EUROPEAN DEFENCE AGENCY

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EDM

EUROPEAN DEFENCE MATTERS

Shelter from the swarm

How we are adapting to the drone age

› MINISTER OF DEFENCE, CYPRUS

Why Ukraine matters for the Eastern Mediterranean

› DRONES AFTER MIDNIGHT

Testing defence robotics from Estonia to Italy via Portugal

› MILITARY AWAKENING

The EU's Military Staff, 25 years after the first bugle call

CONTENTS

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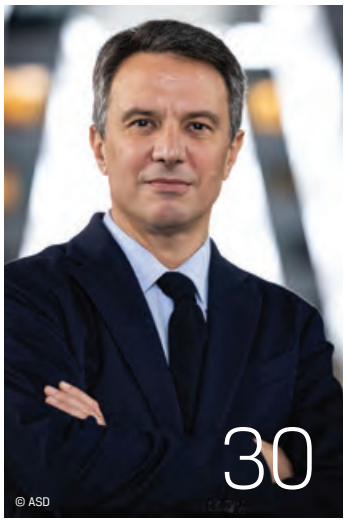

East of Eden

As Ukraine's war enters its fifth year, Europe faces another reckoning. Russia is exploiting its immense industrial base and population to exhaust its neighbour, while Ukraine depends on Western resolve to keep its army supplied and its citizens protected. The EU will loan €90 billion to Ukraine to keep it afloat financially over the next two years. Between 2026 and 2029, Kyiv will require more financial and military support. That will test the EU's staying power as never before.

Complicating matters, the Trump administration's new National Security Strategy brands Europe as weak, questions the foundations of the transatlantic alliance and echoes Russian narratives, signalling that Europe may increasingly need to rely on its own capabilities.

Recent incursions by Russian drones into EU and NATO airspace, including over Poland, Germany and Denmark, have dispelled any illusion that the threat is distant. Cheap, mass-produced drones are probing vulnerabilities in Europe's air defences, forcing a shift towards faster, smarter and more economical countermeasures.

Even so, Europe is not standing still. In this edition of *European Defence Matters*, we show how the European Defence Agency (EDA) is supporting Member States to adapt to the age of autonomous systems, moving more quickly from experimentation to field testing.

Joint procurement efforts for loitering munitions, backed by the first comprehensive business case for collaborative acquisition, are strengthening Europe's ability to equip its armed forces with speed and purpose. And across the domains, preparations for the next era of warfare are well under way.

From Tallinn, we explore how the EDA Action Plan on Autonomous Systems – and its wider Community of Interest – provides a framework to accelerate capability development while upholding reliability, efficiency and ethical standards.

Meanwhile, innovation is reshaping the defence landscape across Europe.

In these pages, Frankenburg Technologies details how affordable missile systems can counter drone attacks. Separately, trials in Portugal with unmanned maritime platforms show a new generation of naval concepts. As with automated air-to-air refuelling, Europe's armed forces are learning to match resilience with ingenuity.

With the focus rightly on Ukraine, Cyprus' Minister of Defence Vasilis Palmas reminds us that Europe must also keep a vigilant eye on the Eastern Mediterranean.

We mark 25 years of the EU Military Staff, reaching its milestone in 2026, and we hear from ASD's new Secretary General, Camille Grand, who calls for a four-pillared agenda: support to Ukraine, readiness, strategic enablers, and innovation – priorities woven throughout this magazine.

The road ahead remains demanding, and Russia's so-called peace proposals still hinge on territorial concessions that are difficult for Ukraine to accept. Negotiations appear to be going in circles. The lesson for Europe is stark: only unity, strategic foresight and an uncompromising defence posture will secure our continent, and citizens' safety.

Robin Emmott
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Kaja Kallas, the EU's High Representative for Foreign Affairs and Security Policy, Vice-President of the European Commission, is also Head of the European Defence Agency (EDA). She sets out her thinking for *European Defence Matters*.

Complementing NATO: Why the EU needs **credible forces** at the ready

The opening of the *White Paper for European Defence – Readiness 2030* published in 2025 comes with the stark warning: "Europe faces an acute and growing threat". Russia's unjustified war of aggression against Ukraine has shattered our continent's security and challenges the foundations of the international rules-based order.

Other powers are now pulling their own levers, disregarding internationally agreed norms while conflict increases across the globe.

