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RETHINKING EUROPEAN SECURITY IN THE FACE OF THE RUSSIAN THREAT

Learning Strategic Lessons from Ukraine and
Relying upon Ukraine for the Defense of Europe

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EXECUTIVE SUMMARY

After decades of believing that large-scale wars on the European continent were a thing of the past, Europe received a stark wake-up call with Russia's invasion of Ukraine in 2022. Russia's aggressive revisionism, disregard for international law, and willingness to use force to achieve its political objectives marks the most straightforward threat to European security since World War II. Russia's military build-up clearly shows that the country is preparing for potential conflict beyond Ukraine. At the same time, Europe must recognize that the United States may not be willing to remain the continent's primary security guarantor for much longer. It has become clear that Europe's responsibility for its own security will be even greater than had been imagined: **Europe must develop the capacity to deter or defend against Russian aggression largely on its own.**

The challenge is massive as defense needs have been underfinanced for decades, Europe's defense-industrial base has been hollowed out, and military capacities in critical areas are sorely inadequate. However, Europe has a strategic asset: Ukraine. With help from its partners, the country has resisted a nuclear-armed adversary with superior manpower and financial resources for more than three years. Ukraine has done so by building a defense model driven by speed, ingenuity, and efficiency—and by creating a decentralized and innovation-friendly institutional framework that supports rapid development, scaling, and deployment of defense technologies. **For Europe, Ukraine offers more than solidarity—it can be a blueprint for and critical element of European defense.** By learning strategic lessons from Ukraine and relying upon Ukraine's military and industrial capacity, Europe can ensure that its rearmament is fast and cost effective—and that it creates effective deterrence against Russia.

Our findings on strategic lessons from Ukraine's wartime experience are as follows:

- **Information superiority.** Ukraine's wartime experience shows that battlefield success now depends as much on data as on munitions. An advanced situational awareness system such as DELTA, integrated with AI for rapid data processing, is indispensable. The suspension of intelligence sharing by the US in March 2025 exposed the need for sovereign space assets. Ukraine, in 2022, took a first step by crowd-funding a SAR satellite; European partners should accelerate their own space intelligence programs. Reliable connectivity is equally critical, so Europe should continue to invest in Starlink alternatives.
- **Battlefield testing.** Combat use has forced the Ukrainian military to reassess weapons. For instance, Excalibur rounds achieved only ~6% effectiveness, and early GLSDB failures prompted urgent upgrades. As navigation and communications systems' reliability played a big role in many instances, this highlights the need to prioritize developing alternatives to traditional navigation—optical navigation, laser designation, and fiber-optic drones—and to sustain Ukraine's rapid, battlefield-driven R&D model.
- **Cost asymmetries.** Destructive systems are becoming cheaper, while countermeasures remain expensive and hard to scale. Russia can launch thousands of Shahed and reconnaissance drones, making traditional SAMs an inefficient defense. Interceptor drones offer a cheaper solution, though traditional air defense is still required. Conversely, low-cost attack drones can destroy high-value assets; every system should be designed with FPV-drone resilience. Learning from Ukraine's experience, Europe can build deterrence against Russia in a way that is cost-effective.

- **Innovation vs. conventional capabilities.** Cutting-edge technology must complement—not replace—conventional arms. For instance, armored vehicles remain essential, even as their tactics evolve due to the transparent battlefield and drone usage, and deep-strike drones are effective but do not eliminate the need for high-speed ballistic missiles. Thus, any rearmament strategy should avoid an excessive focus on drones, and balance innovation with traditional weapons systems.
- **Defense ecosystem.** Private entrants need easier market access and targeted support. For instance, Ukraine’s Brave1 cluster links firms with grants, investors, and procurement guidance. Decentralized purchasing lets brigades field new tech faster, and a secure digital backbone is vital against ongoing Russian cyberattacks. Lessons from Ukraine’s defense against Russia can guide Europe’s urgently-needed procurement reform and the rebuild of its defense-industrial capacities.

Our findings on strategic lessons from Russian military industry and operations are as follows:

- **Battlefield dynamics.** Russia has reasserted the primacy of mass artillery firepower. At the same time, it has developed loitering munitions and imported drone solutions. Naval warfare has been disrupted: losses from successful Ukrainian sea-drone strikes have forced Russia to shift doctrine and develop uncrewed naval units. Meanwhile, reliance on retrofitted Soviet-era armor underpins Russia’s ground assaults. Europe must respond by scaling munitions production, adopting mass drone capabilities with robust counter-UAS systems, reinforcing anti-armor strategies, and preparing for asymmetrical naval engagements using coastal defenses, uncrewed platforms, and adaptive fleet designs.
- **Industry and technology.** Russia’s centralized military-industrial complex (MIC) enables rapid scalability—seen in the surge of artillery, drones, and guided munitions output—but at the cost of flexibility and innovation. A mix of advanced munitions and large quantities of conventional ones are critical for the battlefield. For its production, the Russian MIC continues to rely heavily on Western-made components. This includes the production and modernization of fighter jets, helicopters, and transports to replenish losses. Europe must cultivate a dual-track model: accelerating SME-led innovation while leveraging the existing industrial base to scale-up production.
- **Global dependencies.** Russia’s military strategy is reinforced by institutions like Rosatom and Roscosmos, which, under the guise of civilian programs, support missile development, nuclear capabilities, and space-based military assets. Scientific and commercial ties with Russian institutions and individuals should be stopped as they inadvertently strengthen Moscow’s military capacity. Russian arms exports contributed critical revenues to its military producers before the full-scale invasion, and Russia still uses battlefield-tested equipment as a marketing tool to secure and deepen influence abroad. Europe must respond by actively promoting competitive, reliable defense solutions, thereby denying adversaries market share and military funding through the arms trade.

Our findings on the path forward and key challenges are as follows:

- **Centralizing European defense efforts.** Europe is ramping up defense spending, but without structural reform, it risks reinforcing fragmentation. New tools like SAFE loans and fiscal exemptions encourage investment, yet fail to fix disjointed procurement and weak coordination. Past efforts like PESCO lacked enforcement; emergency measures like ASAP are temporary. Without bold initiatives to centralize procurement, enforce compliance, and include key partners like Ukraine, Europe remains exposed. With it, it can turn spending into real deterrence against the Russian threat.

- **Incorporating Ukraine into European defense.** Given the escalating security challenges, Europe cannot afford to treat Ukraine as a peripheral partner in its defense planning. Ukraine's experience offers important operational insights and battlefield-tested innovations that many European armed forces have yet to encounter. Ukraine now constitutes the frontline of European defense. Ensuring its inclusion in joint procurement initiatives, defense R&D programs, and industrial coordination is not only a matter of solidarity but a strategic necessity for strengthening Europe's collective deterrence posture.
- **Challenges of integrating Ukraine.** Despite unprecedented military aid and growing alignment with NATO standards, deep institutional, legal, and logistical obstacles persist. Europe's fragmented defense structures, divergent national policies, and slow procurement mechanisms hinder rapid integration. In Ukraine, legacy systems, procurement reforms still underway, and the pressures of wartime governance limit full compatibility with EU and NATO frameworks. Without political resolve and structural adaptation on both sides, the vision of a unified European defense risks being delayed or derailed.

Our policy recommendations are as follows:

- **Integrating Ukraine into the European Security Architecture.** Ukraine should be granted partner or observer status in European security committees and Ukraine should contribute to capability development and mission planning. Ukraine's armed forces and industry should be treated as co-investors in European security, allowing Ukrainian firms full participation in R&D funds and in procurement consortia. Finally, Ukrainian tactics and warfighting innovations should be included in EU and NATO curricula and Ukrainian liaison officers and instructors be embedded in EU training missions.
- **Advancing Joint Defense Production.** Ukrainian armed forces and defense industries should be allowed to join selected Permanent Structured Cooperation projects and European Defence Fund calls, and European-Ukrainian military industry forums should formalize pathways for joint procurement and co-development. In addition, reimbursements and funding should be structured as co-investment, with EU Member States allowed to use EPF funds to pre-buy Ukrainian products, or to co-finance new production lines in Ukrainian factories. European countries could even explore possibilities to co-produce Ukrainian drones, anti-drone systems or decoys, building their own industrial capacity while supporting Ukraine and replenishing their own stockpiles. Ultimately, Ukraine's partners should assist the country in the development of an exports strategy and fully integrate it into weapons supply chains.
- **Boosting Capacities and Innovation.** EDA-Ukraine cooperation should be deepened and the EU should enable Ukraine to participate in joint capability development, shared threat assessments, and R&D projects with other partners. Ukraine's agile R&D hubs should be supported. European defense agencies should send liaisons to Ukraine's frontlines (and vice versa) to accelerate field testing. At the same time, the EU should adapt bureaucratic processes so front-line units can immediately prototype and iterate new devices. Also, forums should be established to exchange open-source battlefield data and tech experiments.
- **Securing Knowledge and Best Practices Sharing.** A joint European-Ukrainian mechanism should be developed to collect front-line reports, conduct after-action reviews, and distill tactical and doctrinal lessons. European partners should study Ukraine's models of mobilizing civilian volunteers, reservists, and local defense networks, and incorporate practices into national defense concepts. Their militaries should also test and adopt Ukrainian-developed low-cost attack drones, loitering munitions, electronic warfare kits, and battlefield robots. Finally, Ukraine's senior officers should have formal roles in European missions and exercises, and vice versa.

TABLE OF CONTENTS

I. Europe Confronts the Return of War	5
Europe's Wake-Up Call	5
Russia Is Preparing for Conflict Beyond Ukraine	5
Europe's Response to the Russia Threat	9
The Critical Role of Ukraine for European Defense	10
II. Strategic Lessons from Ukraine's Defense against Russian Aggression	11
Where Things Stand: Asymmetry and Attrition	11
Driving Technological Innovation	13
Reforming the Defense Ecosystem	20
Funding a Country at War	22
Learning from the Enemy	25
III. Next Steps: Rearming Europe and Integrating Ukraine	31
Existing Efforts to Centralize European Defense	31
Integrating Ukraine into European Defense Financing	33
Challenges of Integrating Ukraine	36
IV. Policy Recommendations	39

I. EUROPE CONFRONTS THE RETURN OF WAR

After decades of underinvestment in defense, Europe has been jolted awake by Russia's full-scale invasion of Ukraine. Moreover, Moscow's buildup of long-range and nuclear-capable weapons, along with its covert operations and strategic partnerships with Iran, North Korea, and China signal preparations for potential conflicts beyond Ukraine. With future US commitment to European security uncertain at best, Europe is boosting defense spending and loosening fiscal rules, but it must also reform procurement and rebuild its defense-industrial base. Despite having far greater economic power than Russia, Europe must also spend more effectively. Ukraine's battlefield experience offers valuable lessons and should be integrated into European defense planning.

Europe's Wake-Up Call

After the defeat of Nazi Germany and the violent break-up of Yugoslavia, Europe believed large-scale war was a thing of the past. The fall of the Berlin Wall, open borders, and EU integration fostered lasting peace, while defense spending and military readiness declined. This illusion was initially challenged in 2014—albeit largely underestimated by much of the West—and was ultimately shattered on February 24, 2022. Russia's aggressive revisionism, disregard for international law, and readiness to use force pose the most direct threat to European stability in decades. In March 2022, the European Union adopted the Strategic Compass for Security and Defence, aiming to become “a stronger and more capable security provider.”¹ For the first time in decades, the EU began to position itself not just as a diplomatic actor, but as a defender of its own security and interests.² Experts warn that Russia could be ready to attack an EU and/or NATO member state within as little as five years.³ In the meantime, a modern, large-scale war with a nuclear-armed power is already unfolding alarmingly close—less than 1,000 kilometers from the Polish-Ukrainian border to the frontlines in eastern Ukraine.

Russia Is Preparing for Conflict Beyond Ukraine

Russian forces remain heavily concentrated near NATO's and the EU's eastern borders, particularly in Kaliningrad, where Moscow has built a “Russian Alamo missile fortress.”⁴ This includes Iskander-M ballistic missiles capable of carrying nuclear warheads, S-400 air defense systems that could lock down Baltic airspace, and electronic warfare systems designed to disrupt NATO command structures.⁵ The past three years have shown that these are not Cold-war relics, but active components of Russia's modern war planning—tested in Syria, refined in Ukraine, and now aimed squarely at Europe. Most recently, Russia began building up its presence near its EU borders with Finland and the Baltic states.⁶

Russia is investing heavily in long-range, strategic, and hypersonic weapons—such as the Sarmat intercontinental ballistic missile (ICBM) system, Avangard hypersonic glide vehicle, Tsirkon hypersonic cruise missile, and Poseidon nuclear torpedo—that have no tactical relevance to the war in Ukraine. These systems are designed not for battlefield use in Ukraine, but to counter Western capabilities and

¹ See “A strategic compass for security and defence,” The Diplomatic Service of the European Union

² See “What Europe Needs to Lead American Self-Sabotage Calls for European Self-Help,” *Foreign Affairs*

³ See “Russia could start a major war in Europe within 5 years, Danish intelligence warns,” *Politico*

⁴ See “Kaliningrad: Impregnable Fortress or ‘Russian Alamo’?” *CNA*

⁵ See “9K720 Iskander (SS-26),” *CSIS Missile Defense Project*; “France Decries Russian S-400 Radar Locking Onto Its Maritime Patrol Aircraft Over Baltic Sea,” *TWZ*

⁶ See “Russia builds up military presence along borders with NATO member countries,” *NPR*

signal readiness for potential conflict with NATO or other Western powers. Moscow's official statements present these programs as safeguards of strategic balance. In his 2018 address, Putin explicitly linked the development of new ICBMs, hypersonic weapons, and naval missile systems to bypassing US missile defenses.⁷ Notably, all of these systems feature extreme range, nuclear payloads, and specialized targeting. Their continued production and testing suggest Moscow's priorities extend well beyond the current war in Ukraine, pointing instead to long-term confrontation with the West.

Russia's Preparations for a Broader Conflict

In recent years, Russia has accelerated the development and limited deployment of long-range, hypersonic, and strategic weapon systems that play no role in the war against Ukraine. For example, the RS-28 Sarmat ICBM, a super-heavy liquid-fuel silo-based missile, entered limited service in late 2023 under a state contract. Its 11,000+ km range and capacity to carry dozens of MIRV nuclear warheads (or hypersonic Avangard gliders) make it a global-strike weapon. Sarmat has never been used against Ukraine and is unsuited to the tactical scope of the war. Likewise, the Avangard boost-glide vehicle can reach Mach 20 with a multi-megaton nuclear warhead at ranges exceeding 6,000 km; its purpose is to penetrate Western anti-ballistic missile (ABM) defenses. For example, Avangard test flights have been launched from the Dombarovskiy missile base in Orenburg Oblast to the Kura range in Kamchatka, covering distances of over 6,000 kilometers.⁸

Other hypersonic systems also target areas well beyond Ukraine. The Tsirkon (Zircon) is a sea-launched hypersonic cruise missile (Mach ~9) now entering mass production.⁹ It carries a 300-400 kg warhead and is estimated to have a strike range of 800-1,000 km. Designed for anti-access/area-denial (A2/AD) operations, Tsirkon has been test-fired from modern frigates and submarines (e.g., Admiral Gorshkov, Yasen-class).¹⁰

In parallel, Russia is nearing the deployment of the Status-6 Poseidon nuclear torpedo, a submarine-launched unmanned underwater vehicle. The first set of these nuclear-capable torpedoes has been produced for the Belgorod submarine.¹¹ Poseidon's 24-meter self-propelled body, powered by an onboard nuclear reactor, is designed to deliver a multi-megaton warhead and generate radioactive "tsunami" effects along enemy coastlines. This weapon is explicitly intended to threaten NATO port cities and carrier groups across oceans.

Russia is also increasingly leveraging its orbital operations to prepare for conflicts that extend beyond Ukraine, employing kinetic, electronic, and nuclear capabilities. In November 2021, Russia conducted a direct-ascent anti-satellite (DA-ASAT) missile test, destroying its own defunct satellite, Kosmos 1408. This action created over 1,500 pieces of trackable debris in low Earth orbit, threatening other satellites and the International Space Station (ISS).¹² Beyond kinetic operations, Russia has been developing nuclear-powered anti-satellite weapons. The satellite Kosmos 2553, launched in February 2022, is suspected to be part of this program.¹³ Additionally, Russia's Luch-2 satellite has been observed conducting close approaches to commercial satellites operated by American and European companies. Notably, in July 2024 and January 2025, Luch-2 passed within a few miles of these satellites, raising concerns about potential collisions and the possibility of espionage or interference.¹⁴ The deliberate creation of space debris, close approaches to other nations' satellites, and the development of nuclear capabilities in space are all parts of posture and preparation for confrontation in orbit.

⁷ See "Russia's exotic nuclear weapons and implications for the United States and NATO," [Atlantic Council](#)

⁸ See "Avangard," [CSIS Missile Defense Project](#)

⁹ See "Tsirkon hypersonic missile enters the final stage of state trials," [Naval News](#)

¹⁰ See "3M22 Zircon SS-N-33," [Global Defense News](#)

¹¹ See "Russia produces first set of Poseidon super torpedoes - TASS," [Reuters](#)

¹² See "Early lessons from the Russia-Ukraine war as a space conflict," [Atlantic Council](#)

¹³ See "Russian satellite linked to nuclear weapon program appears out of control, U.S. analysts say," [Reuters](#)

¹⁴ See "Tumbling Russian Sat Highlights Counterspace Threat," [Payload](#)

In addition to its conventional military capabilities, Russia conducts warfare in the shadows—relying on cyberattacks, covert operations, and proxy actors.¹⁵ This form of hybrid warfare is difficult to counter, as it often falls below the threshold of armed conflict and resists clear attribution. Its goal is to disrupt and paralyze NATO and EU decision-making, which often depends on definitive attribution to trigger collective responses.

A prominent example is the GRU, Russia's military intelligence agency, which has been linked to high-profile cyber intrusions targeting political bodies such as Germany's parliament,¹⁶ various government institutions in the Baltic states, and the US Democratic Congressional Campaign Committee.¹⁷ GRU operatives have also executed acts of sabotage, including explosions at ammunition depots in Vrbětice, Czechia, attributed to GRU Unit 29155 and widely viewed as efforts to disrupt weapons transfers to Ukraine.¹⁸ The 2018 attempted assassination of former Russian officer Sergei Skripal in the United Kingdom, using a military-grade nerve agent, stands as one of the most brazen uses of chemical weapons on European soil since the Cold War.¹⁹

In July 2024, US and German intelligence agencies thwarted a Russian plot to assassinate Armin Papperger, CEO of German arms manufacturer Rheinmetall. Rheinmetall has been a significant supplier of military equipment to Ukraine, including artillery shells and armored vehicles. The plot was part of a broader Russian strategy to intimidate and disrupt European defense industry leaders supporting Ukraine. Following the foiled attempt, German authorities increased Papperger's security, reflecting the heightened threat level.²⁰

In recent years, Russia's hybrid tactics have also expanded to include sabotage of critical infrastructure. Since 2021, undersea fiber-optic cables and pipelines in the Baltic and Arctic Seas have become frequent targets.²¹ In Norway, the LoVe Ocean Observatory cable failed mysteriously in 2021, followed by damage to the Svalbard-mainland cable in 2022—raising concerns over national security and space communications.²² In 2025, suspicion fell on a Russian-crewed cargo ship, Silver Dania, after a fiber-optic cable near Sweden's Gotland island was damaged en route to Latvia. While no sabotage was proven, the incident deepened mistrust.²³ These operations—covert, deniable, and disruptive—allow Russia to inflict meaningful damage while avoiding open confrontation.

