ceasefire.

141 Ibid.

142 Ibid.

9.2. Implications for International Support

US aid to Ukraine ceased entirely on January 20, 2025, the day of Trump's second inauguration, with American cumulative contributions reaching €114.6 billion in total. Europe responded with unprecedented urgency in Q1 2025, allocating €26.9 billion, 40% above any previous quarterly record and approaching the €82 billion annual benchmark Kiel researchers calculated as necessary to replace American contributions. By June 2025, Europe surpassed the US in cumulative military aid for the first time since June 2022. However, this surge proved unsustainable: European military aid collapsed in the second half of 2025[143]

Late last year, European Union states couldn't agree on confiscating Russian frozen assets of approximately €195 billion in Russian central bank reserves that sit at Euroclear in Brussels, although the interest of these assets is used for support to Ukraine. The frozen assets generate substantial interest income: $7 billion in 2024 alone.[144] The G7's Extraordinary Revenue Acceleration (ERA) initiative, agreed at the June 2024 Puglia summit, established a $50 billion loan backed by approximately $3 billion in annual frozen asset interest, with the US contributing $20 billion and the EU providing €18.1 billion. The EU separately transfers windfall profits biannually, for example, €2.1 billion in April 2025. On December 3, 2025, the European Commission proposed a dramatic escalation: a €90 billion reparations loan using frozen Russian assets as collateral, which would cover two-thirds of Ukraine's financing needs for 2026-2027.[145] Belgium, however, proved the critical obstacle, with Prime Minister Bart De Wever calling the reparations loan "fundamentally wrong" and demanding EU-wide risk-sharing for potential Russian lawsuits, cash-on-hand guarantees for instant Euroclear repayment if needed, and proportional G7 contributions.[146] Euroclear itself warned that the proposal carried "significant legal, financial and reputational risks."[147] The December 18–19 EU summit showed that legal and financial obstacles were too great to reach agreement. Instead, leaders approved a €90 billion loan backed by the EU budget rather than Russian assets.[148] This prevents immediate Ukrainian bankruptcy and offers Ukraine funding for 2026-2027. However, it falls €40 billion short of the IMF's calculated €130 billion two-year funding requirement. To fully replace US aid, the Kiel Institute calculates Europe must allocate 0.21% of combined GDP annually, more than double historical averages for major European economies.

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143 Kiel Institute for the World Economy, 'Ukraine Support Tracker: Military Aid Falls Sharply despite New NATO Initiative', Kiel Institute, 14 October 2025, https://www.kielinstitut.de/publications/news/ukraine-support-tracker-military-aid-falls-sharply-despite-new-nato-initiative/; Kiel Institute for the World Economy, 'Ukraine Support Tracker: Europe Fails to Offset US Aid Drop', 12 October 2025, https://www.kielinstitut.de/publications/news/ukraine-support-tracker-europe-fails-to-offset-us-aid-drop/.

144 Brad W. Setser, *How to Use Russia's Frozen Assets* (Council on Foreign Relations, 2025), https://www.cfr.org/article/how-use-russias-frozen-assets.

145 Julia Payne et al., 'EU Proposes Using Frozen Russian Assets or Borrowing to Give Ukraine 90 Bln Euros', Business, *Reuters*, 3 December 2025, https://www.reuters.com/business/european-commission-move-ahead-with-proposal-use-russias-frozen-assets-ukraine-2025-12-02/.

146 Charlotte Van Campenhout, 'Belgian PM Says Using Frozen Russian Assets Could Block Ukraine Peace Deal', Finance, *Reuters*, 28 November 2025, https://www.reuters.com/business/finance/belgium-pm-says-using-frozen-russian-assets-could-derail-ukraine-peace-deal-2025-11-28/.

147 Jorge Liboreiro, 'Reparations Loan for Ukraine Is "very Fragile" and Risks Investor Exodus, Euroclear Warns', *Euronews*, 12 May 2025, http://www.euronews.com/my-europe/2025/12/05/reparations-loan-for-ukraine-is-very-fragile-and-risks-investor-exodus-euroclear-warns.

148 European Council, 'European Council, 18 December 2025, Ukraine', 19 December 2025, https://www.consilium.europa.eu/en/press/press-releases/2025/12/19/european-council-18-december-2025-ukraine/.

9.3. **Implications for Support Arrangements**

International military assistance to Ukraine has evolved through several phases since 2022. The most consequential recent shift is the end, by mid-2025, of new US budgetary allocations for Ukraine military aid. According to the Kiel Institute's Ukraine Support Tracker, military assistance has fallen sharply despite new NATO coordination mechanisms, leaving Europe as the primary—indeed almost sole—provider of external military support. Yet European efforts have so far failed to fully compensate for the scale, speed, and diversity of US support.

While US funding has dried up, US weaponry has not entirely stopped flowing to Ukraine. Through NATO's Security Assistance and Training for Ukraine (N-SATU) framework and the Prioritized Ukraine Requirements List (PURL), US-designed equipment continues to transit via the Rzeszów hub in Eastern Poland. This includes categories of capabilities for which there are still no viable European or Ukrainian substitutes: ballistic missile defence interceptors such as PAC-3, certain counter-UAS technologies, long-range strike systems like HIMARS, and associated rockets or missile (ATACMS), as well as niche electronic warfare and cyber-electromagnetic activities (CEMA) enablers. Drawing from US arsenal (especially US Army pre-positioned stockpiles) also offers the capacity and volumes lacking in existing European capabilities. However, PURL largely backfills previously pledged Presidential Drawdown Authority (PDA) equipment authorised under the 2024 US supplemental package. It does not generate genuinely new capability streams, and it relies heavily on contracts placed years earlier under the Ukraine Security Assistance Initiative (USAI), which are only now delivering.