Had Europe delivered support for Ukraine in the months before full-scale Russian invasion began, Russia may not have advanced so far. The lesson is clear: delayed deterrence means weaker deterrence. We cannot afford to make that mistake again.

In the next five years, the European Union must develop the strength to deter real aggression collectively, including from a battle-hardened Russian military. Hybrid attacks have already increased significantly since 2022. If the last two

years were defined by damage to undersea infrastructure, 2025 was the year of airspace violations: balloons, drones and in some cases, fighter jets. Maritime security and work on drone defence have understandably become priority areas for our collective work.

Member States will spend close to €7 trillion on defence over the next decade – the most since the beginning of the Cold War. The European Union's *White Paper for European Defence - Readiness 2030* and recent work on military mobility are the blueprints to transform this funding into the capabilities we need, including to tackle hybrid threats. National governments will always be in the driving seat for defence but EDA can help them steer and do so in convoy, from aggregating demand to connecting governments with industry and identifying areas for collective research and investment.

We are always stronger when we work together and this also makes us a more complementary partner for NATO. The now-over-subscribed Security Action for Europe (SAFE) instrument also encourages European thinking by providing loans to Member States for the development of European defence projects.

As collective work begins across the nine key capability areas identified in the Defence Readiness Roadmap, there are still many hurdles to doing this as fast as required: from mitigating a fragmented European defence industry, to swiftly integrating Ukraine's fresh experience and capabilities with our own. But perhaps the hardest challenge we face is to lessen Europe's dependencies. This applies primarily to China for their supply of raw materials that we need to produce defence equipment.

Only a few months ago, Beijing imposed a temporary export ban on the vital drone components for Ukraine's war effort. Leaving ourselves vulnerable to the possibility of countries turning off the taps is not a sustainable or sensible defence strategy. And it also applies to the United States. For too long we have been too dependent on the U.S. providing us with security.

Work has now begun in earnest to diversify Europe's international partnerships. The positive news is that there are many countries across the world waiting to work with us.

> **"Member States will spend close to €7 trillion on defence over the next decade – the most since the beginning of the Cold War"**

On top of the Security and Defence Partnerships with the United Kingdom and Canada that the EU agreed this year, we are also negotiating more partnerships with like-minded countries across the Indo-Pacific, Africa and Latin America.

In parallel, we are working to strengthen our trade relations and investment across the world to shore up supplies of critical raw materials, including through Global Gateway projects.

European strength and unity are the most important deterrent we can invest in today. But Europe's capacity to convene, negotiate agreements and de-escalate is as important for our ultimate goal: a just and lasting peace in the world.

2026 might be the most dangerous year in decades but this is also why investment in pre-conflict warning and mediation across the globe is also important. To quote Albert Einstein, whose work provided the foundation for nuclear power, "peace cannot be kept by force; it can only be achieved by understanding". To prevent war, we must prepare for war. But peace needs preparation too.

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EU defence readiness: why EDA is **at the forefront**

André Denk is the Chief Executive of the European Defence Agency (EDA). Lieutenant General Denk brings extensive operational and leadership experience, and previously served as EDA's deputy chief. His previous roles include Director of Logistics at the European Union Military Staff and command positions within the German Armed Forces, with deployments under EU, United Nations and NATO missions. He sets out why now is the time to strengthen EDA in a more hostile world.

If there's one acronym that deserves more attention in European Union defence forums, it's EDA – the European Defence Agency. For more than two decades, it's quietly been EU defence's project manager: organising joint training, aligning capability plans, smoothing procurement paths and nudging Member States towards more interoperable defence equipment.

Founded 21 years ago, the Agency was given its mandate in the Treaty on European Union of 2003. That mandate remains our compass today: to support Europe's 27 defence ministries through an intergovernmental structure that is both practical and purposeful.

Our Member States own the Agency, fund its work and meet twice a year at ministerial level to provide strategic direction through the Steering Board. Alongside these meetings, national directors responsible for armaments, capability development, and research and innovation also gather under the Agency's roof. Together, they chart the course for what remains a truly member-driven organisation.

At its heart, the Agency exists to offer a trusted platform for cooperation. We help EU Member States, many of whom are also NATO allies, achieve their shared capability goals while meeting their own national objectives. Our closest partners, including Norway, Switzerland and Ukraine, work with us through special Administrative Arrangements that broaden Europe's defence community.