Russia's efforts to destabilize Europe extend beyond physical sabotage and intimidation. It funnels money to extremist parties and anti-EU politicians,²⁴ undermines trust in EU and NATO institutions, and interferes with democratic elections—most recently in Romania²⁵ and Moldova²⁶. While European institutions have remained resilient, the pressure is unlikely to ease.

At the same time, Moscow exploits protracted conflicts to exert influence. In Moldova's Transnistria region, around 1,500²⁷ Russian troops remain in violation of international

¹⁵ See "Arsonist, Killer, Saboteur, Spy," *Foreign Affairs*.

¹⁶ See "Russia 'was behind German parliament hack'," *BBC*.

¹⁷ See "Compromise of the Democratic National Committee," *Council on Foreign Relations*.

¹⁸ See "Hidden Bear: The GRU hackers of Russia's most notorious kill squad," *The Insider*.

¹⁹ See "2 Russian Agents Carried Out Skripal Poison Attack, U.K. Says; Arrest Warrants Issued," *NPR*.

²⁰ See "Germany says it won't be cowed by Russia after reported plot to kill Rheinmetall CEO," *Reuters*.

²¹ See "Hybrid Attacks Rise on Undersea Cables in Baltic and Arctic Regions," *The James Monitor*.

²² See "A Subsea Cable Went Missing. Was Russia to Blame?," *Bloomberg*.

²³ See "Second ship seized in Baltic Sea cable damage investigation," *Reuters*.

²⁴ See "3rd EEAS Report on Foreign Information Manipulation and Interference Threats," *European Union, External Action*; "Taking the Pulse: Are Information Operations Russia's Most Potent Weapon Against Europe?," *Carnegie Endowment for Peace*; "Russian influence scandal rocks EU," *Politico*; "Easy prey? Russia's influence in Bulgaria," *European Council on Foreign Relations*; "Expect Russia to do 'whatever possible' to reassert influence in Bulgaria, outgoing PM warns," *Politico*; "Expect Russia to do 'whatever possible' to reassert influence in Bulgaria, outgoing PM warns," *Politico*; "Le Pen's far right served as mouthpiece for the Kremlin, says French parliamentary report," *France24*; "Far Right's Ties to Russia Sow Rising Alarm in Germany," *NYT*; "Right-wing influencers were duped to work for covert Russian operation, US says," *AP*.

²⁵ See "The analysis of risks to national security caused by the actions of state and non-state cyber actors on IT&C infrastructure, support for electoral process," *Romanian Foreign Intelligence Service [ro]*; "Alleged Russian election-meddling in Romania resurrects dark memories," *BBC*.

²⁶ See "Parliament condemns Russia's interference in Moldova," *European Parliament*; "Moldova formally protests alleged Russian election meddling," *Aljazeera*.

²⁷ See "Russia wants to deploy 10,000 troops in Moldovan breakaway region, PM warn," *Financial Times*.

agreements, guarding Soviet-era arms and serving as a tool of coercion. In Georgia, Russia enforces so-called "borderization"²⁸ in Abkhazia and South Ossetia, physically severing communities and reinforcing control through troops and surveillance.²⁹ These "frozen conflicts" are, in reality, active instruments of disruption—ready to be escalated at Moscow's discretion, as seen with Donetsk, Luhansk, and Crimea in 2022.

Russia does not act alone but relies on allies and enablers. Since 2022, it has significantly deepened military cooperation with Iran, North Korea, and China. Tehran has supplied hundreds³⁰ of Shahed-131 and Shahed-136 drones, which Moscow has used extensively in Ukraine. Ukraine's Foreign Ministry reports that over 8,000 Iranian-designed, largely Russian-produced drones were intercepted between 2022 and 2024, with launches continuing to rise in 2025 despite American diplomatic efforts.³¹ The partnership has expanded beyond exports. Russia and Iran have established a joint drone production facility in Russia's Alabuga Special Economic Zone.³² In return, Russia has supplied advanced hardware, including Yak-130 trainer jets—modified by Iran for combat with R-73 air-to-air missiles—and is reportedly training on the Fath-360 short-range ballistic missile system.³³ Their cooperation was formalized in May 2025 with a 20-year strategic partnership ratified by Iran's parliament.³⁴

North Korea, now bound by a bilateral mutual defense treaty with Russia,³⁵ has sent millions of artillery shells³⁶ and over 10,000 troops³⁷ to aid Russia's war effort. It has also supplied around 150 KN-23 and KN-24 ballistic missiles, which have become increasingly accurate through iterative improvements.³⁸ With Kim Jong Un pledging "unconditional support" for Russia's aggression³⁹ and North Korea gaining valuable combat experience⁴⁰ and assistance in drone development,⁴¹ this partnership shows no signs of weakening soon.

Finally, China has played a crucial role in supporting Russia's war effort. In 2024, NATO officially labeled China a "decisive enabler" of Russian aggression.⁴² While not openly endorsing the conflict, China supplies drones, electronics, CNC machinery, and domestically produced nitrocellulose, and aids in sanctions evasion.⁴³ At the same time, Chinese state-owned firms have expanded their influence in European ports and energy grids (in Greece, Spain, and Portugal) and Huawei remains active in European 5G networks despite security concerns.⁴⁴ Politically, China has used economic coercion, most notably against Lithuania, after Vilnius allowed Taiwan to open a representative office under the name "Taiwan."

²⁸ Borderization" refers to Russia's gradual and illegal annexation of Georgian territory through military occupation

²⁹ See "The borderization of Georgia's breakaways as a tool of Russia's long-term struggle with the EU and NATO," [George C. Marshall European Center for Security Studies](#)

³⁰ See "Tehran Ships Drones to Russia Over Caspian Sea for Deployment on Ukraine Front, U.S. Says," [The Wall Street Journal](#)

³¹ See "Ukraine says Russia launched 8,060 Iran-developed drones during war," [Reuters](#)

³² See "Ukraine's intelligence: Russia produces around 170 Shahed drones daily, aims to increase output," [Ukrainska Pravda](#); "The Russian Drone Plant That Could Shape the War in Ukraine," [WSJ](#)

³³ See "Exclusive: Iran to send Russia launchers for short-range missiles, sources say," [Reuters](#); "Iran 'Turns' Russian Trainer Aircraft Into A Combat Jet; Arms Yak-130 With R-73 Air-To-Air Missile: Reports," [Eurasian Times](#); "Exclusive: Iran to send Russia launchers for short-range missiles, sources say," [Reuters](#)

³⁴ See "Iran parliament approves strategic pact with Russia," [Reuters](#)

³⁵ See "Dealing with North Korea as It Deepens Military Cooperation with Russia," [RAND](#)

³⁶ See "Brothers in Arms Estimating North Korean Munitions Deliveries to Russia," [Open Source Center](#)

³⁷ See "The North Korea-Russia alliance gets tighter," [Politico](#); "N Korea confirms it sent troops to fight for Russia in Ukraine war," [BBC](#)

³⁸ See "13-second radio intercept describes a dramatic battlefield retreat of North Korean troops in Russia's Kursk region on December 1," [Reuters](#)

³⁹ See "North Korea's Kim says he'll 'unconditionally support' Russia's war against Ukraine," [ABC News](#)

⁴⁰ See "Dealing with North Korea as It Deepens Military Cooperation with Russia," [RAND](#)

⁴¹ See "The North Korea-Russia alliance gets tighter," [Politico](#); "Russia to help North Korea establish production of Shahed drones – Ukraine's intelligence chief," [Ukrainska Pravda](#)

⁴² See "NATO allies call China a 'decisive enabler' of Russia's war in Ukraine," [AP news](#)

⁴³ See "Elina Ribakova. Export controls and technology transfer: lessons from Russia," [Testimony before US-China Economic and Security Review Commission](#)

⁴⁴ See "Chinese investments in European energy infrastructure threaten long-term strategic stability," [Gimbals](#); "In Greece's largest port of Piraeus, China is the boss," [DW](#); "The market for 5G RAN in Europe: Share of Chinese and non-Chinese vendors in 31 European countries," [Strand Consult](#)

In response, China halted Lithuanian imports, pressured European companies to sever ties with Lithuanian suppliers, and removed Lithuania from its customs systems.⁴⁵

Europe's Response to the Russia Threat

As Europe confronts the challenges posed by a revisionist and aggressive Russia, its leaders are increasingly forced to acknowledge the waning US willingness to remain the continent's primary security guarantor.⁴⁶ A partial US troop withdrawal would significantly heighten security risks for the EU. Defense Commissioner Andrius Kubilius has called on European states not only to fill the gap left by the US but also to fulfill existing, unmet defense commitments.⁴⁷ Prior to the return of Donald Trump to the White House, a long-standing status quo prevailed: Europeans relied on the American security umbrella while ceding NATO leadership to the US and purchasing American defense equipment. Trump administration leaders now disdainfully view this arrangement as freeloading.⁴⁸ But Europe's readiness cannot be changed overnight, and this dependence has left the EU with a hollowed-out defense industrial base and a US-sized hole in critical military capabilities—especially logistics, key enablers, rapid deployment, and leadership.⁴⁹

In response, European policymakers have renewed focus on intelligence sharing, resilience, and capability development to counter both conventional and unconventional threats. These efforts demand significant resources and long-term investments. The EU's 2022 Strategic Compass commits to “spend more and better” in defense to address strategic gaps and reduce dependencies.⁵⁰ Driven by Russia's aggression and the US withdrawal, EU governments are undertaking “the largest rearmament effort since the 1950s.”⁵¹ European Commission President Ursula von der Leyen declared, “we are in an era of rearmament,” urging Member States to increase spending to support Ukraine and bolster European defense.⁵²

To meet its growing defense ambitions, the European Commission has called for a major financial push, with von der Leyen's White Paper outlining a goal to mobilize up to €800 billion over the next decade through the ReArm Europe plan. This funding combines national budget increases, defense loans, and EU-level financial instruments to address capability gaps and strengthen European defense. To support this increased spending, the EU activated the Stability and Growth Pact's “escape clause,” allowing Member States to exceed deficit limits specifically for defense-related investments.⁵⁴ In parallel, Germany amended its constitution in 2025 to ease debt limits, enabling higher borrowing for defense purposes.⁵⁵ Furthermore, the EU is exploring common debt issuance and expanding shared budget spending to fund defense initiatives, reinforcing collective European security efforts.⁵⁶

Some progress has been made: in 2024, EU Member States spent €326 billion on defense—about 1.9% of GDP—with spending expected to rise by over €100 billion by 2027.⁵⁷ If all EU states reached 3% of GDP, annual defense spending would increase by several hundred billion euros. While the EU's economy dwarfs Russia's, Moscow still outpaces Europe in

⁴⁵ See “Opening a Taiwan Representative Office was 'mistake', says Lithuanian president,” [Euronews](#); “European Union flags are seen in front of the European Commission building in Brussels, Belgium. Blog Name RealTime Economics Could the EU's “big bazooka” be deployed against the US?,” [PIIE](#)

⁴⁶ See “The EU wants to break its security dependency on the US and buy more European weapons,” [AP news](#)

⁴⁷ See “Participation of Andrius Kubilius, European Commissioner, in the Charlemagne Prize Forum on Europe 2025 in Aachen, Germany: speech,” [European Commission](#)

⁴⁸ See “Here Are the Attack Plans That Trump's Advisers Shared on Signal,” [The Atlantic](#)

⁴⁹ See “The governance and funding of European rearmament,” [Bruegel](#)

⁵⁰ See “Strategic Compass,” [European External Action Service](#)

⁵¹ See “Funding weapons together (or not): How to pay for European defence,” [ISS](#)

⁵² See “‘ReArm Europe’: EU's von der Leyen unveils €800B defense plan,” [AA](#)

⁵³ See “Commission unveils the White Paper for European Defence and the ReArm Europe Plan/Readiness 2030,” [European Commission](#)

⁵⁴ See “Accommodating increased defence expenditure within the Stability and Growth Pact,” [European Commission](#)

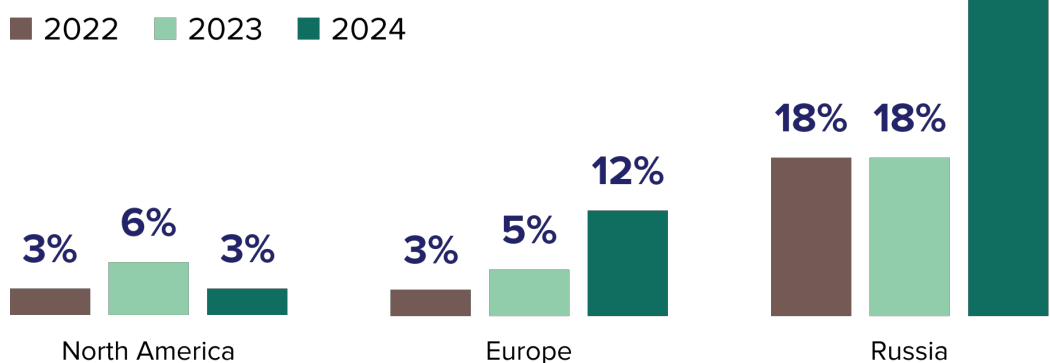
⁵⁵ See “What does German debt brake reform mean for Europe?,” [Bruegel](#)

⁵⁶ See “Defence financing and spending under the Economic Governance Framework,” [European Parliament](#)

⁵⁷ See “EU defence in numbers,” [European Council](#)

defense spending when measured in purchasing power terms. Europe must avoid complacency and focus on spending more effectively—especially on R&D and joint capabilities—to close the real gap.

REAL GLOBAL DEFENSE SPENDING CHANGES BY REGION, %



Source: Military Balance 2025, IISS

However, funding alone will not be enough. Without structural reforms to the ways in which Europe organizes and procures its defense capabilities, even the most ambitious investments risk being squandered. Having outsourced much of its defense industrial base to the US, Europe’s long-run productivity could benefit substantially from large investments bringing the industry back home. The short-term economic benefits stemming from the fiscal multiplier—how much GDP increases with each additional dollar of fiscal expenditure—could be expanded thanks to medium- to long-term gains associated with R&D investments.⁵⁹ For this to come to fruition, defense procurement in Europe must become less fragmented and duplicative.⁶⁰

The Critical Role of Ukraine for European Defense

Ukraine’s role in European security should not be reduced to serving as a frontline buffer or a source of low-cost, highly motivated labor. In confronting Russian military aggression, Ukraine has demonstrated that speed, adaptability and civilian-military cooperation can successfully challenge a conventionally superior adversary. Its innovations at the tactical, operational, and defense-industrial levels offer valuable lessons that can help the EU recalibrate its military and industrial priorities. The remaining sections of this report will focus specifically on how Ukraine can be meaningfully integrated into EU defense initiatives—leveraging its battlefield-tested technologies, institutional resilience, and civil-military coordination to strengthen Europe’s collective defense posture in the face of continued Russian threat.

⁵⁸ See “The Military Balance 2025,” IISS

⁵⁹ See “Guns and Growth: The Economic Consequences of Surging Defense Spending,” Kiel Institute

⁶⁰ See “The Draghi report on EU competitiveness,” (Chapter: “Strengthening industrial capacity for defence and space”), European Commission

II. STRATEGIC LESSONS FROM UKRAINE'S DEFENSE AGAINST RUSSIAN AGGRESSION

Ukraine has fundamentally disrupted traditional assumptions about warfare, demonstrating that speed, strategic relevance, and decentralized innovation can offset an adversary's overwhelming advantage in mass and materiel. Confronting a nuclear-armed power, Ukraine has not only preserved its territorial integrity but inflicted systemic military and economic costs on Russia. For Europe, Ukraine is not just a recipient of direct financial or military support but a strategic reference point. Its wartime innovations and institutional reforms constitute a real-time case study in how democracies can mobilize, scale, and win under conditions of existential threat. Integrating these lessons into European defense strategy is crucial for closing capability gaps and confronting the evolving threat landscape.

Where Things Stand: Asymmetry and Attrition

Ukraine has overturned conventional assumptions about modern warfare by successfully resisting a nuclear-armed adversary with superior manpower, financial resources, and Soviet-era stockpiles. Defying early predictions of a swift Russian victory, Ukraine—backed by international partners—has stalled and at times outmaneuvered Russian forces, turning a planned 'blitz-style' campaign into a grinding war where it retains control over most of its territory. Through innovation, asymmetric tactics, and efficient use of limited resources, Ukraine has not only minimized Russia's territorial gains but also stabilized its economy, with a rapidly expanding defense industry fueling both national resilience and military effectiveness.

Since the start of the full-scale invasion, around \$191 billion have been spent on defense and security within the country's regular budget and an additional \$72 billion are expected this year.⁶¹ While this figure may seem staggering for a country of Ukraine's size—it amounts to ~36% of GDP over 2022-24—it is comparatively modest when assessed against US defense spending in recent conflicts. For example, the United States spent \$2.31 trillion on its war in Afghanistan and is projected to spend nearly \$2.9 trillion on the wars in Iraq and Syria by 2050.⁶² Both were lower-scale conflicts fought on foreign soil, without posing an immediate threat to the US homeland or its European allies.