The most innovative alternative to emerge has been the so-called "Danish model."

A critical open question is whether Europeans will eventually be expected to finance even these US industrial deliveries. The PURL approach has structural limitations. First, it divests European money from capital investment in European or Ukrainian DTIB. As such it does not address the structural European dependency, and even increase its vulnerability to a possible US pause over delivery (as illustrated already twice in week-long suspensions of US deliveries in 2025), or mere re-priorisation of US second hand market customers. Second, US pricing methodologies have increasingly reduced value for money of delivered equipment. Interviews conducted in Europe indicate that the notional price of second-hand US Army Bradley infantry fighting vehicles reportedly quadrupled between mid-2025 and early autumn, meaning fewer platforms delivered for the same European financial contribution. Beyond PURL, traditional models of assistance—donating old equipment—are exhausted, while direct financial contributions to European industry have proven too slow to meet battlefield timelines.

The most innovative alternative to emerge has been the so-called "Danish model." Under this approach, European states provide funding to procure equipment directly from Ukrainian defence companies, enabling local production close to the front. The advantages are clear: Ukraine's defence tech ecosystem is highly adaptive, labour costs are lower, regulatory barriers are fewer, and production cycles are often much shorter. However, this model also has limits. Production sites remain vulnerable to Russian strikes, Ukraine's industry cannot yet produce many high-end systems at scale, and—critically—it does little to help European defence industries expand capacity or resilience. To combine the strengths of direct Ukrainian procurement and European industrial scaling, joint-venture (JV) models have gained prominence. These are increasingly referenced in European policy discussions, including the EU's recent White Paper on Defence and financing instruments such as SAFE.

The logic is to create European-Ukrainian industrial partnerships in which European firms team up with Ukrainian counterparts, with contracts funded by European governments. Early examples include Ukrainian firm Firepoint producing solid fuel components for Denmark, and the offshore production in the UK of Ukrainian-designed maritime drones such as the "Shark" series.

This approach strengthens Ukraine's emerging DTIB while embedding it within European supply chains. JV models also face their own serious political-economy obstacles. Intellectual property (IP) protection is a major concern on both sides. European firms often cite Ukraine's weak IP enforcement framework and fear technology leakage—sometimes illustrated, fairly or not, by the visual similarity between Ukraine's Bohdana howitzer and France's donated CAESAR systems. Conversely, Ukrainian companies at the cutting edge of AI-enabled targeting and autonomous systems worry about losing control over their data sets and algorithms when partnering with large European primes. Additional concerns include NATO perceptions of Ukraine as a legally hazardous production environment, uncertainty about future conflict intensity, and latent fears of Ukrainian firms becoming future competitors in European markets. Potential solutions include the development of standardised, EU-backed IP and data-protection frameworks for wartime co-production; political risk-sharing mechanisms and insurance instruments to de-risk investment; and clearer pathways for Ukrainian firms' gradual integration into the European EDTIB rather than their marginalisation as temporary subcontractors.

9.4. **Key Recommendations**

The central lesson of the past four years is that Ukraine support cannot be episodic. It requires persistent funding across different time horizons.

First, pledging is not the same as delivering. Many countries announce financial commitments that are only partially disbursed. The development of transparent methodologies—such as those pioneered by the Kiel Institute—should be generalised and politically endorsed to ensure accountability and credibility.

In the short term (0–12 months), the priority remains filling critical battlefield gaps: air and missile defence, ammunition, counter-UAS, and sustainment. Speed matters more than elegance, and political constraints should be judged against the cost of Ukrainian battlefield failure.

In the medium term (12–36 months), assistance must shift toward reforming Ukraine's force posture, regenerating units, and building an indigenous EDTIB capable of sustained output. This is where JV models and European-funded co-production become strategically decisive.

In the long term (36–120 months), the objective should be to ensure Ukraine's survival as an independent, militarily viable state through a "porcupine" model: a mix of financial support, selective imports of advanced systems, dense domestic production of mass capabilities, and deep economic and industrial integration with Europe. Assisting Ukraine, in this sense, is not altruism. It is a direct investment in Europe's own security, credibility, and strategic autonomy.

It needs to be stressed that this is a two-way street: this is not only about supporting Ukraine but also about assisting Europe. It is critically important to ensure that lessons from the war

are not only identified but also disseminated to a larger group of stakeholders inside and outside defence organisations, to be learned and subsequently translated into policies and actions that will enable European armed forces and societies to adapt and transform.

To do so, a multi-European state Ukraine Defence Observatory needs to be established with critical hubs in different European capitals as well as a foothold in Kyiv. The Observatory will be tasked to (1) capture frontline adaptations across tactical, operational, and strategic levels; (2) analyse developments within Ukraine's defence-innovation ecosystem; (3) translate findings into recommendations for Western force-development and defence ecosystem requirements; and (4) shape short-, medium-, and long-term international support models through practical policy recommendations. The ultimate objective is to accelerate Western adaptation while directly supporting Ukraine's fight for sovereignty.

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