Fire core tasks, five new areas

Only last year, our Member States agreed a clear set of five core tasks that define our work. First, we help set priorities: identifying what capabilities Europe needs and where effort should be focused. Second, we bring nations together to cooperate on research, technology and

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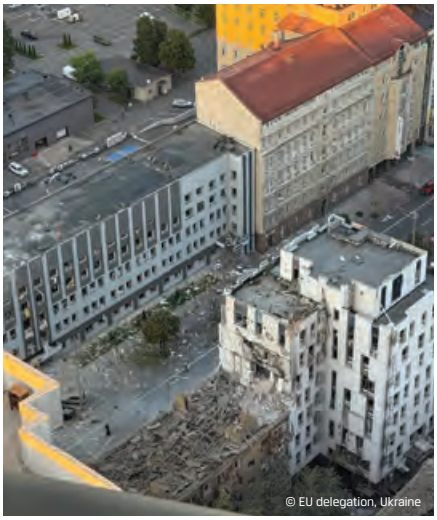
"Cooperation is not a slogan for us; it is practical, hands-on work"


Chief Executive Denk inspects a Russian Geran 2 drone during a visit to Kyiv in July 2025.

innovation – an area that is moving faster than ever. Third, we support capability development, ensuring that concepts turn into real military assets. Fourth, we aggregate national demands to pave the way for joint procurement. And finally, we advocate for Ministries of Defence within wider EU policymaking, ensuring military needs are fully understood – whether in the digital transformation of European airspace or in civilian-driven areas with vital defence implications.

Cooperation is not a slogan for us; it is practical, hands-on work. Take the nine priority capability areas derived from the White Paper on European Defence, Readiness 2030. From integrated air and missile defence to artillery systems, these areas each have dedicated lead nations. Our role is to support them with organisation, expert content and links to our broader programmes.

Another example is our Government-to-Government platform, launched this June. It offers all member states a transparent view of more than 400 existing defence contracts that others have negotiated. It's a number that grows weekly. It has already become an essential tool for identifying opportunities for joint procurement, and it will soon expand to include projects in development and innovation.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Russian missile strikes targeted the EU Mission to Ukraine on 28 August 2025.

Innovation is equally central to our mission. The Hub for European Defence Innovation (HEDI) has become a lively home for ideas, from prizes and hackathons to large-scale gatherings such as this year's Defence Innovation Days in Krakow, which drew 1,000 participants.

Through experimentation campaigns, such as the one held near Rome on drones for logistics and reconnaissance, we help turn promising concepts into deployable capabilities. Our work with the Brave Tech EU initiative is another illustration: a €100 million programme designed to match Ukrainian operational needs with European ingenuity, accelerating solutions from concept to testing and beyond.

Capability development also benefits from deep cooperation. A recent example is the joint effort on loitering munitions, where 18 ministers signed a letter of intent to work together. Since then, we have helped define the capability, gather national requirements, survey European industry and prepare a solid business case for joint procurement – proof, once again, of what can be achieved when nations align their efforts.

Looking ahead, EU's leaders have called for a stronger Agency. In response, we have put forward proposals focused on five areas: **bolstering our role in research and innovation; expanding our support to capability development; enhancing joint procurement; reviewing our internal structures and resources; and deepening cooperation with partners**, including possible new ones such as Canada.

As we take these next steps, our purpose remains straightforward: to help our Member States work together more effectively and to strengthen the EU's collective security. After 21 years, the spirit that founded the Agency is very much alive, and more important than ever.

Building bridges at the crossroads of three continents

Vasilis Palmas has been serving as Minister of Defence since 2024. He brings experience to the role, notably as Deputy Minister to the President of the Republic of Cyprus from 2017 to 2022. With a background in political science and public administration, as well as in the private sector, he speaks to *European Defence Matters* about Cyprus' EU presidency priorities, the island's security challenges, and the pursuit of stability in the Eastern Mediterranean.

With Syria in transition after years of conflict, Libya divided, instability in Lebanon and pressure on democracy in Turkey, as well as the conflict in Gaza, the Eastern Mediterranean faces significant geopolitical challenges. At home, Cyprus' capital, Nicosia, is the last divided city in Europe.

Situated at the crossroads of Europe and the Middle East, Cyprus confronts security issues that reflect the wider ones facing the European Union. As the country takes over the presidency of the Council of the EU for the second time (the first was in 2012) Minister of Defence Vasilis Palmas intends that Cyprus uphold unity, develop readiness and make practical progress across Europe's defence agenda. Cyprus is also contributing to the EU's continued efforts to support Ukraine.