Despite Ukraine's sustained resistance on the battlefield, the country is managing to stabilize its economy. After a dramatic 28.8% contraction in GDP in 2022, the economy rebounded with 5.5% growth in 2023, 2.9% in 2024, and 2.8% growth is expected again in 2025.⁶³ The defense industry has emerged as a cornerstone of this recovery. By the end of 2023, Ukraine increased mortar round production 42-fold and nearly tripled artillery shell output.⁶⁴ It now produces more than one million FPV drones annually, with industrial capacity still expanding.⁶⁵

⁶¹ See "Ukraine macroeconomic handbook: April 2025," KSE Institute

⁶² See "Human and budgetary costs to date of the U.S. war in Afghanistan, 2001-2022," Watson Institute for International & Public Affairs; "Blood and treasure: United States budgetary costs and human costs of 20 years of war in Iraq and Syria, 2003-2023," Watson Institute for International & Public Affairs

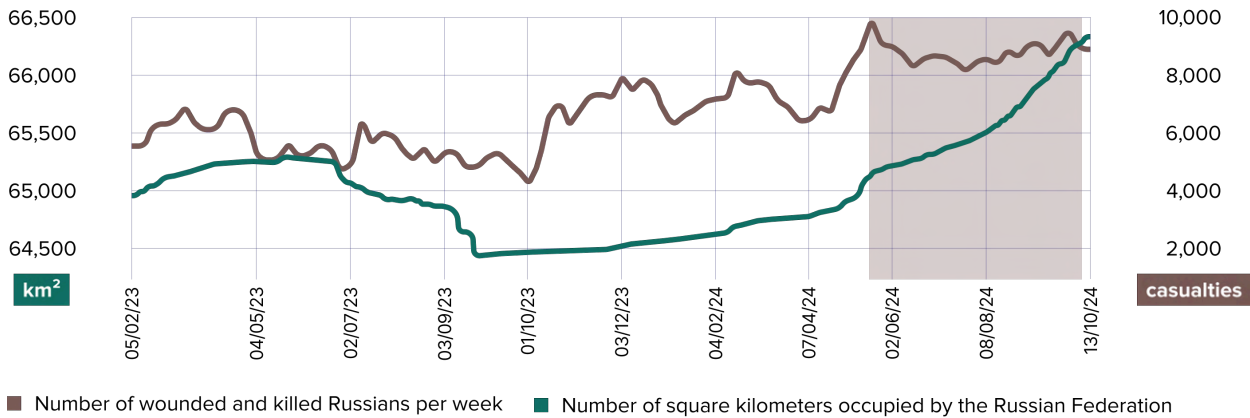
⁶³ See "Ukraine macroeconomic handbook: April 2025," KSE Institute

⁶⁴ See "PM Shmyhal: Ukrainian ammunition production grew significantly in 2023," Kyiv Independent

⁶⁵ See "How Ukraine's drone arsenal shocked Russia and changed modern warfare," Bloomberg

Ukraine is already partnering with top global industry leaders, like Thales,⁶⁶ Rheinmetall,⁶⁷ KNDS⁶⁸ and others.

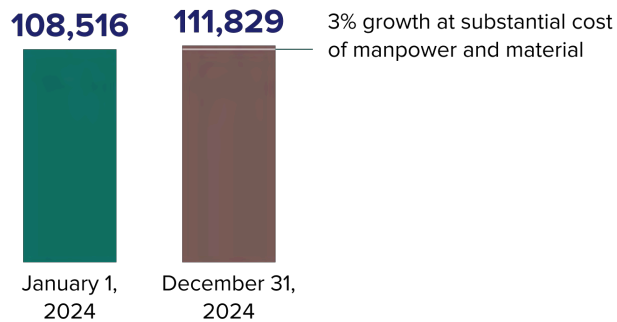
HOW RUSSIAN CASUALTIES CORRELATE WITH PROGRESS AT THE FRONT



Data: DeepState, analysis by Texty.org.ua
Infographic: Texty.org.ua

Russia controls
<19%
of Ukrainian territory

Russian-Occupied Territory of Ukraine, km²



Data: DeepState

Even under severe economic constraints, Ukraine continues to deliver measurable and strategically significant results on the battlefield. According to the Ukrainian and British militaries, an estimated one million Russian soldiers have been killed or wounded between February 2022 and June 2025.⁶⁹ This assessment may contain inaccuracies due to several factors: (1) potential double-counting of affected targets, (2) challenges in evaluating the severity of injuries resulting from remote strikes, and (3) missing data from certain affected targets.⁷⁰ Russia's losses, growing at around 1,000-1,200 casualties a day, far exceed the combined total of all of the country's post-WWII wars.⁷¹ Its human losses are matched by equally devastating materiel losses: around 11,000 tanks and 23,000 armored infantry vehicles.⁷² In the face of these staggering losses of men and materiel, Russia's territorial gains in Ukraine remain limited.

⁶⁶ A 2025 joint venture between France's Thales and Ukraine's Ukroboronprom is modernizing production lines and introducing Western technological standards. "Ukrainian Defense Industry (UDI) and Thales to establish joint venture," *Defence Industry Europe*
⁶⁷ See "Ukroboronprom and Rheinmetall open the first joint armoured vehicle repair and production workshop in Ukraine," *Ministry of Strategic Industries of Ukraine*
⁶⁸ See "Ukrainian subsidiary of armaments group KNDS opened," *KNDS*
⁶⁹ See "Russia's military casualties top 1 million in 3-year-old war, Ukraine says," *AP*.
⁷⁰ Russian open-source casualty trackers record ~111,000 confirmed Russian military deaths since the start of the full-scale invasion—figures that exclude personnel from the so-called "DNR" and "LNR." A probate registry excess mortality study places the true toll closer to ~165,000. See "Russian losses in the war with Ukraine," *Mediazona*
⁷¹ See "Vladimir Putin's sickening statistic: 1m Russian casualties in Ukraine," *The Economist*
⁷² See "Vladimir Putin's sickening statistic: 1m Russian casualties in Ukraine," *The Economist*. Open-source intelligence confirmation of materiel losses by Oryx stand at 4,030 tanks and 8,166 armored and infantry fighting vehicles, as of June 1, 2025; "Attack on Europe: Documenting Russian equipment losses during the Russian invasion of Ukraine," *Oryx*.

As of June 17, 2025, Russian forces occupy approximately 113,417 square kilometers of Ukrainian territory, constituting about 18.8% of Ukraine's total land area.⁷³ The change in occupied territory in 2024, amounting to 3,313 square kilometers (+3%), was accomplished with the remarkable cost of 14 confirmed deaths per square kilometer.⁷⁴ Russia's emphasis on human wave attacks, particularly its manpower-heavy 'meat-grinder' tactics that aim to overwhelm Ukrainian positions by sheer numbers, have led to disproportionate losses since 2022.

Driving Technological Innovation

For European states, Ukraine offers more than solidarity. It offers a blueprint. Facing a larger, better-funded enemy, Ukraine has built a defense model driven by speed, ingenuity, and efficiency—turning necessity into innovation. Innovation cycles that take years in Western capitals are compressed into weeks on the Ukrainian front. Technologies are not piloted—they are deployed, improved, fixed, and reused immediately after testing, often in a single battle. By developing independent intelligence sources, GPS-independent navigation, alternative infrastructure to Starlink, and affordable air defense solutions, Ukraine is offsetting the cost and scalability imbalance of modern warfare. Its battlefield-driven model, combining public-private collaboration, agile development, and integration of conventional systems, provides invaluable lessons for European defense transformation. The lessons from Ukraine highlight that interoperability, adaptation, bottom-up innovation, and understanding of the adversary may offer greater strategic value than large-scale procurement efforts focused on legacy systems.

1. Building Independent Intelligence Sources

In March 2025, the United States briefly suspended its intelligence-sharing arrangement with Kyiv, blocking even commercial imagery from providers such as Maxar Technologies.⁷⁵ The blackout stripped Ukraine of real-time targeting data and early warnings on missile and drone strikes against critical civilian infrastructure. The episode underscored the need for sovereign intelligence channels—above all, national space assets.

Ukraine started down that path in August 2022, when the Serhiy Prytula Charity Foundation crowdfunded the purchase of one ICEYE synthetic aperture radar (SAR) satellite and secured tasking rights across the ICEYE's full constellation.⁷⁶

The deal gave the Defence Intelligence Directorate (GUR) unrestricted access to high-frequency SAR imagery over Russian force groupings. GUR claimed that, in the first six months of tasking, the "People's Satellite" helped turn "billions of dollars' worth" of Russian armour and logistics nodes into scrap metal.⁷⁷

SAR sensors can cut through clouds, smoke, and darkness, but hostile electronic-warfare radars can still degrade—or briefly blind—them. A resilient national overhead architecture should therefore combine SAR with high-resolution electro-optical platforms and invest heavily in automated image exploitation.

2. Ensuring Effective Utilization of Large Data Arrays

Information superiority now rivals fire-power as the decisive factor in modern warfare. Real-time situational awareness enables Ukrainian units to offset ammunition shortages by directing each available round at the most valuable target. Equally critical is the secure storage and rapid exchange of that information across echelons and services.

At the core of Ukraine's digital command-and-control architecture is DELTA—a combat information system developed by the Ministry of Defence's Center for Innovation and Development of Defence Technologies.

⁷³ See: [DeepState](#)

⁷⁴ Change in territory calculated using [DeepState's](#) map of Ukraine, death statistics calculated from [Mediazona](#)

⁷⁵ See "US government revokes some access to satellite imagery for Ukraine," [Reuters](#)

⁷⁶ See "People's satellite," [Prytula Foundation](#)

⁷⁷ See "The people's satellite sees all," [GUR](#) [ua]

DELTA fuses multiple services into a single environment. Its modules include:

- **DELTA Monitor:** collects, processes, and visualizes enemy dispositions while coordinating friendly forces;
- **Element:** a resilient messenger that links dispersed units and allied formations;
- **Vezha:** integrates live video from airborne sensors into a common operating picture and distributes decrypted feeds to Joint Strike Force units;
- **Mission Control:** allocates UAV airspace and synchronizes multi-drone flight plans.⁷⁸

Ukraine now maintains one of the world's largest repositories of high-resolution imagery of Russian equipment. Reconnaissance UAVs alone stream thousands of hours of video each day—volumes no staff can sift through manually—while satellite products add yet another layer of data.

To handle this flow, Ukraine has implemented artificial intelligence tools that automate target detection. Foremost among them is Avengers, a platform within the DELTA ecosystem that flags up to 12,000 valid targets every week.⁷⁹ The platform ingests dozens of simultaneous drone and fixed-camera feeds, outlines detected vehicles in red, classifies their type, pinpoints coordinates, and pushes the results straight into DELTA for immediate fire-mission generation. By combining large-scale data collection with AI-driven analytics and secure dissemination, Ukraine maximizes the combat value of its expanding information arrays and preserves a critical edge on a resource-constrained battlefield.

3. Developing Alternative Navigation Methods

The war in Ukraine has exposed the vulnerability of GPS in modern conflict, as Russian electronic warfare systems increasingly jam, spoof, or disable satellite signals—especially deep behind enemy lines. Field reports indicate that the hit probability of GPS-guided M982 Excalibur rounds fell precipitously once Russian electronic-warfare systems saturated the battlefield. What had been a success rate of roughly 70% dropped to about 6%, as persistent jamming denied the projectiles the satellite fixes required for terminal guidance.⁸⁰ Moreover, Russia has jammed GPS and other satellite-based navigation systems around the Baltic Sea, affecting commercial air traffic.⁸¹ While GPS remains important, Ukraine is actively reducing its reliance on it by developing alternative navigation methods—pioneering innovative solutions in navigation and electronic warfare (EW) countermeasures.

Some Ukrainian unmanned aerial vehicles now employ optical scene-matching navigation: real-time imagery captured by the onboard camera is correlated with a pre-loaded library of geo-referenced terrain snapshots, enabling the aircraft to determine its position even when satellite signals are jammed or spoofed. This approach is hardly novel; it echoes the Digital Scene-Matching Area Correlator (DSMAC) and Terrain Contour Matching (TERCOM) guidance packages that have steered cruise missiles for decades.⁸² What is new is the miniaturisation and algorithmic refinement that allow the same technique to be fitted onto small UAV platforms and updated in flight.

Ukraine and Russia are also actively deploying fiber-optic tethered drones, which remain physically connected to the operator. This makes them nearly invulnerable to electronic warfare and supports real-time, high-definition video transmission.⁸³

⁷⁸ See "Battlefield innovation: Ukraine's DELTA system paves the way for allied interoperability at CWIX24," NATO; "Does Ukraine already have functional CJADC2 technology?" CSIS; "For Western Weapons, the Ukraine War Is a Beta Test," *New York Times*

⁷⁹ See "AI at the service of the AFU," *Forbes* [ua]

⁸⁰ See "Ukraine has two months to make most out of ATACMS missiles — report," *New Voice of Ukraine*

⁸¹ See "Russian jamming is wreaking havoc on gps in eastern europe. But is it hybrid warfare?," *Air & Space Forces Magazine*

⁸² See "Image processing for Tomahawk scene matching," *Johns Hopkins APL Technical Digest* (1994)

⁸³ See "Ukraine's 'invisible' drones," *Tech Ukraine*; "'They cannot be jammed': fibre optic drones pose new threat in Ukraine," *The Guardian*; "The terrifying new weapon changing the war in Ukraine," *BBC*

Laser designation offers a parallel route to precision when satellite guidance is challenged. Semi-active laser seekers fitted to missiles, artillery projectiles, and—prospectively—drone-dropped munitions home in on the reflected energy from a spot illuminated by a UAV, ground team, or aircraft, steering the round to the exact point. Both Ukrainian and Russian forces are already flight-testing such laser-guided weapons, viewing them as a cost-effective way to sustain accuracy under heavy GPS jamming.

Ukrainian producers are also actively seeking innovative approaches with alternative guidance methods. One example is the Time-of-Flight (ToF) navigation system by Ukrainian firm Sine.Engineering. It measures signal travel time between transmitter and receiver to enable satellite-free drone navigation in GPS-denied environments—specifically countering Russian electronic warfare.⁸⁴

4. Investing in Reliable Connectivity

After Russia's full-scale invasion in February 2022, Ukraine's communication networks were heavily damaged by cyberattacks and physical strikes.⁸⁵ In response, Ukraine quickly adopted Starlink, activated by SpaceX days after a request from Ukrainian officials.⁸⁶ Further development of technologies on the battlefield has led to a constant increase in the amount of information: the modern battlefield requires the transmission of terabytes of data in real time. By 2024, over 42,000 terminals were deployed nationwide, supported by European partners like Poland, Germany, and the US.⁸⁷

Starlink's low-latency, high-throughput service proved vital for battlefield communications, drone operations, and civilian needs from emergency medicine to government continuity. However, reliance on a single commercial provider revealed a critical vulnerability—SpaceX CEO Elon Musk's decision to restrict Starlink access over Crimea has directly hindered Ukrainian military efforts, and his threatening to cut off Starlink access to Ukraine.⁸⁸ European forces share the same vulnerability and are moving to diversify by investing in alternatives to Starlink, such as France's Eutelsat,⁸⁹ Iris Initiative,⁹⁰ and GovSatCom.⁹¹

5. Investing in Low-Cost and Scalable Defense Solutions

Destructive weapons are becoming cheaper, while countermeasures lag behind in cost-effectiveness, efficiency, and scalability. A particularly illustrative case of the asymmetry is the Iranian-made Shahed-136 (called the Geran-2 in Russian) loitering munition, which costs around \$193,000 per unit according to data leaks.⁹² Russia's subsequent localization program at the Alabuga special economic zone and, more recently, at Izhevsk plant Kupol (Garpiya-A1), have aimed at cutting the price to a planned \$48,000 per drone.⁹³ Russia is also introducing a still-cheaper expendable UAV marketed as Gerbera.⁹⁴ Fielding this lower-cost platform alongside the upgraded Geran-2 allows Russian commanders to intensify saturation attacks, exhausting Ukraine's interception capacity, both technically and financially. In contrast, each missile interceptor can cost up to \$3 million per shot.⁹⁵

No less challenging is Russia's reconnaissance drones (platforms such as Orlan-10, Supercam, Zala, etc.), streaming real-time coordinates to artillery, Lancet loitering munitions and guided bombs.⁹⁶ As with attack drones, the economics favor the aggressor:

⁸⁴ See "Ukrainian drones to evade Russian jamming with new alternative to GPS," [The Next Web](#)

⁸⁵ See "The Battle for Control Over Ukraine's Internet," [Time](#)

⁸⁶ "Starlink and the Russia-Ukraine War: a case of commercial technology and public purpose?," [Belfer Center](#)

⁸⁷ See "Ukraine is stuck with Musk's Starlink for now," [Politico](#); the US also provides Ukraine with access to a classified and encrypted version of Starlink called Starshield, see "SpaceX gets US contract to expand Ukraine's access to Starshield," [Bloomberg](#)

⁸⁸ See "Elon Musk's refusal to have Starlink support Ukraine attack in Crimea raises questions for Pentagon," [AP](#); "Musk and Rubio spar with Polish minister over Starlink in Ukraine," [BBC](#)

⁸⁹ See "Could Europe's Eutelsat help to replace Starlink in Ukraine?," [Reuters](#)

⁹⁰ See "Europe races to find Starlink alternatives for Ukraine," [Financial Times](#)

⁹¹ See "Ukraine fears Musk may cut vital Starlink internet amid Trump pressure," [Washington Post](#)

⁹² See "The cost of Shahed-136 for Russia has been reported," [Militarnyi](#)

⁹³ See "Gold for Drones: Massive Leak Reveals the Iranian Shahed Project in Russia," [Haaretz](#)

⁹⁴ See "The newest drone 'Gerbera': the younger sister of 'Gerans' and how they differ," [Dzen \[ru\]](#)

⁹⁵ See "Iranian drones in the Russian invasion: analysis by Molfar experts," [Molfar](#)

⁹⁶ See "Ukrainian forces in Donetsk Oblast show how they down Russian UAVs with FPV drones," [Ukrainska Pravda](#)

each ISR airframe costs a fraction of the interceptor missile—or electronic-warfare sortie—needed to neutralize it.

Anti-aircraft interceptor drones have become Ukraine’s most cost-effective answer to both loitering-munition floods and the reconnaissance UAVs that cue Russian artillery. Each interceptor now costs around \$5,000, which makes this solution highly scalable.⁹⁷ Anti-aircraft drones already have proven performance: for example, the Come Back Alive fund’s “Dronopad” initiative reports nearly 2,000 confirmed shoot-downs in just three months of field use.⁹⁸ This case highlights the urgent need for scalable, affordable Western countermeasures to avoid depleting missile stockpiles and budgets in prolonged conflicts.

It is worth noting, however, that while low-cost interceptor drones represent a solution against loitering-munition drones and reconnaissance UAVs, they do not substitute for a layered air-defense architecture; countries must still expand production of radars, SAM batteries and interceptor missiles to keep pace with evolving aerial threats.

6. Leveraging Cost-Asymmetries in the Drone Space

The Ukrainian battlefield has become a proving ground for a transformative shift in modern warfare, leading to a rise in low-cost, high-impact uncrewed systems. This rapid scale-up reflects Ukraine’s “whole-of-nation” innovation model, which combines state procurement, private enterprise, and grassroots engineering under a shared national defense effort. The urgent battlefield needs drive soldiers and engineers to develop solutions that require minimal investment to cause maximal disruption. This approach is exemplified by platforms like Escadrone’s Pegasus FPV drones—costing under \$500 (without a payload) and delivering precise anti-tank strikes guided by real-time operator feedback. FPV drones’ hit rates fall in the 10-50% range, with the spread driven by pilot skill, hostile electronic warfare, and overall battlefield conditions. Even at the low end—roughly five drones per confirmed kill—the economics still favor the user because it costs far less than a single precision-guided missile or artillery round. Ukraine’s recent Operation Spider Web (see below) exemplifies how these economics can be taken to their logical conclusion. Another example is the case of a Magura V5 naval drone equipped with missiles neutralizing a Russian Su-30 fighter jet valued at around \$50 million.⁹⁹

Russia has also embraced the cheap munitions model, fielding its own FPV floods. This shift merits a rethinking in both tactics and platform design. Crews now maneuver in short, masked bursts, keep vehicles under overhead cover, and add ad-hoc cages or netting over optics and engine decks. More importantly, future design standards must treat FPV resilience as rigorously as they already treat mine and blast protection—baking drone-defeat cages, electronic jammers, or hard-kill dazzlers into the baseline spec rather than bolting them on after the fact.

Case Study: Operation Spider Web

On June 1, 2025, Ukraine’s Security Service (SBU) conducted one of the most technologically innovative operations of the war: Operation Spider Web.¹⁰⁰ In a coordinated, multi-front drone attack deep inside Russian territory, Ukrainian forces struck at least five strategic air bases simultaneously, damaging or destroying over 40 military aircraft, including Tu-95 and Tu-22M3 bombers and A-50U airborne early-warning aircraft. Rather than using long-range missiles, many of which were politically restricted or limited in range, Ukraine relied entirely on small, domestically produced, low-cost FPV drones, paired with real-time intelligence, autonomous guidance systems, and covert insertion tactics.¹⁰¹

⁹⁷ See “Ukraine deploys world’s first drone-based air defense,” [Defense Express](#)

⁹⁸ See “Dronopad,” [Come Back Alive \[ua\]](#)

⁹⁹ See “World first: defence intelligence of Ukraine destroys Russian Su-30 fighter jet with a sea drone strike,” [GUR](#)

¹⁰⁰ See “Ukraine’s Operation Spider’s Web shows future of drone warfare,” [Council on Foreign Relations](#)

¹⁰¹ See “Russian offensive campaign assessment, June 4, 2025,” [ISW](#)

The operation was the culmination of 18 months of planning.¹⁰² Ukrainian agents infiltrated Russian territory with disassembled drones and explosives, hiding them in camouflaged shipping containers mounted on trucks. These mobile launch platforms were pre-positioned just kilometers from the targeted airbases. At the coordinated moment, each truck's roof slid open and released a flood of attack drones, launched in parallel across multiple time zones. This decentralized flood strategy achieved total surprise and overwhelmed Russia's air defense.

Technologically, the operation leveraged several breakthroughs. First, the drones were equipped with modern UAV control technology, which combines autonomous AI algorithms and manual operator intervention, enabling them to continue their missions when communications were jammed.¹⁰³ Second, each UAV was piloted using FPV goggles, allowing human operators to guide the drones to specific targets in real time, including the cockpits and fuel tanks of parked aircraft. In total, 117 drones were launched, each controlled by an individual operator, with all Ukrainian personnel successfully exfiltrated after the mission.¹⁰⁴

Operation Spider Web also revealed critical weaknesses in Russia's defense infrastructure. Strategic bombers were parked in the open without hardened shelters or effective camouflage. Radar systems failed to detect the low, slow-moving drones launched from within Russian territory. The attacks exposed gaps in Russia's air defense coverage, poor internal communication, and slow response coordination, particularly when attacks occurred simultaneously across thousands of kilometers.

While Operation Spider Web was an important victory for Ukraine and a significant blunder for Russia, it is unlikely to entirely diminish Russia's ability to launch cruise missiles at Ukraine—Russia likely retains 45 Tu-95s and 15 of the more advanced Tu-160 bombers—or to use its nuclear arsenal.¹⁰⁵ Nevertheless, estimates by Ukrainian government officials indicate Operation Spider Web disabled nearly one-third of Russia's strategic bomber fleet in a single night, at a fraction of the cost and without risking pilots or manned aircraft.¹⁰⁶ The drones, costing a few thousand dollars each, inflicted losses estimated at around \$7 billion.¹⁰⁷ By demonstrating that low-cost, homegrown UAV technology coupled with superior ingenuity, Ukraine has undoubtedly achieved a historic feat, and according to some experts,¹⁰⁸ even redefined asymmetric warfare.

7. Prioritizing the Development of High-Speed Strike Capabilities

Ukraine's defense against Russian aggression has highlighted the strategic value of high-speed strike capabilities. Striking targets deep in enemy-held territory—fuel depots, rail hubs, troop concentrations, production lines—remains essential to degrade the adversary's war machine. The fastest way to regain that reach has been with long-range, low-cost strike drones, now reported to hit hostile sites almost every day.

Yet deep-strike UAVs are no silver bullet. They carry small warheads, fly at subsonic speeds, and deliver limited kinetic energy; reliability hovers well below that of cruise missiles, and their slower flight profiles make them easier for modern air defense systems to track and shoot down. In other words, they complement—rather than replace—heavier precision weapons and must be fielded as one layer of a broader strike portfolio.

¹⁰² See "How Ukraine's Operation 'Spider's Web' redefines asymmetric warfare," [CSIS](#)

¹⁰³ See "SBU shows recordings from drones during Operation Spider's Web," [Suspilne \[ua\]](#)

¹⁰⁴ See "Operation Spiderweb—everything we know about Ukraine's 'audacious' attack on Russia's heavy bombers," [Kyiv Independent](#); Ukrainian President Volodymyr Zelenskyy's announcement on [Telegram \[ua\]](#)

¹⁰⁵ See "Russian nuclear weapons, 2025," [Bulletin of Atomic Scientists](#); Aviation is perhaps the least important element of Russia's nuclear triad, meaning that Operation Spider Web does not truly threaten Russia's ability to utilize (or threaten to utilize) its nuclear arsenal. See "Ukraine's drone attack on Russia's strategic aviation has broader implications," [Carnegie](#)

¹⁰⁶ See "Ukraine destroys 40 aircraft deep inside Russia ahead of peace talks in Istanbul," [AP](#); "Ukraine's drone attack on Russian warplanes was a serious blow to the Kremlin's strategic arsenal," [PBS](#)

¹⁰⁷ See "How Ukraine carried out daring 'Spider Web' attack on Russian bombers," [BBC](#)

¹⁰⁸ See "How Ukraine's Operation 'Spider's Web' redefines asymmetric warfare," [CSIS](#)

Ukraine now pairs deep-strike drones with missiles to regain strategic reach. Subsonic cruise missiles of up to 1,000 km in range—such as the extended-range Long Neptune, Peklo and Ruta—are effective but their low-altitude, low-speed flight profiles make them vulnerable to modern air defense systems.¹⁰⁹

While Western partners have supplied ATACMS tactical ballistic missiles, low national stocks and political restrictions constrain their use. President Zelenskyy confirmed a successful test of a domestic ballistic missile in August 2024 and ordered extra funding to accelerate its production,¹¹⁰ after financing of the operational-tactical complex development had been allocated in February 2022. According to Minister Of Strategic Industries Herman Smetanin, Ukrainian ballistic missiles are now fired monthly on the battlefield.¹¹¹

For European nations, Ukraine’s experience is a wake-up call on the need to revitalize strike capabilities and build up stockpiles.¹¹² Inspired by Ukraine’s progress, countries like Sweden have launched cooperative efforts, including the European Long-Range Strike Approach (ELSA), to address Europe’s persistent gaps in conventional deterrence.¹¹³

Meanwhile, Russia employs high-speed, low-observable missiles that defeat many interceptor systems, yet both Europe and Ukraine possess only limited numbers of air-defense batteries and interceptor missiles, constraining coverage.

8. Testing and Refining Systems in Real Combat Conditions

Technologies that perform well in controlled environments may falter in real-world combat—something Ukraine’s battlefield uniquely reveals. The US Army’s original ground-launched Small Diameter Bomb (GLSDB), built on Boeing’s GBU-39/B and co-developed with Saab, proved vulnerable when first deployed in Ukraine. Its reliance on a purely satellite/inertial navigation package allowed Russian electronic-warfare units to jam GPS links and disrupt mid-course guidance. To address these shortcomings, Raytheon is converting the next-generation GBU-53/B Small Diameter Bomb II (StormBreaker) for ground launch. Unlike its predecessor, the GBU-53/B carries three terminal seekers—active radar, semi-active laser homing, and thermal imaging—while using satellite/inertial guidance only during the mid-course phase. This multimodal approach guarantees that, even under GPS denial, the weapon can autonomously acquire and strike its target. Moreover, lessons from Ukraine have spurred consideration of jet engine use. A powered GLSDB flies low and fast, reducing the time enemies have to detect, jam or shoot it down—unlike the rocket booster, which lofts high and glides unpowered into the kill zone.¹¹⁴

Another example of successful iteration is Quantum Systems, which rapidly established a local Service, Support, Training, and Logistics Center in Ukraine after “Vector” drones proved vital in 2022. The center partnered with military training centers and deployed an automated feedback system. Continuous frontline input drove three major Vector upgrades—improved camouflage, structural reinforcements, longer battery life, new sensors, and software tweaks—and the development of a locally designed anti-jamming GPS antenna.¹¹⁵

For European defense planners, this provides an invaluable opportunity to observe emerging technologies in action, assess force structures under sustained pressure, and identify doctrinal gaps. The EU’s €20 billion in defense support to Ukraine reflects not just

¹⁰⁹ See “Ukraine combat-tests longer-range indigenous Neptune missile,” *The Defense Post*; “Ukraine’s expanding long-range missile arsenal: ‘Neptune,’ ‘Palianytsia,’ ‘Peklo,’ and ‘Ruta,’” *United 24*

¹¹⁰ See “Ukraine to provide separate funding for domestic ballistic missile program,” *Militarnyi*

¹¹¹ See “Ukrainian missile production expands eightfold with new systems in 2024,” *Militarnyi*; “Tired of military aid delays, Ukraine has designed its own ballistic missile — and it’s already in mass-production” *Kyiv Independent*

¹¹² See “Ukraine may have used its new FP-1 deep-strike drone against Russia weeks before publicly acknowledging its existence,” *Army Recognition Group*

¹¹³ See “Ukraine is expanding its long-range arsenal for deep strikes inside Russia,” *Atlantic Council*; “Swedish defense minister: ELSA long-range strike development driven by Ukraine lessons,” *Breaking Defense*

¹¹⁴ See “After setbacks in Ukraine, the U.S. makes new ‘GLSDB 2.0’ bomb that should fix the problem,” *Defense Express*

¹¹⁵ See “Ukraine’s drones industry: Investments and product innovations,” *KSE Institute*

solidarity, but also recognition of the strategic insight gained through this real-time experimentation.¹¹⁶

9. Ensuring Continuous Development and Improvement of Weapons

Ukraine's wartime experience offers profound insights into the future of defense innovation, particularly for European states grappling with slow procurement cycles and institutional inertia. Under existential pressure, Ukraine has replaced traditional, years-long defense development processes with a rapid, battlefield-driven innovation model. As a result, the design, testing, and deployment of new systems occur within condensed timelines—often a matter of weeks. R&D cycles are intentionally short—new concepts are prototyped and evaluated immediately, with non-viable solutions discarded within days. Moreover, the pace of change remains relentless, as fresh innovations—built on existing technologies and frontline feedback—are rolled out each month.

Innovations in technology must be matched by innovations in tactics. Often, an existing system—without any major redesign—can yield far greater impact when used in a new way. Drones, for example, should be understood as modular platforms that can be rapidly re-tasked. A striking case is the recently fielded AI-powered “drone queen,” which transports two FPV drones up to 300 kilometers before releasing them to autonomously locate and hit targets.¹¹⁷

Another example is Ukraine's rapid adaptation of naval drones, such as the Magura V5, which have redefined asymmetric maritime warfare. These low-cost, explosive-laden surface drones were quickly modified to carry out successful strikes on high-value Russian naval assets, including the destruction of a \$50 million Su-30 fighter jet. Their success helped force Russia to relocate much of its Black Sea Fleet away from occupied Crimea, proving how small, improvised systems can deliver outsized strategic effects when deployed with speed and tactical creativity.

Naval drones illustrate platform-based evolution: what began as simple kamikaze boats now can swap payloads—machine guns, MLRS pods, or even SAMs—on a common hull in hours, letting forces rapidly tailor capabilities to shifting threats. They have also started to operate in flocks—each drone assigned a role and mutually protecting one another.

10. Balancing Innovation with Conventional Capabilities

Future military effectiveness depends not only on how much is spent, but on how quickly forces can integrate legacy firepower with low-cost innovation. While drone proliferation is reshaping the battlefield, traditional platforms—such as tanks, armored combat vehicles, and artillery—remain essential and must continue to receive investment. Armored vehicles are still an essential component of modern warfare, while their tactics of usage may differ significantly.

Although FPV platforms have been adapted for direct strikes, reconnaissance and psychological warfare, they are not a replacement for artillery. FPVs cease to function when there is no radio line of sight (i.e., when they are beyond the radio horizon) and remain vulnerable to weather, frequency overlap, and electronic warfare jamming. Under those same conditions, artillery can still deliver firepower and provide suppression, denial of movement, and remote mining. The two systems therefore complement—rather than substitute for—each other; applied in a single, coordinated scheme of fire, their combined effect is greater than either weapon can achieve alone.

Ukraine's successful use of Western-supplied artillery systems like the M777 howitzer and Caesar self-propelled guns shows the importance of conventional firepower in holding and retaking territory.¹¹⁹ Similarly, the Ukrainian Bohdana self-propelled howitzer has proven its effectiveness on the battlefield, combining precision, mobility, and NATO-standard 155mm firepower to support long-range strikes against Russian positions. Ukraine now

¹¹⁶ See “Ukraine: Europe's weapons-testing ground,” *The Trumpet*

¹¹⁷ See Ukrainian Vice Prime Minister Mykhailo Fedorov's post on [Telegram](#)

¹¹⁸ See “Ukraine shows its latest ‘ship-killer’ Magura drone series to the public for the first time,” *Kyiv Independent*; “Video: \$50 million Russian Su-30 jet destroyed by Ukraine naval drone,” *NDTV*

¹¹⁹ See “In Ukraine, ‘shoot-and-scoot’ tactics helping Caesars survive,” *Defense News*

produces over 150 Bohdana howitzers per year—outpacing the combined annual output of comparable European artillery systems.

Reforming the Defense Ecosystem

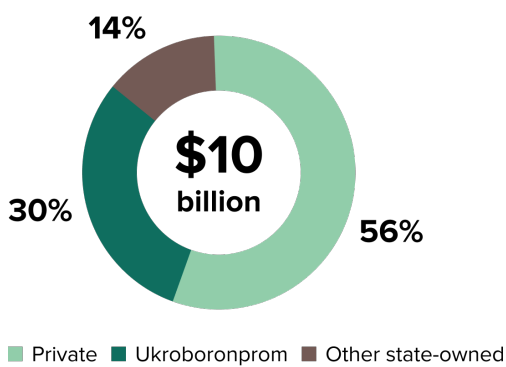
Given the growing importance of innovation on the modern battlefield, creating an institutional ecosystem that supports rapid development, scaling, and deployment of defense technologies is essential, as traditional procurement is too slow and rigid for modern warfare. Ukraine’s experience demonstrates that a decentralized, innovation-friendly system with strong public-private partnerships enables startups, engineers, and state agencies to collaborate and deliver battlefield solutions in real time.

1. Simplifying Access to the Defense Market for Small Companies

Over the past three years, Ukraine has overhauled its defense procurement system to foster rapid innovation and greater participation from small and medium-sized enterprises. In early 2024, it integrated defense contracts into the Prozorro e-procurement platform, significantly increasing transparency and expanding supplier access. This also helped to reduce the price of drones by 30%.¹²⁰

Simultaneously, the government launched subsidized loan programs for defense manufacturers. The government extended Ukraine’s cheap loans program (5-7-9%) to the arms industry.¹²¹ A May 2024 law granted defense manufacturers access to subsidized loans (7% for investments, 9% for working capital, up to UAH500 million) via the Ministry of Strategic Industries.¹²² By late 2024, the government had launched a 5% interest lending program for defense firms—the first loan (UAH100 million at 5% for one year) went to an EW/ELINT equipment maker.¹²³ Additional incentives like VAT exemptions for operations involving the import of specific defense-related goods to Ukraine influenced substantial increase of defense production and significantly added to army supplies.

UKRAINIAN DEFENSE PRODUCTION STRUCTURE, 2024



These reforms, along with the streamlined support provided by the Brave1 defense tech cluster—a government innovation hub—have cut procurement lead times dramatically—from approximately two years to just 1-2 months.¹²⁴ By mid-2025, hundreds of contracts and low-interest loans had already been awarded to startups and SMEs, rapidly expanding Ukraine’s defense industrial base and accelerating the deployment of innovative battlefield technologies. The share of private companies has grown significantly: traditionally, the industry was predominantly state-owned, but now private companies account for about half of production in 2024.

2. Encouraging Innovation: Brave1, Hackathons, Accelerators

Ukraine has built a vibrant defense-tech ecosystem with government support for R&D. The centerpiece is Brave1, a state-backed innovation cluster and online portal. Brave1 (launched in 2023) solicits ideas, organizes pitch events, and manages grants. In two years it has enrolled ~1,500 companies and 3,200 R&D projects with military applications.¹²⁵ In 2024, Brave1 issued grants totaling \$40 million to develop and test drones, EW systems,

¹²⁰ See “How open source e-procurement system Prozorro helps to sustain Ukrainian economy,” [European Commission Open Source Observatory](#); “A step towards transparency: The purchase of all FPV drones in 2025 can be transferred to a closed Prozorro module,” [Forbes \[ua\]](#)

¹²¹ See “Affordable loans at 5-7-9%: Businesses in high war risk areas will receive a longer period of concessional lending - 5 years,” [Ministry of Economy of Ukraine](#)

¹²² See “The Rada passed a law that gives arms manufacturers access to soft loans,” [Ukrinform \[ua\]](#)

¹²³ See “The first available loan was issued to a defense enterprise,” [Delo \[ua\]](#)

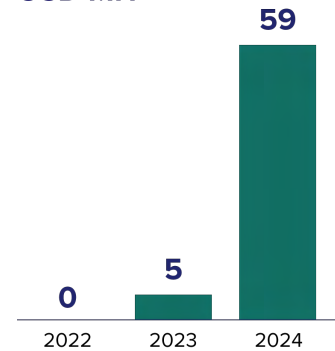
¹²⁴ See “Ukraine’s tech sector is playing vital wartime economic and defense roles,” [Atlantic Council](#)

¹²⁵ See “Ukraine’s drones industry: Investments and product innovations,” [KSE Institute](#)

robotic vehicles, etc., and it aims to issue \$100 million grants in 2025.¹²⁶ And Brave1 does far more than issue grants: the cluster matches firms with investors, secures access to military test grounds and battlefield tests, guides teams through defense market procedures, and stages hackathons to solve urgent battlefield problems.

Since 2022, the number of domestic drone producers in Ukraine has grown from four to over 500, with a combined production capacity of up to 5 million drones annually.¹²⁷ This innovation ecosystem is attracting international investment in next generation technologies. According to a recent KSE Institute report on drone industry,¹²⁸ Ukrainian startup Swarmer, which develops Styx—an AI system for coordinating drone swarms—raised \$2.7 million in funding.¹²⁹ The round was led by US defense tech firm R-G.AI, with participation from American investors Radius Capital, Green Flag Ventures, and D3. Total investments in the Ukrainian defense industry in 2024 amounted to \$59 million,¹³⁰ and has high potential for further growth.