"As the only EU Member State with part of its territory under illegal occupation, Cyprus deeply identifies with the plight of Ukraine and stands in full solidarity with its people," says Palmas. "Ukraine has shown that it is possible to resist aggression even when the odds are unfavourable," he says.

Hope for reunification

The occupation of part of the territory of the Republic of Cyprus stretches back more than 50 years to July 1974, when Turkey invaded the island in violation of international law. Since then, the United Nations Peacekeeping Force in Cyprus (UNFICYP) has monitored the ceasefire between the Turkish forces and the Cyprus National Guard.

> **"Ukraine has shown that it is possible to resist aggression even when the odds are unfavourable"**

Despite the intransigent and unconstructive attitude of Turkey, the Republic of Cyprus remains committed to the reaffirmed position to reach a comprehensive and viable solution based on a bizonal and bicommunal federation with political equality as prescribed by UN Security Council resolutions. So hope for a settlement endures.

Towards this objective, President Nicos Christodoulides has prioritised the resumption of an effective negotiation process under UN auspices with the support

of the European Union for the reunification of Cyprus.

The Mediterranean crossroads

For Palmas, the island's political and security challenges are inseparable from the wider world.

"Europe's security landscape is changing faster than at any other point in recent history," he says. "The war in Ukraine, the rise of hybrid and cyber threats, instability in our wider neighbourhood and the expansion of conflict into new domains ranging from space to information are redefining how we think about security and defence." These are not distant challenges, the minister stresses. "They affect every European citizen."

Palmas emphasises the need to move from planning to action. "Our goal is clear: to turn Europe's strategies into capabilities, to move from fragmentation to resilience. We want a Europe that can deliver, deter, and defend."

He frames the upcoming presidency around three core priorities *(Also see box overleaf)*.

- **First,** advancing the implementation of the EU Defence Industry Strategy (EDIS) and the Security Action for Europe (SAFE) initiative. These aim to scale the European industrial base, reduce dependencies and deliver capabilities to armed forces faster. Cyprus plans to host high-level conferences and support efforts to deepen cooperation among Member States, EU institutions and like-minded strategic partners.
- **Second,** Cyprus is shining a spotlight on the Eastern Mediterranean for European and transatlantic stability. Palmas underlines that safeguarding maritime routes, undersea cables and critical infrastructure is vital not just for Cyprus but for the EU as a whole.
- **Third,** support for Ukraine will remain central. Cyprus aims to advance European efforts to uphold Ukraine's independence and resilience, contributing to joint European action in security, stability and reconstruction. →

Greek, Cypriot and U.S. Naval Special Operations Forces (SOF) carry out a joint maritime exercise in the Mediterranean.

Personnel of the 6th Motorised Infantry Brigade take part in 'Silver Falcon 2025' at the Kalo Chorio Firing Range in Cyprus, November 2025.

This dual focus on European cooperation and regional security is rooted in experience. As Palmas puts it: "From Cyprus' perspective, the balance between national responsibility and European coordination is not theoretical; it is lived experience".

Stronger together

As a Member State facing occupation and complex threats, solidarity is the cornerstone of security. Modern challenges, from cyber-attacks to climate-induced migration pressures, cannot be managed by countries acting alone.

Although not a member of NATO, the Republic of Cyprus has supported enhanced EU–NATO cooperation based on openness, transparency, inclusiveness, and full respect for the decision-making autonomy of both organisations. At the same time, Cyprus has strengthened its strategic partnership with the United States, notably through the 2024–2029 Defence Cooperation Roadmap, which focuses on crisis management, maritime security and innovation.

For Palmas, strategic autonomy is about resilience. "This means securing supply chains, advancing technological capacity, and strengthening our industrial base so Europe can maintain peace and prosperity alongside its like-minded partners," he says. But defence cooperation cannot be pursued with third countries whose actions contradict the security and defence interests of the Union and its Member States, he adds. That reflects the presence of Turkish occupation troops on EU territory.

Cyprus' participation in EU defence is not only political but also operational. As an EU Member State since 2004, it engages fully with the Common Security and Defence Policy (CSDP) and instruments such as the European Defence Fund (EDF), which promotes joint research, industrial cooperation and capability development. Under the SAFE Regulation, Cyprus can access €1.18 billion in low-interest loans to enhance defence production capacity and support national modernisation efforts.

Meanwhile, strategic modernisation is visible on the ground. Military infrastructure upgrades, including the Andreas

Cyprus' EU presidency priorities at a glance

› Strengthen European defence industry

Implement EDIS and the SAFE initiative.
Scale Europe's industrial base and deliver capabilities faster.

› Secure the Eastern Mediterranean

Protect maritime routes, undersea cables and critical infrastructure.
Boost crisis response, humanitarian operations and non-combatant evacuations.
Promote regional stability and EU readiness.

› Support Ukraine

Uphold Ukraine's independence and resilience.
Contribute to joint European actions on security, stability and reconstruction.
Maintain support for Ukraine as a central EU priority.

> **"Europe's security landscape is changing faster than at any point in recent history"**

Papandreou Air Base in Paphos and the Evangelos Florakis Naval Base in Mari, are central to Cyprus' planning. Cyprus, at the crossroads of three continents, is positioning itself as a bridge between Europe and the Middle East.

EDA, EDF, ECV, EW: a hearty alphabet soup

Cyprus is active in the collaborative, the European Defence Agency (EDA)-led process of developing land, maritime, cyber and air capabilities. Cyprus helped revitalise the MARSUR community – MARSUR being a maritime surveillance information-exchange system launched by EDA with participating Member States – and is helping to prepare its next-generation systems.

Nicosia has signed letters of intent to jointly procure loitering munitions, develop integrated air missile defence, a future European Combat Vessel (ECV) and electronic warfare (EW). Cyprus uses the EDA's satellite communication services.

President Christodoulides has underlined that Cyprus has a promising domestic defence industry, which the government is committed to further strengthening. At the DEFEA 2025 exhibition in Athens, the Cypriot pavilion highlighted companies already exporting to other EU Member States.

On 26–27 February 2026, Cyprus will also host under its EU presidency: 'BATTLEFIELD ReDEFiNED 2026 – Modern Technologies with Dual-Use Potential for Enhancing Security, Defence and Space Resilience'. The event, with the support of the European Commission, provides a platform for engagement between the Cypriot defence industry and international partners.

Meanwhile, a Cyprus Defence Industry Council has recently been established, acting in an advisory role, with a primary mission to provide recommendations to the government regarding its policy planning in the field of defence industry development. "Our expanding network of over 30 domestic companies, ranked seventh in the EU for participation in EDF projects, shows that Cyprus is ready to deliver," Palmas says.


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Cyprus is championing industrial integration, a competitive EU Single Market for defence, and technological sovereignty, while maintaining openness to partnerships with like-minded countries that share the Union's values. "Reducing dependencies does not mean closing ourselves off; it means strengthening Europe's ability to act collectively and effectively," he says.

So Cyprus' EU presidency is more than a political milestone. It shows how a small EU Member State in times of geopolitical complexity can lead on resilience, defence, and cooperation. "Ukraine reminds us that Europe's security depends on collective readiness, trust and solidarity," he adds.

For Cyprus, these principles guide a Member State that, though shaped by division, is determined to play an active role in promoting stability across the region and Europe.

How Cyprus works with EDA

Capability development & participation:

- Active in land domain, cybersecurity and air transport within the Capability and Technology Groups, and projects related to loitering munitions.
- Signed four letters of intent for: loitering munitions, the European Combat Vessel, integrated air and missile defence, and electronic warfare.
- Engaged in testing and evaluating advanced drones and loitering munitions.
- Contributed to integrated air and missile defence efforts, including short-term needs such as ground-based air defence and counter-unmanned aircraft systems, and radar systems.
- Active in defence energy and sustainability initiatives, including work on energy resilience, energy efficiency and circular-economy approaches in the defence sector.
- Participating in Military Airworthiness Forum and activities.
- Active in Military Mobility and related initiatives such as the Cross Border Movement Permission.

Joint procurement:

- EU Satellite Communications Market: participating since April 2015.
- Joint procurement of flight suits: project started following a letter from the Cyprus Ministry of Defence to EDA in August 2019; first delivery ceremony took place in Cyprus in June 2025.
- Maritime Surveillance: One of the longest-running projects undertaken by EDA with the participation of Cyprus.

Europe enters the **Drone Age**

Unmanned systems are **redefining** warfare

There are times when today's battlefield no longer erupts with the roar of aircraft, engines and artillery, but with the low hum of machines. In Ukraine's brave fight against Russia, an assault can begin not just with soldiers advancing, but with a swarm of drones sweeping silently over the frontlines.