INVESTMENTS, USD MN



Source: Brave1, AVentures Capital

3. Developing a Decentralized Procurement Model

Ukraine has empowered frontline units with budgetary autonomy and direct procurement powers. Rather than relying solely on central acquisitions, the military shifted in 2024-25 to a model where brigades and divisions can spend allocated funds on gear they urgently need. For example, in January 2025 the Defense Ministry announced that combat units will receive an extra UAH2.5 billion per month (~\$60 million) to buy drones directly. The funds are split amongst brigades, letting unit commanders purchase the specific UAS models best suited to their missions. Defense Minister Umerov emphasized that this gives commanders “flexibility to use these funds to acquire the drones... most effective for carrying out mission requirements at the front,” bypassing lengthy central approvals.¹³¹ Similar programs exist for other categories (e.g. electronic warfare, ground drones).

Ukraine formalized this decentralization in policy: CSIS observers note that “military units [are now] enabled to procure equipment directly and to use funds either from the state budget or reallocated by local budgets”—a major source of flexibility in meeting frontline demands.¹³² In practice, this means each brigade can invoice purchases through Prozorro or through the Brave1 Market portal directly to manufacturers. In April 2025, Ukraine launched Brave1 Market, an online ‘Amazon-style’ store for defense tech. This lets units browse & compare hundreds of validated systems—drones, robots, sensors, EW kits, software, munitions—and contract suppliers directly with unit funds.¹³³

These reforms mean that instead of waiting for a multi-year central contract, front-line units can rapidly procure off-the-shelf or recently developed systems. In effect, decision-making has been pushed down to commanders and early results are promising: units have quickly fielded thousands of tactical UAVs, advanced optics, comms gear, and loitering munitions via these direct-budget pathways.

4. Investing in Secure Digital Infrastructure

Since February 2022, Russia has stepped up cyber-pressure—targeting government portals, energy infrastructure and, of course, military digital infrastructure. Given the importance of information for the modern war, Ukraine needs secure digital infrastructure to store

¹²⁶ See “DealBook of Ukraine 20254 by AVentures Capital,” [Ukraine Venture Capital & Private Equity Association](#)

¹²⁷ See “Ukraine is winning the drone start-up war,” [Financial Times](#)

¹²⁸ See “Ukraine’s drones industry: Investments and product innovations,” [KSE Institute](#)

¹²⁹ See “Swarmer raises \$2.7m to unleash autonomous drone swarms, revolutionizing modern warfare,” [Tech Ukraine](#)

¹³⁰ See “DealBook of Ukraine 2025 by AVentures Capital,” [Ukraine Venture Capital & Private Equity Association](#)

¹³¹ See “Ukraine to give combat units \$60M a month to procure drones directly as it seeks to reduce reliance on centralized acquisition,” [Business Insider](#)

¹³² See “How Ukraine rebuilt its military acquisition system around commercial technology,” [CSIS](#)

¹³³ See “Brave1 Market: Ukraine launches marketplace for cutting-edge defense technologies,” [Ukrinform](#)

and share it across military units. In response to the threat, Ukraine has invested in hardened IT and data infrastructure. Early in the war, critical state databases and government services were migrated to secure cloud providers outside Ukraine; the government moved key data into the cloud and out of the country with the help of private cloud suppliers to secure systems against cyberattacks and strikes on physical data centers. At the same time, Kyiv has ramped up cybersecurity on its home soil. US and allied aid has bolstered Ukraine's cyber defenses: USAID alone provided roughly \$90 million for Ukrainian cyber-defense projects over 2019–2023.¹³⁴ The government created or upgraded multiple CERTs (cyber emergency response teams) and integrated volunteer IT Army hackers under civilian coordination. Ukraine's approach combines a cloud-backed backbone (protected by encryption and multi-layer defense), secure mobile comms (e.g. SpaceX Starlink terminals widely used for field communications), and rapid threat-sharing with NATO partners.

In terms of cyberthreats, Europe is already under Russian attack. Russian military intelligence has waged a long-running cyber-espionage and sabotage campaign against EU and NATO institutions, hitting the German Bundestag in 2015,¹³⁵ leaking Emmanuel Macron's campaign emails in 2017,¹³⁶ and mounting fresh intrusions that Germany and France publicly attributed to Moscow in 2024.¹³⁷ US agencies warn that destructive malware, defacements, and large-scale data-exfiltration are spreading across European governmental and critical-infrastructure networks.¹³⁸

Funding a Country at War

Defending oneself against a full-scale invasion—especially by a much larger and, on paper, much stronger adversary—is extremely costly: defense spending soars, the destruction of civilian infrastructure requires urgent and costly fixes, and the economy suffers, which is reflected in lower revenues. Over 2022–24, Ukraine spent roughly \$192 billion on defense and security within the state budget and is expected to spend another \$72 billion this year. As such amounts—around 36% of GDP over the three years—cannot be paid for with domestic revenues, Ukraine has relied heavily on foreign financial assistance for its non-military budget, while using its own financing sources for military expenditures. While these sums are large, they pale in comparison to what Europe would have to pay for its own defense if Ukraine had fallen—or should it be forced to give up the fight now.

Ukrainian national resilience has been supported by sustained and immediate state financing from the very first day of the Russian invasion. Defense and security immediately became the government's core fiscal priority. The government redirected money originally budgeted for development projects to defense—an estimated \$8.3 billion was reallocated in the first months for needs like weapons procurement and support for displaced civilians.¹³⁹ Prime Minister Denys Shmyhal noted that essentially “all taxes paid by people and businesses” were being directed to strengthening defense capabilities.¹⁴⁰ This focus on defense needs has not changed; if anything, it has been exacerbated. Fundamentally, Ukraine cannot use macro-financial assistance from its international partners to pay for defense expenditures. Thus, this part of the budget is covered by domestic revenues and financing sources—taxes, bond issuance, privatization proceeds—while foreign support is used to cover all other spending, including on social programs.¹⁴¹

In 2021, Ukraine's state budget had allocated roughly \$11 billion (or 5.5% of GDP) for defense and security. This number rose to \$49 billion in 2022, \$73 billion in 2023, \$69 billion in 2024, and (projected) \$72 billion in 2025. The fluctuations are a result of exchange rate

¹³⁴ See “Ukraine teaches Europe cyber lessons,” [CEPA](#)

¹³⁵ See “Russian hackers suspected in German cyberattack,” [DW](#)

¹³⁶ See “France accuses Russian intelligence of repeated cyber attacks since 2021,” [Reuters](#)

¹³⁷ See “Germany and allies accuse Russia of sweeping cyberattacks,” [Reuters](#)

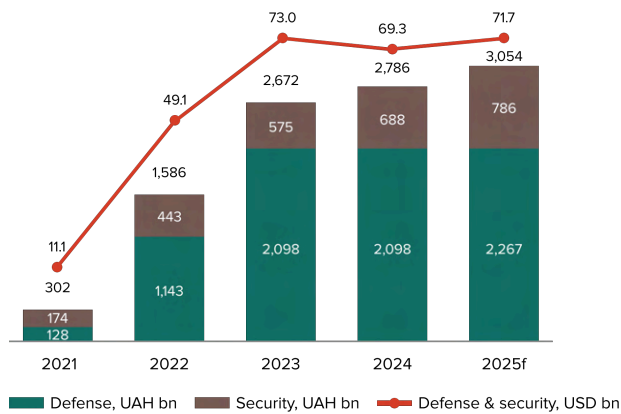
¹³⁸ See “Russian military cyber actors target US and global critical infrastructure,” [CISA](#)

¹⁴⁰ See “War forces Ukraine to divert \$8.3 bln to military spending, tax revenue drops - minister,” [Reuters](#) See “Ukraine's 2025 budget clears first reading, allocates \$53 billion for defense,” [Kyiv Independent](#)

¹⁴¹ See “Fiscal Digest Q1 2025,” [KSE Institute](#)

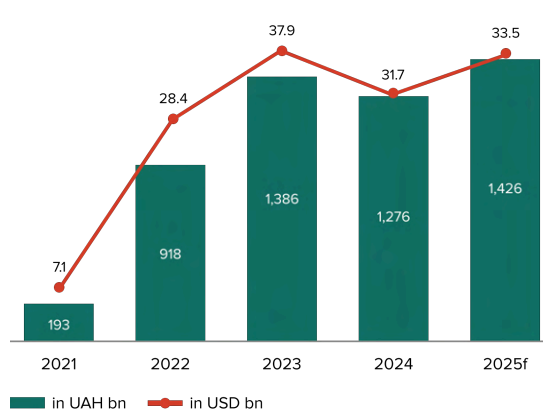
movements, while numbers in local currency terms have risen every year—from ~UAH300 billion in 2021 to more than UAH3 trillion in 2025. With little room to cut social or capital expenditures, this had led to a dramatic increase in overall budget spending, with the projected 2025 value of UAH4.8 trillion (or \$113 billion) almost four times the pre-war level of UAH1.5 trillion in 2021 (or \$55 billion). Despite the economy’s 29% contraction in 2022, revenues excluding foreign grants rose in nominal terms—from UAH1.3 trillion (or \$48 billion) in 2021 to (projected) UAH2.7 trillion (or \$65 billion) in 2025.¹⁴²

BUDGET SPENDING ON DEFENSE AND SECURITY



Source: KSE Institute

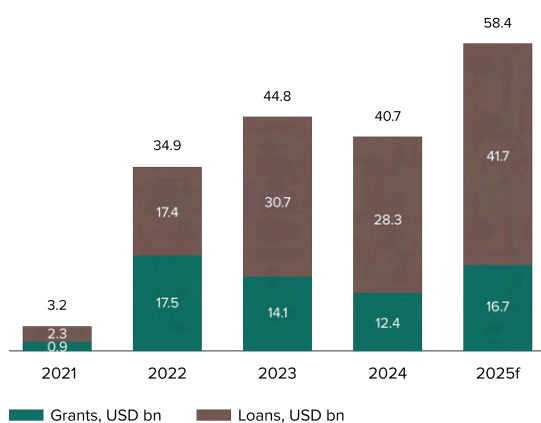
STATE BUDGET DEFICIT



Source: KSE Institute

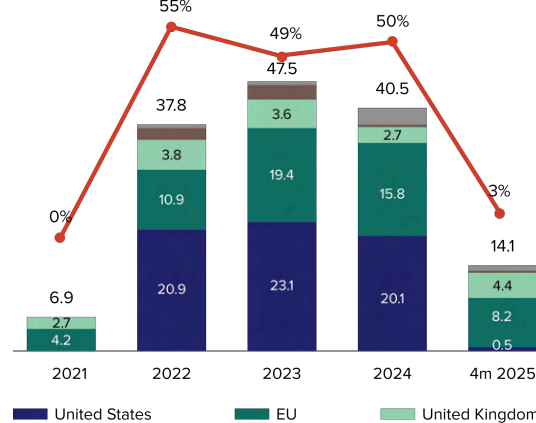
As a result of these developments, Ukraine’s budget deficit excluding grants from foreign partners has grown dramatically—from 3.6% of GDP to around or above 25% in 2022–25. Altogether, the deficit reached a cumulative \$133 billion during the war (including projected numbers for this year).¹⁴³ Ukrainian authorities undertook some important steps to generate additional revenues and support budget financing. In 2022 the NBU directly printed UAH400 billion (around \$12.5 billion) to purchase government war bonds and cover the deficit,¹⁴⁴ which helped pay soldiers and producers of military equipment, but stoked inflation, leading the NBU to curb money-printing in 2023 as other funding sources stabilized. In addition, the government moved to increase taxes for the first time during the war in October 2024. Facing a UAH500 billion (\$12 billion) shortfall in the defense budget that external aid could not cover, parliament approved emergency tax hikes.¹⁴⁵ The “military levy” on personal income (originally a 1.5% surtax introduced in 2014) was raised to 5% for most taxpayers. Finally, issuance of sovereign debt in the domestic market provided important funding.

FOREIGN BUDGET SUPPORT



Source: KSE Institute

MILITARY SUPPORT BY PARTNER, EUR BN



Source: Kiel Institute

¹⁴² See “Ukraine macroeconomic handbook: April 2025,” KSE Institute

¹⁴³ See “Ukraine macroeconomic handbook: April 2025,” KSE Institute

¹⁴⁴ See “Ukraine war economy tracker,” Centre for Economic Strategy

¹⁴⁵ See “Ukraine increases taxes amid mounting budgetary pressures,” Centre for Eastern Studies

However, domestic sources alone would have been wildly insufficient. Foreign financial assistance in the form of grants and loans is what has allowed Ukraine to continue its fight against Russian aggression. Over 2022–24, Ukraine received \$44 billion in grants (i.e., transfers) with ~\$17 billion expected in 2025 and \$76 billion in loans with disbursements of additional ~\$42 billion expected this year. Aside from bilateral arrangements, three items deserve particular attention: the IMF’s ~\$15 billion EFF program, the EU’s macro-financial assistance programs, including its €50 billion Ukraine Facility, and the G7’s \$50 billion Extraordinary Revenue Acceleration (ERA) mechanism.¹⁴⁶ Going forward, should the war continue into 2026 and, possibly, beyond, more foreign assistance will inevitably be needed. While Ukraine has implemented significant macroeconomic reforms even during the war, the potential for additional revenue mobilization is limited. The country has had a reasonably developed tax and revenue system for many years, which leaves relatively little room for improvements. For instance, in 2024, tax revenues (of the general government) already stood at close to 35% of GDP.¹⁴⁷ An increase of the magnitude needed to close financing gaps is simply unrealistic.

Ukraine’s military budget has been heavily skewed toward personnel and pay. Since 2022, all of Ukraine’s tax revenues have effectively been absorbed by military spending, primarily to maintain its armed forces through salaries, pensions, and mobilization costs, while non-military expenses have been covered by foreign aid and only a smaller share has gone toward arms procurement and equipment renewal.¹⁴⁸ In the approved 2024 defense budget, roughly 74% was earmarked for salaries, allowances and social benefits for service members, while only 23% went to procurement and repair of weapons and equipment.¹⁴⁹ In mid-2024 Parliament passed a supplemental budget (+\$13.5 billion) in which more than half of the increase was again devoted to soldier pay and benefits.¹⁵⁰

In addition to the aforementioned budgetary support, Ukraine has also received direct military assistance of around €126 billion from its allies in 2022–24. This number includes all types of weapons and military equipment alongside items explicitly donated to the Ukrainian army (such as bottled water, gasoline, or foodstuff), as well as funding for weapon acquisition. The support amounted to €38 billion in 2022, €48 billion in 2023, and €40 billion in 2024. In the first four months of 2025, €14 billion in military assistance were provided, pointing to a robust level for the full year. However, the composition has changed noticeably. Since Trump’s return to the White House, the US has not allocated any new military assistance,¹⁵¹ but additional support from other partners, in particular the EU, the United Kingdom, and Canada has made up for it.¹⁵² Over 2022–24, the United States accounted for 51% of the total, the EU and its Member States for 37%, and the United Kingdom for 8%. In January–April 2025, the respective numbers were 3%, 58%, and 31%. The extent to which Europe can replace America’s military aid to Ukraine is uncertain, even if top-line nominal figures remain steady.

Denmark pioneered a groundbreaking “Danish model” in 2024 by directly financing the procurement of Ukrainian-made weapons—initially ordering Bohdana self-propelled howitzers, then drones and anti-tank/anti-ship missiles—through a cooperative mechanism where the country finances existing contracts of the Ukrainian DPA (Defense Procurement Agency). Sweden and Iceland have also joined the initiative, and accrued interest on frozen Russian assets was used. This approach not only ensures faster, more cost-effective delivery and local maintenance, but also strengthens Ukraine’s defense industry capacity and economic resilience, with over €538 million worth of equipment funded in 2024 and plans to expand to approximately €1 billion in 2025.¹⁵³

¹⁴⁶ See “Ukraine macroeconomic handbook: April 2025,” KSE Institute

¹⁴⁷ See “Ukraine: seventh review under the extended arrangement under the extended fund facility,” IMF

¹⁴⁸ See “Ukraine to revise 2025 budget, increasing financing for defence, lawmaker says,” Reuters

¹⁴⁹ See “Trends in world military expenditure, 2024,” SIPRI

¹⁵⁰ See “Ukraine spent US\$64.7bn on war in 2024, Russia more than twice as much,” Ukrainska Pravda

¹⁵¹ See “Ukraine support tracker,” Kiel Institute

¹⁵² See “Ukraine support: Europe largely fills the US aid withdrawal, lead by the Nordics and the UK,” Kiel Institute

¹⁵³ See “Results of the ‘Danish Model’ of support for Ukraine’s defense industry in 2024: The Armed Forces of Ukraine received weapons valued at nearly €538 million,” Ministry of Defence of Ukraine

Ukraine is actively working to reduce its dependence on foreign military equipment. In 2024, the country's domestic arms production reached \$10 billion—roughly triple the sector's output in 2023. Simultaneously, Ukraine spent approximately \$3 billion of its own funds on imported military equipment. According to official statements, around 40% of the equipment currently used on the battlefield is domestically produced.¹⁵⁴ Nevertheless, Ukraine continues to rely heavily on international partners for certain categories of weaponry, particularly air defense systems. Ukraine also possesses significant potential to expand its domestic defense industrial base: total production capacity is estimated at \$35 billion.¹⁵⁵ While a portion of this output could be allocated directly to frontline needs, the remaining capacity presents a strategic opportunity for defense exports, offering a potential source of additional revenue for the country.

Ukraine's war effort goes far beyond the scope of a national undertaking—it protects Europe while Ukrainians shoulder most of the burden. With nearly all domestic revenue consumed by military expenditures, including soldier pay and mobilization costs, Ukraine relies on foreign partners to sustain its civilian functions. This division of fiscal responsibility is vital. If Ukraine falls, the cost to Europe in both security and economic terms would far exceed current aid levels. Therefore, continued and expanded burden-sharing is not charity; it is strategic investment. Integrating Ukraine into EU defense financing and procurement mechanisms would not only help close funding gaps, but also strengthen Europe's long-term security posture. Supporting the growth of Ukraine's defense industry would further reduce dependency and create future revenue streams, anchoring Ukraine more firmly within the European security architecture.

Learning from the Enemy

Russia's warfighting strategy blends Soviet-style mass firepower with modern drone warfare, showcasing the scale and speed at which adversaries can mobilize for prolonged conflict. This chapter examines how Russia has sustained artillery dominance, expanded UAV use, adapted naval doctrine, and leveraged foreign tech despite sanctions. It also outlines how Europe must respond—by scaling ammunition production, securing supply chains, investing in uncrewed and counter-drone systems, and preparing for hybrid threats that target both battlefield and civilian resilience.