While core Western equipment and doctrine is still vital, unmanned systems are now being developed across all branches of the military.

They give troops real-time awareness and precision targeting, in the air, on land and also underwater. Even some logistics have gone robotic, with rugged machines hauling ammunition.

***European Defence Matters* has been following how European firms and militaries are fast-tracking new technologies from concept to battlefield, from Tallinn to Troia via Montelibretti, near Rome.**

But this technological ballet hangs on a fragile thread: the invisible war in the electromagnetic spectrum. Every command link and video feed is a vulnerability. Enemy electronic warfare can jam, intercept and trace signals, turning advanced systems into wreckage.

So drones should not replace conventional NATO firepower, but should be optimised to support and enable Europe's armed forces.

From testing to field use: How the European Defence Agency (EDA) is helping the EU **move faster**

ITALY Unmanned ground and aerial systems in live trials across all domains

EDA launched its first Operational Experimentation (OPEX) campaign in July 2025. Held near Rome at the Italian Army's Multifunctional Experimentation Centre in Montelibretti, the live trials were coordinated by EDA's Hub for EU Defence Innovation (HEDI).

Companies including Beyond Vision from Portugal, Altus LSA from Greece, Schiebel from Austria, Alysis from Spain, Piap from Poland and Germany's ARX Robotics (Germany) carried out simulations focused on autonomous logistics and last-mile delivery in lifelike scenarios.

PORTUGAL The world's largest exercise for unmanned maritime systems

EDA, NATO and the Portuguese Navy co-hosted the 15th Robotic Experimentation and Prototyping using Maritime Unmanned Systems (REPMUS), off the coast of Portugal in September 2025. The Portuguese-led event brought together 24 nations to test around 300 unmanned systems across sea, air and land. It linked directly with NATO's Dynamic Messenger exercise for the first time to combine experimental testing with operational training.

Participants trialled robotics and AI in real-world conditions, including electronic warfare, GPS-denied operations, amphibious landings, dummy mines and coordinated swarm missions with multiple drones. The exercise also highlighted interoperability challenges, prompting EDA-led seminars on standards and best practices, as well as the SARUMS safety and regulatory framework for unmanned maritime systems.

ESTONIA A European community of people creating and using defence robotics

EDA brought together the Autonomous Systems Community of Interest (ASCI) in November 2025 for the second year running. This time in Tallinn, the forum gathered Member States, NATO, Ukraine and industry to discuss ways to move faster from research to deployment.

Discussions focused on how shared experimentation and joint testing can help Member States and companies validate emerging concepts and integrate them into military structures. An emphasis was placed on the role of trustworthy AI, including the need for secure, high-quality datasets, standardised training methods and robust testing frameworks.

Europe's defence robotics: **breaking out** of the silos

As more European tech firms make the leap into defence, EDA believes that advances in autonomous systems, artificial intelligence, advanced computing and microelectronics demand a coherent, coordinated approach.

On a rainy evening in Tallinn, bright lights shine inside a small factory as two men with tools adjust the caterpillar treads of a half-built robot. Assembled by hand, the unmanned ground vehicle is surprising in its simplicity. Between the robot's two wide, green rubber tracks, there is nothing in the middle but a metal shelf – and that is exactly the point.

Designed by Estonia's Milrem Robotics to be 'modular', the remotely-controlled, diesel/electric 'Themis' can be outfitted with a small canon or carry drones and equipment, or even evacuate wounded soldiers. When necessary, it can be autonomous, following a series of way points or simply come back to base.

Themis has been sold to 19 militaries, including eight NATO allies such as France and Germany and is being used in Ukraine and other countries. It has sometimes been a vertiginous trajectory since being established in 2013. "Milrem started with two engineers, and one day they came to me and said, we need a third engineer. And I asked: what would he do?," jokes Milrem's CEO Kuldar Vaarsi.

Making a Skype call

As part of the shift in warfare to take humans out of the battlefield when possible, tech-savvy Estonia – a former Soviet state that borders Russia – has been leading the way. With a digitally literate workforce and a tech start-up culture, Estonia is moving into defence systems reliant on robotics, AI and cyber.

From tethered drones to long-distance, remote-control cars, Estonian engineers have created a range of potential suppliers to EU armed forces, despite a lack of access to financing and what many see as overregulation in a sector traditionally beset by moral objections.

Jaan Viru, an Estonian engineer and founder of Crystal Space, which makes camera systems for loitering munitions, says Skype – sold to Microsoft in 2011 – left a strong legacy in Estonia. "But it is still hard to compete with the United States due to a lack of venture capital," Viru says.

Start-ups across Europe face bureaucratic hurdles and slow funding. Matthias Luha of KrattWorks notes that it took two years to secure an EU grant, while Dario Pedro of Beyond Vision says excessive regulation slowed testing in Portugal.

Even in Germany, frequency allocation permits can take six months, and importing drones between EU countries is slow, according to Marco Lotz of Quantum Systems. Luha adds: "U.S. start-ups can raise five million dollars. In Europe, we sometimes must make do with fifty thousand," though he notes financing is becoming easier to obtain.

The THEMIS (Tracked Hybrid Modular Infantry System) at Milrem Robotics. It is the company's flagship multi-mission Unmanned Ground Vehicle (UGV).

"Autonomous and unmanned systems are now critical to protecting Europe"

Do you know your APAS from your ASCI?

So the EU faces a quandary. "Autonomous and unmanned systems are now critical to protecting Europe, but development remains costly, slow and not at the scale that the EU needs," says Nathalie Guichard, EDA's Director of Research, Technology and Innovation.

There is progress, however. "From the technology perspective, EU industry is improving. It is growing rapidly, and some companies are a reference point worldwide. Just look at Milrem," says Mario Martinho, EDA's Project Officer for Land Systems Technologies. Before EDA started collaborative projects on unmanned ground systems with EU funding, the industry worked mainly in silos. "Now the landscape has changed completely," Martinho adds.

The EDA Action Plan on Autonomous Systems (APAS) is an important tool. Though legally non-binding, it covers land, air and maritime domains – and their intersections. APAS guides Member States with three main goals *(see below)*.

Not to be confused with the many other acronyms of EU defence, the Autonomous Systems Community of Interest (ASCI) is part of that approach, linking civilian and military efforts and fostering essential partnerships. Several EU projects illustrate this shift, with multiple developers pooling expertise rather than working in isolation.

EDA's Guichard highlights the importance of strong networks between Member States and industry. HEDI encourages knowledge sharing and fosters ecosystems where innovation can thrive. Dual-use technologies are a particular focus: civilian tools for agriculture or logistics can be adapted for defence, letting the EU leverage broader innovation.

Open architecture and modularity are equally crucial. Standardised components allow multiple suppliers to integrate into the same system, reducing fragmentation and accelerating development. An autonomous vehicle from one country can work seamlessly with platforms from another or be upgraded more easily as technology evolves.

Martinho and Guichard agree: autonomous systems are here to stay, and the EU must innovate, stay agile and act collectively. The next decade will test its ability to balance ambition with responsibility. Guichard warns: "We cannot afford to let bureaucracy slow innovation."

The European Union aims to enhance its defence readiness by 2030, focusing on closing capability gaps and supporting Member States in high-intensity warfare. Areas include autonomous solutions and AI, cyber and electronic warfare, drones, ground combat and maritime operations.

APAS has three main goals:

- Improving individual unmanned systems;
- Enabling cooperation between autonomous platforms;
- Fostering manned–unmanned teaming, where humans and robots work in concert.

The plan includes 94 action lines spanning technology development, testing, verification, certification, regulation, standardisation and taxonomy. Rigorous experimentation ensures prototypes quickly evolve into operational capability.

"I don't see unmanned maritime systems replacing submarines in the short run"

NATO and EDA meet in Europe's unmanned maritime systems laboratory

Robotic Experimentation and Prototyping using Maritime Unmanned Systems (REPMUS) is the world's largest exercise for unmanned maritime systems. It demonstrates how NATO allies and EU Member States are helping shape the future of unmanned maritime warfare, providing a platform for innovation, collaboration, and interoperability.

From the deck of the Portuguese patrol vessel Figueira da Foz, a cluster of reporters watch as a small, dark object glides across the water's surface. Moments later, the shape emerges: an autonomous underwater vehicle, the Greyshark, capable of seabed mapping, mine detection with AI, and patrolling critical infrastructure.