1. Artillery Volume Still Matters

Russia has dramatically ramped up its artillery production since 2022. In 2024 alone Russia produced ~2 million 122/152 mm shells and reportedly imported ~2.7 million more from North Korea.¹⁵⁶ Analysts estimate Russia's 2024 artillery output was ~150% higher than in 2022.¹⁵⁷ At the same time, North Korea has supplied Russia with heavy artillery pieces—roughly 160–200 “Koksan” 170 mm guns as of late 2024.¹⁵⁸ On the battlefield this translated into massive barrages: Russian forces have relied on continuing heavy shelling (in Donetsk, Luhansk, Kharkiv regions, southern Ukraine, etc.) to suppress Ukrainian defenses.¹⁵⁹ There are estimates that Russia fires about 70,000 shells daily and Ukraine fires around 20,000, roughly 2 million and 600,000 per month, respectively.¹⁶⁰

European armies must assume that any future conflict could feature similarly high artillery volumes. To keep pace, Europe is boosting its own munitions and counter-battery capabilities. For example, Rheinmetall is expanding its shell plants (to 350 thousand 155 million rounds/year in Germany and 450 thousand in Spain).¹⁶¹ Europe should likewise expand artillery factories and stockpiles, invest in counter-battery radars (e.g. COBRA and

¹⁵⁴ See “Zelensky: over 40 percent of weapons produced in Ukraine,” [Radio Svoboda \[ua\]](#)

¹⁵⁵ See “Production capacity of Ukrainian defense industry increased by 75%,” [Militarnyi](#)

¹⁵⁶ See “Russia building major new explosives facility as Ukraine war drags on,” [Reuters](#)

¹⁵⁷ See “Defending Europe without the US: first estimates of what is needed,” [Bruegel](#)

¹⁵⁸ See “Ukrainian forces knock out North Korean self-propelled howitzer, military says,” [Reuters](#)

¹⁵⁹ See “Russia says its production of artillery shells has soared,” [Reuters](#)

¹⁶⁰ See “The core issue: ammunition manufacturing and its effects on the Russia-Ukraine war,” [Habor Research](#)

¹⁶¹ See “Focus: Germany's Rheinmetall expands artillery ammunition production as war in Ukraine drives global demand,” [Army Recognition Group](#)

counter-fire systems), and improve air defenses against incoming rockets and shells. Robust counter-artillery means not only more radars and howitzers but also harder targets (better shelters) and electronic jamming for enemy aiming drones. In sum, Russia's artillery surge shows that volume matters: Europe must sustain large ammunition production and develop systems (radars, interceptors) to track and neutralize massive barrages.

2. Rise of UAVs and Loitering Munitions

Russia has aggressively expanded its use of unmanned systems, especially small attack drones and reconnaissance UAVs. For example, the Lancet-3 loitering munition (EO-guided "kamikaze" drone) has been successful in combat operations against Ukrainian systems including Western-supplied armor and artillery—in early 2025, Russian state media claimed that over 2,800 Lancet strikes have been successful against Ukrainian materiel.¹⁶² These drones often operate in coordinated "sensor-to-shooter" teams: reconnaissance UAVs like the Orlan-10 or ZALA variants spot targets, and Lancets then autonomously dive on the coordinates.¹⁶³ Notably, the Lancet-3 incorporates advanced Western-made components (an NVIDIA AI processor and Swiss GPS module) that give it sophisticated target recognition and anti-jamming.¹⁶⁴ Russia has also experimented with machine vision technology in Lancet-3 drones for targeting and guidance, though the technology is not yet mature.¹⁶⁵ Beyond Lancet, Russia fields large fleets of ISR drones (Orlan-10, ZALA, Korsar, etc.), having deployed hundreds that now constantly watch over the front.¹⁶⁶

Simultaneously, Russia leveraged external partnership with Iran, notably acquiring the Shahed drone, a ready-made solution, rapidly scaling its manufacturing, deployment, and integration into combat and terror operations.

These threats suggest Europe must also mass-produce drones and drone defenses. Europe has already moved to expand the UAV industry (e.g. EU-funded Eurodrone MALE project) and is developing indigenous loitering munitions.¹⁶⁷ At the same time, countermeasures are critical. Europe should invest in electronic warfare systems to jam and spoof enemy drones' navigation, and procure or develop scalable Counter-UAS systems (radars, jammers, and kinetic interceptors). The EU-led JEY-CUAS project is an example of this approach.¹⁶⁸ Finally, for reconnaissance, Europe should equip units with friendly drones (loitering and FPV types) to negate enemy UAV advantage. In short, the lesson is that launching floods of drones is cost-effective and potent; Europe should mirror-scale its own drone production and expand EW/C-UAS capacities to protect forces and civilian areas from mass drone attacks. Europe should also remain adaptive, quickly integrating external innovations when beneficial, ensuring preparedness against evolving UAV threats.

3. Disrupted Naval Warfare: How Ukraine Uses Drone Boats and Uncrewed Systems

Russian naval doctrine has been upended by recent losses and drone attacks. The sinking of the Black Sea Fleet flagship Moskva in April 2022 (struck by Ukrainian Neptune missiles) was a severe blow.¹⁶⁹ Russia also lost or disabled several large amphibious ships: e.g. the landing ship Saratov was hit and scuttled in Berdyansk (March 2022),¹⁷⁰ and the

¹⁶² See "Russian Lancet-3 kamikaze drone filled with foreign parts: Western parts enable Russian Lancet-3 drone to have advanced targeting and anti-jamming capabilities," [Institute for Science and International Security](#); "The 100 most effective Lancet strikes against UAF materiel," [Rossiyskaya Gazeta](#) [ru]

¹⁶³ See "How Russia's homegrown Lancet drone became so feared in Ukraine," [Kyiv Independent](#); "Russia's use of uncrewed systems in Ukraine," [CNA](#)

¹⁶⁴ See "Russian Lancet-3 kamikaze drone filled with foreign parts: Western parts enable Russian Lancet-3 drone to have advanced targeting and anti-jamming capabilities," [Institute for Science and International Security](#)

¹⁶⁵ See "The battlefield AI revolution is not here yet," [ISW](#)

¹⁶⁶ See "Adaptation under fire: mass, speed, and accuracy transform Russia's kill chain in Ukraine," [CEPA](#); "Russia's use of uncrewed systems in Ukraine," [CNA](#)

¹⁶⁷ See "Eurodrone program bags fresh round of EU subsidies," [Defense News](#)

¹⁶⁸ See "Europe's direction in military drone development," [Orbital Today](#)

¹⁶⁹ See "Russian warship sinks; Ukraine says its missile is responsible," [Reuters](#)

¹⁷⁰ See "Russia salvages landing ship hit by Ukraine missile fire," [BBC](#)

Olenegorsky Gornyyak was badly damaged by Ukrainian sea drones at Novorossiysk (Aug 2023).¹⁷¹ The cumulative effect has been to force Russia's larger warships to remain in port or redeploy. In response, Russia is now organizing specialized naval drone regiments (unmanned surface, undersea and aerial systems) to perform reconnaissance and strikes on sea/coastal targets.¹⁷²

European navies and coast guards must invest in coastal defense rockets (like shore-based anti-ship missiles), naval mines, and unmanned patrol boats. Coastlines and critical ports should be defended with layered sensors (coastal radars, drones) and counter-drone weaponry (small-boat C-UAS). Europe should also practice asymmetric sea-denial tactics: e.g. use its own uncrewed vessels or subs to protect choke points. Finally, ship design may adapt (e.g. smaller, distributed fleets instead of a few large vessels).

4. Ammunition Strategy: Mix of Mass and Precision

Russia's ammunition doctrine mixes overwhelming quantities with precise effects. On the mass side, Russia has been firing unprecedented shell volumes (backed by imports). Intelligence reports note Russia produced ~2 million medium-caliber shells in 2024 and bought ~2.7 million from North Korea.¹⁷³ GUR intelligence even credits North Korea with providing "four million artillery shells" since late 2022 (mostly 122/152 mm).¹⁷⁴ This flood of rounds has enabled daily barrages against Ukrainian cities and frontlines. At the same time, Russia fields more precision munitions than ever. One key example is the 2K25 Krasnopol 152 mm laser-guided shell, which Ukraine observed reliably blasting individual tanks and bunkers.¹⁷⁵ Russia also deploys guided mortar rounds, GPS-assisted rockets, and a growing stock of cruise and ballistic missiles (Iskander, Kalibr, Kh-59/69, etc.).

Similarly, Russia has achieved a combination of mass and precision in its use of glide bombs, enabled by rapid adoption of the UMPK (Universal Gliding and Correction Module) kits. These retrofit modules convert unguided FAB and RBK bombs into high-payload precision-guided munitions with extended range. By 2025, Russia is expected to deploy approximately 50,000 of these glide bombs. Production is accelerating rapidly, with a 175% increase in glide bomb strikes and 218% growth in UMPK deployment from 2023 to 2024. This capability has significantly supported Russian ground advances: a single 500- to 1,500-kg warhead can flatten reinforced concrete blocks, turning urban strongpoints to rubble and exponentially complicating city defense.

Europe must similarly balance bulk and precision. On the one hand, stockpiles and production capacity are critical: exemplified by Germany's multi-hundred-million-euro programs to build millions of 155 mm rounds.¹⁷⁶

EU members should coordinate to maintain large consortia of shell and rocket factories. On the other hand, Europe should not abandon precision: continued development of PGMs (e.g. guided artillery shells like SMARt155, GPS rocket kits) is essential to strike high-value targets. In practice, Europe could follow Ukraine's approach by utilizing laser-guided or GPS-guided shells for counter-battery operations and bunker destruction, while reserving less expensive ammunition for saturation fire. European armed forces must also adapt to the proliferation of low-cost precision-guided munitions. This includes developing layered air defense systems optimized for intercepting glide bombs, investing in hardened infrastructure near the front, and deploying electronic warfare tools to disrupt guidance. Additionally, Europe should prioritize research into countermeasures against retrofit technologies like UMPK, while accelerating development of its own scalable precision strike capabilities to avoid strategic overmatch in future conflicts.

¹⁷⁰ See "Russia salvages landing ship hit by Ukraine missile fire," [BBC](#)

¹⁷¹ See "Ukrainian drone hits key Russian port, damage naval ship," [Al Jazeera](#)

¹⁷² See "Ukraine situation report: Russian navy creating new drone regiments in wake of enemy successes," [TWZ](#)

¹⁷³ See "Russia building major new explosives facility as Ukraine war drags on," [Reuters](#)

¹⁷⁴ See "Inside North Korea's vast operation to help Russia's war on Ukraine," [Reuters](#)

¹⁷⁵ See "Russia's artillery war in Ukraine: challenges and innovations," [RUSI](#)

¹⁷⁶ See "Germany's Rheinmetall expands artillery ammunition production as war in Ukraine drives global demand," [Army Recognition Group](#)

5. Centralized Industry: Scalability Beats Adaptability

Russia's military-industrial complex is characterized by extreme centralization, dominated by a few state-run conglomerates that control the majority of MIC assets. While this centralization enables rapid scaling and mass production, as illustrated by Russia's adaptation and scaling of Shahed drones, it severely hampers adaptability, innovation, and efficiency. Heavy industry sectors such as manufacturing and metallurgy dominate, while IT and R&D remain significantly underutilized, limiting the potential for technological breakthroughs and flexible innovation. Even so, multiple inefficiencies are smoothed over by the sheer volume of resources poured into MIC.

The EU should cultivate a balanced military-industrial ecosystem, fostering competition and innovation by actively supporting startups, SMEs, and R&D-driven initiatives. Efforts must ensure that successful innovations from SMEs can transition smoothly to scalable production without losing the agility inherent in smaller enterprises. Strategic coordination is essential to prevent resource duplication at the SME level and ensure alignment toward common defense objectives, without imposing overly rigid control that stifles innovation. This approach would leverage Europe's strengths in IT and advanced R&D while maintaining sufficient heavy industry capabilities necessary for comprehensive European rearmament.

6. Ground Assaults Tied to Availability of Armor

Russia's offensive capabilities depend heavily on armored vehicles, around 80% of which are retrofitted older Soviet-era models.¹⁷⁷ Its modern tank production remains limited, with only approximately 16 advanced T-90M tanks manufactured monthly.¹⁷⁸ This poses significant constraints in scaling modern tank production, forcing reliance on outdated platforms to sustain battlefield operations.

European defense strategies should exploit adversaries' dependency on outdated armored vehicles by investing in anti-armor tactics and technologies specifically designed for neutralizing large numbers of older tanks. Concurrently, EU policies should prioritize disrupting retrofit supply chains, restricting access to critical components necessary for modernizing aging fleets. This dual strategy capitalizes on production vulnerabilities, significantly weakening an adversary's armored capabilities and limiting their ability to sustain prolonged ground offensives.

7. Domestically-Sustained Air Force Fleet

Despite combat attrition, Russia has kept a large air force by producing replacements at home. For example, state announcements reported the 2023 delivery of multiple new airframes: Su-34, Su-35S and Su-57 fighters, new IL-76 transports, Yak-130 trainers and modernized Mi-28NM/Ka-52M helicopters.¹⁷⁹ In 2024, Russia acquired approximately 12 to 14 new Su-34 bombers and at least five Su-57 jets.¹⁸⁰ Even as it loses aircraft in Ukraine, Russian plants (Irkut, Sukhoi, Ulan-Ude) have maintained output. While Russia does not manufacture strategic aircraft at scale—such as those targeted during Operation Spider Web—its tactical aircraft are more sustainable, with production rates sufficient to compensate for battlefield losses.

European countries should ensure their own aerospace industries remain robust. Europe already pursues this with projects like Franco-German FCAS (future fighter) and Anglo-Italian Tempest/GCAP.¹⁸¹ However, more can be done: stockpiling critical parts (jet engines, avionics) and encouraging maintenance facilities will help fleets survive wartime. Nations should continue funding domestic aircraft (Typhoon, Rafale, Gripen) and share production across the EU (e.g. Airbus/Leonardo). Key engine lines (Eurojet

¹⁷⁷ See "Fit for war in decades: Europe's and Germany's slow rearmament vis-a-vis Russia," Kiel Institute

¹⁷⁸ See "Russian frontline units receive new batches of enhanced T-90M and T-72B3M tanks," [Military Watch Magazine](#)

¹⁷⁹ See "Russia increases artillery guns, ammunition production tenfold in 2023 over 2022," [Defense Mirror](#)

¹⁸⁰ See "Additional Su-34 Fullbacks, Su-57 Felons delivered to Russian Air Force as year draws to a close," [The Aviatorist](#)

¹⁸¹ See "FCAS? SCAF? Tempest? Explaining Europe's sixth-generation fighter efforts," [Breaking Defense](#)

EJ200, M88) and UAV programs (Eurodrone) should be secured. Europe should also diversify its defense procurement. For instance, Poland's decision to order F-35s while also investing in Eurofighter and Gripen platforms helps prevent reliance on a single supplier and avoids potential bottlenecks.¹⁸² Like Russia, Europe may need to adopt surge production strategies, such as building additional trainer jets or drones that can be upgraded, and invest in resilient logistics, including double-stacked airframes and dedicated repair teams, which will be as vital as raw numbers.

8. Dependence on Foreign High-Tech Components

Russian industry has repeatedly relied on foreign-made components to sustain its war effort, despite sanctions. Investigations reveal that Russian drones and missiles use Western electronics.¹⁸³ For example, the Lancet-3 drone contains a US NVIDIA Jetson AI processor and a Swiss U-blox GPS module enabling advanced target tracking and anti-jamming.¹⁸⁴ Likewise, many of Russia's precision-guided weapons still use Western or third-country optics, sensors, and radio chips. Even machine tools, crucial for ammunition, missile and aircraft factories have been imported through intermediaries. German media found 300+ CNC machine tools (milling, bending, welding machines) shipped to Russia in 2023 (often via Turkey).¹⁸⁵ Ukrainian analysts warn that ~80% of Russia's CNC equipment (historically German-made) is now servicing military production.¹⁸⁶

This reveals that export controls and supply-chain integrity are crucial lessons. Europe must clamp down on dual-use exports: machinery, semiconductors, optics, and communications equipment intended for civilian use often end up in Russian weapons systems. Tightening this means rigorous end-use enforcement and real-time monitoring of shipments. Sanctions lists should be updated to cover new critical items (e.g. certain RF amplifiers, specialized lenses) and to blacklist third country enablers. At the same time, Europe should invest in domestic alternatives for such technologies (chip fabs, optics manufacturers) to avoid vulnerability. Allied coordination, such as sharing intelligence on smuggling networks, is essential. By closing loopholes in Turkey, China, and other transshipment hubs, Europe can disrupt Moscow's evasion tactics.

9. Space and Nuclear Technologies Enhance Military Capabilities

Entities like Roscosmos and Rosatom, though nominally civilian, play critical roles in bolstering Russia's military capabilities, including missile technology, nuclear weapons, and advanced guidance systems. Russia's space program directly enhances its warfighting potential, notably through ballistic missile advancements and the capability to threaten foreign satellite infrastructure, disrupting vital communications and reconnaissance operations. Despite this, Russia's space technology sector remains partially dependent on Western-made components.

The EU must cease cooperation in space and nuclear technologies with adversarial regimes, as such collaboration inadvertently strengthens their military capacity. Ending dependency on Rosatom is essential to reduce Russia's ability to leverage critical EU energy infrastructure for political coercion and influence over the Union's decision-making processes. Additionally, Europe should suspend scientific and technological cooperation with Russian entities and individuals, removing them from major international research initiatives (ITER, ISS), thereby denying Russia indirect support for its military-industrial ambitions.

10. Arms Exports Create Partnerships and Generate Income

Before 2022, Russia was one of the world's top arms exporters, with exports serving as a

¹⁸² See "Game changer: Lockheed unveils Poland's first F-35," [Breaking Defense](#)

¹⁸³ See "Challenges of export controls enforcement," [KSE Institute](#).

¹⁸⁴ See "Russian Lancet-3 kamikaze drone filled with foreign parts," [Institute for Science and International Security](#)

¹⁸⁵ See "Russia received over 300 shipments for military needs from German companies, SWR investigation reveals," [UNITED24 Media](#)

¹⁸⁶ See "German companies alleged to circumvent Russia sanctions via Turkey: report," [Turkish Minute](#)

key revenue source for its military industry, ensuring stable production lines and forging strategic dependencies abroad.¹⁸⁷ This export model allowed Russia to embed itself in client countries' defense planning and policymaking.¹⁸⁸ The collapse of export revenue after its full-scale invasion of Ukraine left a chasm, forcing the Russian government to redirect massive internal funding to bail out its military-industrial complex. Despite setbacks, Russia continues to participate actively in international arms fairs, using battlefield engagements as marketing tools to secure new contracts and strategically foster dependency among purchasing countries. Meanwhile, Ukraine is actively exploring arms exports for similar reasons—generating revenue, stabilizing production, and building strategic partnerships.

Europe must not only avoid importing arms from adversarial regimes but should also seize the opportunity to fill the vacuum left by Russia's decline in global arms markets. By supporting reliable, competitive exports of EU and Ukrainian defense technologies, Europe can expand its strategic influence, reinforce industrial stability, and deny authoritarian regimes the leverage, and the funding, that arms exports historically provided.

11. Atrocities and Ecocide Operations

Russia has systematically violated international humanitarian norms through deliberate torture, executions of prisoners of war and civilians, widespread use of banned munitions, and genocidal actions such as mass rape, child abduction, and attempts at cultural eradication.¹⁸⁹ These atrocities also include intentional environmental destruction, notably the ecocide¹⁹⁰ caused by the demolition of the Kakhovka hydroelectric dam, resulting in profound and lasting ecological damage.¹⁹¹ Additionally, Russia has routinely targeted civilian infrastructure, particularly energy systems, in sustained campaigns aimed at terrorizing the population over military objectives.

Beyond legal prosecution and accountability, European defense policies and military doctrines must incorporate preparedness for adversaries who use atrocities as deliberate psychological operations. Military planning and population resilience strategies should anticipate and actively mitigate such acts by integrating specialized contingency scenarios and clear communication measures to counter psychological impacts. Enhancing public preparedness, developing rapid-response mechanisms for war crimes, and systematically incorporating atrocity-awareness into training and strategic planning are essential for effectively addressing and mitigating this form of warfare.

¹⁸⁷ See "Disassembling the Russian War Machine: Key Players and Nodes," [KSE Institute](#)

¹⁸⁸ See "Russia and the arms trade," [Stockholm International Peace Research Institute](#)¹⁸⁹ See "War Crimes in Ukraine," [Library of Congress](#)

¹⁹⁰ The current legal discourse reflects a growing consensus that the deliberate and widespread destruction of the environment warrants recognition as an international crime. In 2024 a number of states submitted a proposal to amend the Rome Statute of the International Criminal Court to include ecocide as a fifth core crime, alongside genocide, crimes against humanity, war crimes, and the crime of aggression. In 2021, an independent expert panel convened by the Stop Ecocide Foundation proposed a definition of ecocide as "unlawful or wanton acts committed with knowledge that there is a substantial likelihood of severe and either widespread or long-term damage to the environment." For further details, please see [here](#) and [here](#). Additionally, in 2024 the International Criminal Court issued a policy paper on how the Rome Statute as it stands could address environmental crimes (without a crime of ecocide), available [here](#).

¹⁹¹ See "Ecocide: The catastrophic consequences of Kakhovka Dam demolition," [Vox Ukraine](#)

III. NEXT STEPS: REARMING EUROPE AND INTEGRATING UKRAINE

Europe is rearming at scale, but without structural reform, its rising defense budgets risk reinforcing dysfunction rather than building deterrence. Ad hoc tools like SAFE and EDIRPA cannot overcome entrenched fragmentation. A centralized mechanism—like the proposed European Defence Mechanism—can align spending with strategy, but it will require real political will. Ukrainian experience, meanwhile, has become crucial to Europe’s security: its battlefield innovations, industrial scale-up, and rapid procurement under fire offer the most relevant lessons for modern defense. Excluding Ukraine from Europe’s defense architecture would not just be a missed opportunity, but could turn into a strategic failure. Without full integration, Europe may spend billions and still remain unprepared to deter a real military threat.

Existing Efforts to Centralize European Defense

As Europe ramps up defense spending, it requires structural reform to reduce its fragmentation. New tools like SAFE loans and fiscal exemptions encourage investment, yet fail to fix disjointed procurement and weak coordination. Past efforts like PESCO lacked enforcement; emergency measures like ASAP are temporary. Bruegel proposes a more ambitious solution: a European Defence Mechanism (EDM) to centralize procurement, enforce compliance, and include key partners like Ukraine.¹⁹² Without bold change, Europe remains exposed. With it, it can turn spending into real deterrence—guided by Ukraine’s frontline experience and a unified defense framework.

Recognizing the inefficiencies of this fragmented approach, the European Union has in recent years expanded its toolkit to bolster collective defense capabilities, particularly through centralized funding mechanisms. One such step is the new instrument called Security Action for Europe (SAFE), which will provide up to €150 billion in EU-backed loans for joint defense procurement by at least two Member States (one of which may be an EEA member).¹⁹³ While this offers savings for Member States that borrow at higher interest rates than the EU budget can, it still adds to national debt and does not solve the problem of separate equipment procurement. As a second measure, the European Commission is considering loosening fiscal rules by activating a “national escape clause” (NEC) that allows countries to increase net defense spending by up to 1.5% of GDP annually without breaching EU budget limits.¹⁹⁴ By introducing new instruments, the EU encourages countries to invest more in defense as a response to the urgent geopolitical context in Europe.

This initiative follows earlier efforts to strengthen defense cooperation, particularly Permanent Structured Cooperation (PESCO) established in 2017. PESCO facilitated numerous multinational projects in areas such as training and capability development, yet its voluntary nature and project-specific structure limited its broader effectiveness.¹⁹⁵ What truly mobilized the European defense sector was the emergence of a tangible military threat from Russia, the urgent

¹⁹² See “The governance and funding of European rearmament,” Bruegel

¹⁹³ See “Safe: Council adopts €150 billion boost for joint procurement on European security and defence,” Council of the EU; “European defence in numbers,” Council of the EU

¹⁹⁴ See “Accommodating increased defence expenditure within the Stability and Growth Pact,” European Commission; “Economic bulletin issue 3/2025” page 84-85, European Central Bank

¹⁹⁵ See “Fostering a culture of collaboration: PESCO projects are ambitious, inclusive,” PESCO; “PESCO projects progress report,” PESCO

need to provide coordinated support to Ukraine in the face of full-scale invasion, and growing fears that future US administrations might reduce its transatlantic security commitments. In response, the EU introduced a series of emergency and structural measures to reinforce its defense capabilities. One such measure is the Act in Support of Ammunition Production (ASAP), adopted in July 2023, which aims to rapidly expand ammunition manufacturing capacity through 2025, supported by €500 million in funding.¹⁹⁶ To reduce the cost burden on individual Member States and promote more efficient spending, the EU also adopted the European Defense Industry Reinforcement through Common Procurement Act (EDIRPA) in 2023, offering financial incentives for countries to jointly procure urgently needed defense capabilities and products.¹⁹⁷ Recognizing the need for continuity and long-term planning, the EU subsequently proposed the European Defense Industry Programme (EDIP) to bridge the gap between the conclusion of ASAP and EDIRPA and to ensure sustained industrial readiness for future security challenges.¹⁹⁸

Despite meaningful advances, the challenge of scaling and formalizing defense cooperation across Europe persists. To achieve a more integrated and efficient rearmament process, Wolff et al.¹⁹⁹ outline two main options for the future of EU defense financing and governance. One option is to expand the mandate of the current institutions, such as EDA, PESCO and SURE.²⁰⁰ As a second alternative, Bruegel proposes the creation of a new intergovernmental body—the European Defence Mechanism (EDM)—that would incorporate major European democracies, including non-EU countries like the UK and Ukraine. The EDM would act as a central procurement agency for military capabilities, running joint tenders for standard munitions and next-generation systems, and coordinating shared investment in big-ticket defense assets that no single country might afford alone, such as satellite constellations or advanced air-defense systems. A core feature would be the establishment of a single defense market, reducing national favoritism in contracts. Unlike voluntary initiatives such as PESCO or the EDA, the EDM would include enforcement mechanisms and sanctions for non-compliance. Due to creating a true single market for defense, EDM has the potential to halve unit costs for military equipment, provide collective financing vehicles for big projects, and integrate key European allies outside the EU. Mechanisms like the EDM represent a comprehensive solution, aligning funding with governance to accelerate European rearmament while avoiding past pitfalls of fragmentation.

Initiative	Status	Description
Act in Support of Ammunition Production (ASAP)	Projects selected in 2024	More than €500 million to ramp up production capacity of ammunition and missiles
Draghi report on EU competitiveness	Published in September 2024	Calls for: larger and more cohesive defense spending among EU Members, including through EU-level funding; some consolidation in defense industrial base to enable scaling
European Defence Agency (EDA)	Active since 2004	EU body facilitating cooperation among Ministries of Defense of 27 participating Member States
European Defence Fund (EDF)	Active since 2017	Funds collaborative capability development and R&D; €8 billion budget for 2021-27

¹⁹⁶ See “Act in support of ammunition production (ASAP),” [European Commission](#)

¹⁹⁷ See “The governance and funding of European rearmament,” [Bruegel](#)

¹⁹⁸ See “EDIP: dedicated programme in defence,” [European Commission](#)

¹⁹⁹ See “The governance and funding of European rearmament,” [Bruegel](#)

²⁰⁰ Support to mitigate Unemployment Risks in an Emergency

European Defence Industry Programme (EDIP)	Proposed by European Commission	€1.5 billion from EU budget (2025-27) for defense industrial base; open to Member States, Associated Countries, and Ukraine
European Defence Mechanism	Proposed (Wolff et al.) in April 2025	Intergovernmental institution for joint defense procurement and borrowing among participating European democracies; mandates single market (anti-home bias) and contributions to joint pool of capital
European Defence Industry Reinforcement through Common Procurement Act (EDIRPA)	Adopted by European Commission, projects selected for 2025 funding	One-time €300 million—€60 million for each of five <u>selected projects</u> —for joint procurement of urgent defense capabilities (air/missile defense, armored vehicles, and ammunition)
Permanent Structured Cooperation (PESCO)	Active since 2017	Framework for coordinating and funding joint capability development; <u>75 projects</u> currently in development amongst <u>26 participating Member States</u>
ReArm Europe Plan/Readiness 2030	NEC activation under consideration by European Commission; SAFE adopted	Up to €800 billion for defense investments (€150 billion from SAFE, €650 billion in fiscal space from <u>four-year activation</u> of the national escape clause); <u>simplifies</u> permitting, regulations, and access to finance
Security Action for Europe (SAFE)	Adopted by European Council	Up to €150 billion of loans backed by EU budget for joint procurement

Europe stands at a crossroads in securing its future. As questions loom over the reliability of long-term US military support, the lack of a unified mechanism to coordinate defense spending leaves Europe exposed not just politically, but strategically. Without bold structural reform, the continent risks pouring billions into a fragmented system that fails to deliver real deterrence.

The threat is no longer theoretical. Underinvestment in strategic enablers, persistent innovation bottlenecks, bureaucratic inertia, and divergent threat perceptions are already undermining Europe’s defense preparedness. The result may be a force structure that appears robust on paper but proves dangerously inadequate in the face of real conflict. In such a scenario, Europe risks not only falling behind in the global capabilities race but also forfeiting its credibility as a serious security actor. Yet Europe does not need to operate in uncertainty. Ukraine offers unparalleled operational insight, having stress-tested the modern battlefield against a peer adversary. It has developed a clear understanding of which systems yield results, how to accelerate military innovation under pressure, and how to execute procurement at speed and scale. This hard-won experience is a strategic resource Europe cannot afford to overlook. The path forward is clear: integrate Ukraine’s frontline lessons, align defense investments through a cohesive framework, and build a resilient, future-ready European defense posture—or remain fragmented, outdated, and vulnerable to future Russian military aggression.

Integrating Ukraine into European Defense Financing

Given the escalating security challenges on NATO’s eastern flank, Europe cannot afford to treat Ukraine as a peripheral partner in its defense planning. Ukraine’s experience offers important operational insights and battlefield-tested innovations that many European armed forces have yet to encounter. Far from serving as a geopolitical buffer, Ukraine now constitutes the frontline of European defense. Ensuring its inclusion in joint procurement initiatives, defense R&D programs, and industrial coordination is not only a matter of solidarity but a strategic necessity for strengthening Europe’s collective deterrence posture.

As the EU accelerates defense investment in response to growing security threats, integrating Ukraine into its financing mechanisms raises urgent questions about reforming Europe's fragmented procurement system. The root of this fragmentation lies in how defense procurement is structured across Europe. Defense procurement in Europe is predominantly handled by individual nations, often favoring domestic suppliers ("home bias").²⁰¹ The EU treaties (notably Article 346 TFEU) allow countries to exempt defense industries from single-market rules for national security reasons.²⁰² This rule has resulted in duplication, small production runs, and incompatibilities across countries. Europe's defense market is "fragmented and weakened" by these national silos and low cooperation, which heavy reliance on US protection historically masked.²⁰³ Now, with greater threats, the cost of fragmentation is becoming untenable—lack of coordination and increased demand is likely to inflate costs without delivering corresponding improvements in defense capabilities. To address this coordination gap, the EU established the European Defence Agency (EDA) in 2004.²⁰⁴ The Agency is used as a platform for joint research, development, and procurement initiatives. However, its inability to mandate collective purchasing or prevent unilateral action by Member States has significantly constrained its effectiveness.

Yet while Europe is preparing to spend more, how it spends may matter even more than how much it spends. The effectiveness of increased defense budgets will depend on the continent's ability to streamline and integrate its capabilities. Interoperability has long been a critical challenge for European militaries, compounded by linguistic, cultural, and technical differences. This fragmentation is not merely administratively costly—it is also operationally costly. As of 2018, the EU operated six times as many weapon systems as the US, leading to higher costs and logistical inefficiencies.²⁰⁵ For example, Europe fields 14 types of main battle tanks, including the AMX Leclerc, Leopard 2, and PT-91, while the US uses only the M1 Abrams.²⁰⁶ This fragmentation extends across other systems, including infantry fighting vehicles and howitzers.

Association with EU Defense Programs

There has been a strong political consensus (with a few exceptions) that supporting Ukraine is crucial for defending the European security order. Since the EU treaties (Article 41(2) TEU) forbid using the regular EU budget for "expenditure arising from operations having military or defense implications", financing weapons to help Ukraine had to be done via alternative platforms.²⁰⁷ Therefore, since 2022 the EU has bent its financial and legal frameworks in novel ways to fund Ukraine's defense, via intergovernmental funds and initiatives that uphold the letter of EU law while meeting the urgent demands of war.

The European Peace Fund (EPF) has been the central channel for EU arms financing to Ukraine, with legal basis in Council decisions under the Common Foreign and Security Policy (CFSP) and a strong political consensus that supporting Ukraine helps "protect Europe's peace and security."²⁰⁸ Since 2022 the EU has earmarked over €11 billion via the EPF to reimburse Member States for weapons, ammunition, and training provided to Ukraine, which marked the first time common EU funds were used to supply lethal military equipment.²⁰⁹ Now it is worth €17 billion overall, including €5 billion from the Ukraine Assistance Fund (UAF).²¹⁰ Announcements of proposals and actual deliveries have not always been aligned, however. The UAF, originally proposed as a four-year €20 billion

²⁰¹ See "What role do imports play in European defence," [Bruegel](#)

²⁰² See "EU defence and defence industry policy," [EUR-Lex](#)

²⁰³ See "The governance and funding of European rearmament," [Bruegel](#)

²⁰⁴ See "European Defence Agency (EDA)," [European Union](#)

²⁰⁵ See "Europe has six times as many weapon systems as the U.S.," [Forbes](#)

²⁰⁶ See "Europe's Next-Generation Main Battle Tank: New Hope?," [CEPA](#)

²⁰⁷ See "Article 41(2) of the Treaty on European Union," [European Parliament](#)

²⁰⁸ See "European peace facility," [European Commission](#); "Common foreign and security policy," [European Commission](#)

²⁰⁹ See "How the war in Ukraine has transformed the EU's common foreign and security policy," [Yearbook of European Law](#)

²¹⁰ See "European defence industry programme (EDIP)," [European Parliamentary Research Service](#); "Ukraine assistance fund: Council allocates €5 billion under the European Peace Facility to support Ukraine," [Delegation of the European Union to Ukraine](#)

program, was eventually brought down to a single year.²¹¹ And High Representative Kaja Kallas' proposal to spend €5 billion on 2 million artillery shells failed to garner sufficient support in early 2025.²¹²

In addition to arms, the EPF also finances non-lethal equipment and training. In 2022, the EPF set aside about €380 million for non-lethal supplies (medical kits, protective gear, fuel, etc.) for Ukraine.²¹³ The EU's new Military Assistance Mission (EUMAM), which is training 73,000+ Ukrainian soldiers in EU countries, has a budget of €55 million financed via the EPF, as well.²¹⁴ This covers expenses from training facilities to ammunition used in exercises and equipment for trainees.

Ukraine's new status as an EU candidate and close defense partner in 2023-2024 made the EU-sourced European Defence Fund (EDF) projects accessible to Ukrainian companies, allowing Ukraine's defense industry and research entities to join multinational projects and receive funding.²¹⁵ This significant step allows Ukraine to contribute to and benefit from European weapons development. For instance, Ukrainian firms can partner on projects for new European drones, cyber defense tools, or armored vehicle R&D. This association of Ukraine with the EDF framework is a significant step towards development of a joint defense-industrial base and aligning its industry with EU standards for the long term.

Joint Procurement

In coming years, Ukraine can be included in further EU-coordinated procurement projects —not just as a producer but as a joint buyer. Under the SAFE scheme and the EDIP, Ukraine will be eligible to co-launch procurement projects with EU members.²¹⁶

Ukraine has already been designated as an associated country under SAFE and the EDIP, a key aim of which is to foster the development of Ukraine's defense industry and integrate it into the European defense industrial base.²¹⁷ Being "associated" means Ukrainian entities can directly participate in and receive EU funding from these programs, even prior to EU membership. Under SAFE and EDIP, the Ukrainian government can also participate in joint procurement projects with EU states. For example, Ukraine and Poland could together procure air defense systems or artillery, with the EU loan covering a large share of the cost. The political rationale is to support Ukraine's needs and integrate its procurement with EU partners, while also ensuring funds benefit the European defense industry. Indeed, SAFE rules require that 65% of the components cost must come from the EU, the EEA-EFTA, or Ukraine.²¹⁸ This opens the door for Ukraine's arms manufacturers and tech companies to join consortia building the next generation of European weapons (radars, missiles, etc.) with EU co-financing, and for Ukraine to join the European defense industry's supply chains. The EU Defence Innovation Office (EUDIO) in Kyiv was opened in 2024 to help coordinate Ukraine's integration into the EU's defense industry.²¹⁹ In essence, beyond 2025 Ukraine could move from ad-hoc project participation toward structured programmatic support for its defense industry via the EU. Participating in such initiatives will allow Ukraine to obtain modern equipment at lower costs (leveraging bulk orders and EU subsidies), increase interoperability with EU forces, and build its industrial capacity for its own and the EU's rearmament.

There are also moves to involve the European Investment Bank (EIB) more in defense supply chains.²²⁰ The Commission's 2025 White Paper on European Defense suggested

²¹² See "Kaja Kallas' €40-billion plan for Ukraine flounders at EU summit," [Euronews](#)

²¹³ See "European peace facility – support for the Ukrainian Armed Forces," [EUR-Lex](#)

²¹⁴ See "EUMAM Ukraine," [European External Action Service](#)

²¹⁵ See "Commission mobilises €910 million to boost European defence and close capability gaps," [European Commission](#)

²¹⁶ See "SAFE: Council adopts €150 billion boost for joint procurement on European security and defence," [Council of the EU](#); "Joint press release by the European Union and Ukraine on strengthening military industry ties at the EU-Ukraine Defence Industries Forum," [European Commission](#)

²¹⁷ See "EDIP: dedicated programme in defence," [European Commission](#); "Council regulation establishing the Security Action for Europe (SAFE) through the Reinforcement of the European Defence Industry Instrument," [Council of the EU](#)

²¹⁸ See "SAFE: Council adopts €150 billion boost for joint procurement on European security and defence," [Council of the EU](#)

²¹⁹ See "EU defence innovation office in Kyiv," [European Union](#); "EU and Ukraine deepened cooperation and advanced reform agenda – 10th Association Council meeting," [European Commission](#)

²²⁰ See "EIB steps up financing for European security and defence and critical raw materials," [European Investment Bank](#)

doubling EIB investments in defense to €2 billion annually and broadening its scope to areas like drones and cybersecurity (still excluding lethal arms).²²¹ If rules are eased, Ukraine could become a beneficiary of EIB loans or guarantees for dual-use infrastructure (e.g. building a new explosives plant or satellite communication systems).

As the EU's defense initiatives expand, Ukraine is on track to plug into these frameworks, gaining access to capital, technology, and collaborative projects that were previously reserved exclusively for EU members. Politically, there is momentum to treat Ukraine as part of the European defense family. Ukraine should be included into all the EU's embryonic defense and defense-industrial-related institutions and treat Ukraine as a full member in defense-industrial terms erasing the distinction between 'buying European' and 'buying Ukrainian.'²²² While full EU membership (which would guarantee Ukraine a direct slice of EU defense funds and a say in decision-making) might be years away, these intermediary integrations are likely to deepen year by year. Beyond 2025, Ukraine could participate in multi-national defense projects, joint exercises, and capability planning under EU auspices nearly on par with EU countries—profoundly tightening the defense bond.

Challenges of Integrating Ukraine

As Ukraine fights for its survival and Europe grapples with its security responsibilities, integrating Ukrainian and European defense systems has become both a strategic necessity and a complex challenge. Despite unprecedented military aid and growing alignment with NATO standards, deep institutional, legal, and logistical obstacles persist. Europe's fragmented defense structures, divergent national policies, and slow procurement mechanisms hinder rapid integration. On Ukraine's side, legacy systems, procurement reforms still underway, and the pressures of wartime governance limit full compatibility with EU and NATO frameworks. Without political resolve and structural adaptation on both sides, the vision of a unified European defense that includes Ukraine risks being delayed or derailed. This chapter examines the core obstacles and outlines the urgent steps needed to bridge the gap.

Institutional, Political, and Legal Hurdles

European support for Ukraine's armed forces has been critical but financial, political and institutional constraints on both sides have complicated integration. National reluctance, legal limits and shifting public moods in Europe have slowed aid flows even as Ukraine's army urgently needs modern Western equipment. Within Europe, leaders must balance solidarity with Ukraine against war-weariness at home. For example, recent EU surveys show citizens are split on military aid—roughly one-third say their government does too little, one-third too much, and one-third about right, which creates electoral risks for further spending.²²³ Several Member States also legally or politically opt out of joint defense spending.²²⁴ The EU's European Peace Facility explicitly excludes contributions from neutral or reluctant countries (notably Austria, Hungary, Ireland and Malta).²²⁵ Even among more supportive members, internal divisions have emerged about how to deal with the holdouts: Hungary has repeatedly held up EU budget packages for Ukraine, forcing EU leaders to consider severe sanctions against Budapest to unlock a new €50 bn aid tranche.²²⁶ In short, national budget limits and political divides mean generous pledges of tanks and ammunition can be delayed or downsized.

War in Ukraine shows that Europe's defense bureaucracy and legal framework are not well-suited to quick wartime support, especially for a non-member. EU defense cooperation remains largely intergovernmental: the European Defense Agency and other

²²¹ See "Introducing the white paper for European defence and the ReArm Europe plan – Readiness 2030," [European Commission](#)

²²² See "Ukraine: European democracy's affordable arsenal," [Bruegel](#)

²²³ See "Support for Ukraine still high among EU citizens but some fall off apparent among certain groups," [Eurofound](#)

²²⁴ See "EU's defence push puts its neutral members in tough spot," [The Parliament Magazine](#)

²²⁵ See "MFF: European peace facility," [European Parliament](#)

²²⁶ See "Orbán's stance on Ukraine pushes Hungary to brink in EU relations," [The Guardian](#)

structures rely on national voluntary funding, not a common defense budget.²²⁷ This ‘national reflex’ means that collaborative instruments (like PESCO or the European Defence Fund) have limited reach unless all 27 Member States agree. Ukraine is not an EU member—only a candidate—so it cannot directly participate in most EU defense programs. Brussels has proposed new tools (the €50 bn Ukraine Facility and the G7 “ERA” loans) to channel support, but these require complex legislation and agreement. For example, the EU’s recent defense White Paper urges front-loading a G7 loan and creating a “Ukraine Support Instrument” under a new European Defence Industrial Programme, but these proposals must still be ratified.²²⁸

Meanwhile, Ukraine’s own institutions and procurement systems differ sharply from EU norms. Prior to the war, Ukraine’s defense procurement was heavily centralized, secretive and Soviet-style—about 95% of major contracts were classified and not subject to open tendering.²²⁹ Since 2016, Ukraine has tried to adopt NATO codification and more transparent auction-based contracts.²³⁰ Though Ukraine still has a ways to go, progress has been made in modernizing them.²³¹

Military Interoperability and Logistical Challenges

Integrating Ukraine’s armed forces with EU/NATO frameworks poses difficult operational challenges. Ukrainian forces have long used Soviet-era equipment and doctrine. Transitioning to NATO standards is a multi-year process and NATO’s assistance, whether through centers like the Joint Analysis Training and Education Centre (JATEC) or in joint statements,²³² NATO is explicitly focused on helping Ukraine permanently integrate into its ecosystems. Each new Western weapon must undergo NATO codification and training before being fielded—a process Ukraine began in 2016 and continues under wartime constraints.²³³ Practically, this means retraining troops on new caliber weapons and different radios, and repairing or replacing incompatible gear. Logistically, even getting arms to the front is complicated: one analysis of a Czech-led ammunition initiative noted that coordinating ships, trains and security across many borders can take weeks.²³⁴ Strict secrecy requirements further impede timely deliveries. Thus, even when funding is available and weapons are pledged, transport bottlenecks and interoperability gaps delay Ukraine’s use of them.

NATO and the EU are taking steps to close these gaps. For instance, NATO’s Comprehensive Assistance Package funds training and equipment to help Ukraine integrate with allied systems.²³⁵ Joint centers like JATEC in Poland (opened in 2025) teach modern command procedures.²³⁶ The EU likewise proposes extending its military mobility corridors, and even space and C4ISR services, into Ukraine.²³⁷ Still, adaptation is difficult: NATO experts warn that standardization efforts take time and “allies will meet interoperability standards at different paces.”²³⁸ Every aspect (weapon calibers, communications, logistics chains, medical support, etc.) must be retooled. Ukraine’s forces remain in transition—increasingly effective, but not yet fully interoperable with Western units, and it will take sustained effort to reach the high degree of integration seen among NATO members.

Looking ahead, the structural consequences of these challenges are grave. If Europe fails to integrate Ukraine’s defense effectively, the continent’s security architecture could fragment. European analysts warn that the urgency of war is driving short-term

²²⁷ See “Financing European Defence: the end of budgetary taboos,” *European Papers*

²²⁸ See “Introducing the white paper for European defence and the ReArm Europe plan – Readiness 2030,” *European Commission*

²²⁹ See “How Ukraine rebuilt its military acquisition system around commercial technology,” *CSIS*

²³⁰ See “NATO Trust Fund,” *NATO*

²³¹ See “Ukraine’s reformed military procurement agency drives the country’s NATO ambitions,” *Associated Press*

²³² See “Statement of the NATO-Ukraine Council issued by the heads of state and government participating in the meeting of the NATO-Ukraine Council,” *NATO*

²³³ See “How Ukraine rebuilt its military acquisition system around commercial technology,” *CSIS*

²³⁴ See “Czechia’s quiet struggle for artillery shells holds lessons for Europe,” *Defense News*

²³⁵ See “Comprehensive assistance package (CAP) for Ukraine,” *NATO*

²³⁶ See “NATO and Ukraine open the Joint Analysis Training and Education Centre,” *Allied Command Transformation*

²³⁷ See “White paper for European defence: Readiness 2030” page 11, *European Commission*

²³⁸ See “Ukraine war is exposing NATO interoperability gaps,” *National Defense Magazine*

“off-the-shelf” arms buys from non-EU suppliers (including the US), which undercuts the long-term goal of a unified European defense industry.²³⁹ Mejino-López and Wolff note that Europe’s defense market is already fragmented, with small national projects and high costs, and that only a concerted strategy (on the order of €500 bn over five years) can fix this.²⁴⁰ The EU has begun to address this by proposing joint ammunition procurement and linking Ukraine’s industry into EU supply chains, but success depends on sustained political will.²⁴¹

Another risk is political backsliding or fatigue. If the war drags on, European publics may grow increasingly divided over Ukraine, making future troop or fund contributions—both to Ukraine and to the EU’s collective defense—unlikely. Domestic upheavals (including the election of anti-Ukraine governments or the rise of extremist parties) could further halt integration. Additionally, Ukraine itself must undertake massive reforms as part of its EU candidacy—reforms difficult to carry out under fire. Any failure to strengthen Ukraine internally will complicate full integration later.

Finally, there is the broader strategic danger: if Europe’s unity cracks, Russia’s influence could grow again. Until Ukraine is fighting and organizing on the same page as its Western allies, collective defense will remain imperfect. The path to integrating Ukrainian and European defense is fraught and lies in overcoming political divisions and budget limits among EU states, aligning disparate institutions and procurement rules, and transforming Ukraine’s armed forces—all under the shadow of a still-unfinished war.

²³⁹ See “Ukraine conflict’s impact on European defence and permanent structured cooperation (PESCO),” [European Papers](#)

²⁴⁰ See “A European defence industrial strategy in a hostile world,” [Bruegel](#)

²⁴¹ See “Joint white paper for European defence readiness 2030,” [European Commission](#)

IV. POLICY RECOMMENDATIONS

In order to establish effective deterrence against Russia, Ukraine should be integrated into the European security architecture by inviting it into European defense bodies and planning, including it in defense industrial strategy, and incorporating its field experience into training and doctrine. In addition, joint defense production should be advanced, including by involving Ukraine in PESCO and joint projects and encouraging joint procurement and co-production. It is also critical to boost capacities and innovation by expanding the role of the European Defense Agency, cultivating joint innovation ecosystems, and leveraging civilian tech and agile R&D. Finally, the exchange of knowledge and best practices should be facilitated through a permanent European-Ukrainian lessons learned mechanism, the sharing of cross-society and civil-military practices, the transfer of field-proven technologies, and a broader exchange of training and command.

1. Integrating Ukraine into the European Security Architecture

Invite Ukraine into European defense bodies and planning. Ukraine should be granted partner or observer status in European security committees. Ukraine (as an EU candidate country and front-line state) could already contribute to European capability development²⁴² CSDP mission planning. For example, Ukraine could co-chair a sub-group of the EU Military Staff or CSDP committees focused on eastern defense.

Include Ukraine in defense industrial strategy. Treat Ukraine's armed forces and industry as co-investors in European security. For example, the EU's white papers and capability roadmaps should explicitly note Ukraine's contributions and roles. As one expert succinctly put it, Europe has "become the most generous" backer of Ukraine's armed forces and must acknowledge that fact by integrating Ukraine's defense industry into planning.²⁴³ Structurally, this means allowing Ukrainian firms full participation in EU R&D funds (EDF, EDIP) and in procurement consortia, as if they were associated EU members.

Integrate Ukrainian field experience into training and doctrine. Include Ukrainian tactics and warfighting innovations (e.g. decentralized command, all-domain coordination, hybrid resilience) in EU and NATO curricula. For example, exercises and wargames simulating the sort of mobile defense and counter-battery warfare Ukraine fights today could have embedded Ukrainian liaison officers and instructors providing mutual benefit where EU forces supply support and gain real-world wartime insights in return.

2. Advancing Joint Defense Production

Include Ukraine in PESCO and Joint Projects. Allow Ukrainian armed forces and defense industries to join selected Permanent Structured Cooperation projects and European Defence Fund calls. This could mean admitting Ukraine as an "associate partner" in relevant PESCO projects so that its innovations and requirements directly inform capability development. European-Ukrainian military industry forums should formalize pathways for joint procurement and co-development (for instance, co-financed EU contracts that include Ukrainian companies).

Encourage joint procurement and co-production. Structure reimbursements and funding as co-investment. For instance, European Council decisions already direct

²⁴² For instance, through the EU's Capability Development Plan (CDP); see "Priority setting," European Defence Agency

²⁴³ See "Europe's trillion dollar opportunity to save Ukraine—and the free world," CSIS

EPF and Ukrainian Assistance Fund (UAF) money to purchases from Ukraine's industry. The EU should formalize this: Member States could use EPF funds to pre-buy Ukrainian ammunition or drones produced in Ukraine (with production by at least one EU country, as proposed in EU guidance), or to co-finance new production lines in Ukrainian factories. Such arrangements treat EU support as shared procurement: Europe pays now for capability it will use later, benefiting both Ukraine and European supply security. Ultimately, European partners should work with Ukraine to identify its future role in the production and supply chains of weapons needed for European defense, and assist in the development of an exports strategy that takes advantage of Ukraine's unique expertise and capacities.

Leverage frozen Russian assets. Commit the proceeds of immobilized Russian central bank assets to EU-Ukraine defense cooperation. The EU rule of allocating 95% of these extra revenues through a Ukraine loan mechanism could be extended (or a parallel facility created) to finance joint EU-Ukraine armament projects.²⁴⁴ For example, interest from these funds could co-finance Ukrainian ammunition production for EU purchase, or capital injections into Ukrainian defense firms working with EU partners.

3. Boosting Capacities and Innovation

Expand the role of the European Defence Agency (EDA). Deepen EDA-Ukraine cooperation by upgrading their Administrative Arrangement,²⁴⁵ which formalized their relationship in 2015. The EU should work with Ukraine on joint capability development, shared threat assessments, and R&D projects with other partners. Institutionalizing the partnership—e.g., with a 'Ukraine desk' to help align equipment standards, coordinate co-production, and channel Ukrainian requirements into EU defense planning—is crucial for long-term integration.

Cultivate joint innovation ecosystems. Support the kinds of agile R&D hubs that Ukraine has pioneered (for example, BRAVE₁ defense tech cluster). European defense agencies should send liaisons to Ukraine's frontlines (and vice versa) to accelerate field testing. At the same time, the EU could adapt bureaucratic processes (fast-track testing, relaxed certification rules) so front-line units can immediately prototype and iterate new devices—the same short-term and timely procedures that Ukraine has developed to respond rapidly on the battlefield. Cross-border pilot projects would help diffuse Ukraine's innovations throughout the continent.

Leverage civilian tech and agile R&D. Host EU-Ukraine defense innovation forums to exchange open-source battlefield data and tech experiments. Ukraine has repeatedly turned civilian hardware and software into weapons (commercial drones repurposed as kamikaze munitions, volunteers building Starlink networks, etc.). Ukraine's European partners should encourage similar civilian-military synergies—for instance, jointly funding adaptation of industrial drones or automotive components for defense.

4. Securing Knowledge and Best Practices Sharing

Establish a permanent EU-Ukraine lessons-learned mechanism. Create a joint EU-Ukraine analysis cell (under the EDA or EU Military Staff) to collect front-line reports, conduct after-action reviews and distill tactical and doctrinal lessons. This could expand on Ukraine's existing EDA administrative arrangement and mirror models like the EUMAM training command that "continuously improve and adapt the training based on observations of the war in Ukraine."²⁴⁶ Lessons should be documented and fed into European military education and exercises.

Share cross-society and civil-military practices. Ukraine has mobilized civilian volunteers, reservists and local defense networks to bolster its military effort. European

²⁴⁴ See "EU military support for Ukraine," Council of the EU

²⁴⁵ See "Administrative arrangement between the European Defence Agency and the Ministry of Defence of Ukraine," [European Defence Agency](#)

²⁴⁶ See "Fast and flexible: EUMAM UA special training command," [EEAS](#)

countries should study these models (e.g., territorial defense, volunteer logistics) and incorporate compatible practices into national defense concepts (e.g., frameworks for civilian resistance, public-private support cells). The EDA can play a coordinating role. Regular EDA-hosted seminars or workshops could disseminate front-line innovations (e.g., counter-drone tactics, battlefield sustainment under fire) across EU armies.

Facilitate transfer of field-proven technologies. Create EU procurement and certification fast-tracks for Ukrainian innovations. Ukraine's forces have ramped up domestic production of low-cost attack drones, loitering munitions, electronic warfare kits, and battlefield robots. European militaries should test and adopt these systems (e.g., by purchasing Ukrainian designs under joint contracts). Partnerships like the German-Ukrainian Frontline and Quantum-Systems drone initiative, as an example, integrate Ukrainian innovations into the European defense system.²⁴⁷ European countries could even explore possibilities to co-produce Ukrainian drones, anti-drone systems or decoys, building their own industrial capacity while supporting Ukraine and replenishing their own stockpiles.

Broaden the training and command exchange. Ukraine's senior officers should have formal roles in European missions and exercises, and vice versa. For instance, Ukrainian brigade commanders could serve as observers in EU training exercises (NATO already does this), and, in return, EU staff officers could be embedded with Ukrainian units in staff planning. Such exchanges would send a clear signal that Ukraine's battlefield experience is a resource for all.

²⁴⁷ See "Battle-tested Ukrainian tech to enter European defense system through German partnership," [Euromaidan Press](#); "Quantum Systems partners with Frontline to integrate cutting-edge C-UAS capabilities," [Quantum-Systems](#)

LIST OF ABBREVIATIONS

- ASAP** – Act in Support of Ammunition Production
- ATACMS** – Army Tactical Missile Systems
- C2** – Command and Control
- CAP** – Comprehensive Assistance Package (NATO)
- CARD** – Coordinated Annual Review on Defence
- CJADC2** – Combined Joint All-Domain Command and Control
- CSDP** – Common Security and Defence Policy
- C-UAS** – Counter-Unmanned Aerial Systems
- EDA** – European Defence Agency
- EDIP** – European Defence Industry Programme
- EDIRPA** – European Defence Industry Reinforcement through Common Procurement Act
- EDM** – European Defence Mechanism
- EEA-EFTA** – European Economic Area-European Free Trade Association
- EIB** – European Investment Bank
- EFF** – Extended Fund Facility (IMF)
- ELINT** – Electronic Intelligence
- EO** – Electro-Optical (e.g., EO-guided munitions)
- EPF** – European Peace Facility
- EW** – Electronic Warfare
- FPV** – First-Person View (drones)
- GRU** – Main Intelligence Directorate of the Russian Armed Forces
- IMF** – International Monetary Fund
- IRIS²** – Infrastructure for Resilience, Interconnectivity and Security by Satellite (EU satellite initiative)
- ISR** – Intelligence, Surveillance, and Reconnaissance
- JATEC** - Joint Analysis Training and Education Centre (NATO)
- MFA** – Macro-Financial Assistance (EU)
- NBU** – National Bank of Ukraine
- PESCO** – Permanent Structured Cooperation
- SAFE** – Security Action for Europe (EU defense loan instrument)
- SME** – Small and Medium-Sized Enterprise
- ToF** – Time-of-Flight (navigation system)
- UAV** – Unmanned Aerial Vehicle (alternatively, Uncrewed Aerial Vehicle)
- UDCG** – Ukraine Defence Contact Group
- UMPK** (from ru) – Unified gliding and correction module (bomb kit)