Welcome to REPMUS 2025, the 15th edition. A Portuguese Navy-led exercise, it is co-organised by Oporto University (FEUP), NATO Centre for Maritime Research and Experimentation (CMRE) and NATO Joint Capability Group Maritime Unmanned Systems (JCGMUS) and EDA. It takes place in the waters south of Lisbon every September, gaining in size every year. In 2025, it brought together 24 nations and nearly 300 different autonomous platforms across sea, air and land.

For the first time, NATO's operational exercise Dynamic Messenger was directly linked with REPMUS, merging operational training with experimental testing. Led by NATO's Allied Command Transformation (ACT) and Allied Maritime Command (MARCOM), the exercise allowed both militaries and industry to trial robotics and artificial intelligence in real-world scenarios, including electronic jamming and dummy underwater mines. Ships from Standing NATO Maritime Group 1 (SNMG1) also joined, highlighting the alliance's focus on maritime readiness.

Captain Nuno Palmeiro Ribeiro, Director of the Portuguese Navy Operational Experimentation Centre (CEOM), explains: "This was an opportunity to experiment on unmanned vehicles across all domains and in a real environment. What's special about this zone is that we can do experimentation that is not possible elsewhere."

Swarms, rockets and hydrogen airships

At Dynamic Messenger, the red and blue teams deployed swarms of unmanned vehicles above and below the waves. Scenarios included Intelligence, Surveillance and Reconnaissance (ISR) in coastal zones, electronic warfare in GPS-denied environments, and amphibious landings supported by robotic scouts and logistics drones. One highlight saw multiple aerial drones performing coordinated swarm operations.

The Ukrainian DELTA combat management system, used to coordinate the red team, was successfully integrated with NATO's STANAG 4817 open standard, allowing over a hundred drones, submarines and aircraft to share information in real time.

Juergen Scraback, who heads maritime capability development at EDA, highlights the significance of working with so many nations from across NATO and the EU. "REPMUS allows us to link unmanned systems so that we are not working in stove pipes. Operational centres from Berlin, London, Kyiv are meanwhile exchanging data. This is really the key: this network."

To that end, EDA led the second edition of its Unmanned Surface Vessels (USV) Sense and Avoid experimentation exercise and advanced work on

Aerial and underwater drones at REPMUS off the Portuguese coast in September 2025.

the Safety and Regulations for European Unmanned Maritime Systems (SARUMS) framework, based on EDA's Best Practice Guide. They are designed to provide guidance on safety, design, operations and legal compliance.

Scraback, a German naval officer with 39 years of experience, says that developing standards will greatly improve interoperability between forces. "We would like to develop EU standards. At the moment, you cannot charge electric-powered unmanned systems universally. They all have different batteries and chargers."

He also stresses the integration of Permanent Structure Cooperation (PESCO) projects into REPMUS: "We have five underwater PESCO projects running. We want to avoid siloed development and enhance information exchange. For example, sensors developed for one project could be used for another."

Fail and improve

The measure of success at REPMUS lies in adaptation. How quickly can systems learn, adjust, and be redeployed? 'Spiral development,' as military technologists call it, is the doctrine of the day: build, test, fail, improve, repeat. Scraback highlighted the value of learning: "If you have a failure, then you have success, because you can work on your mistakes."

Several start-ups supported by NATO's Defence Innovation Accelerator for the North Atlantic (DIANA) used the event to test technologies for communications resilience, protecting undersea infrastructure and improving mine countermeasures. The Faculty of Engineering at the University of Porto and NATO's Centre for Maritime Research and Experimentation were also contributors.

Still, there are limits of autonomy in naval operations. "I personally don't see huge unmanned maritime systems replacing submarines in the near future," Scraback says. "But we are thinking about deploying unmanned systems from submarines, using them to extend range and gather sensor data."

He also emphasises the strategic and political dimension of manned systems: "Showing the flag is a political demonstration of support for an ally, for freedom of navigation. You cannot do that in the same way with unmanned systems. If a ship is attacked, that's a totally different story."

REPMUS Technology & participation snapshot

Technology on display:

- Rheinmetall Greyshark AUV: Torpedo-shaped, 6.5 metres, seabed mapping, mine detection.
- Hunter-02 Rocket (Portugal): Mach 1 test flight, refining guidance and control systems.
- Kelluu Hydrogen Airship (Finland): Twelve-metre floating drone bridging sensor networks and satellite coverage.

Unmanned platforms:

- 61 aerial drones.
- 57 unmanned surface vessels.

Operational highlights:

- NATO-EU joint exercises linking experimental robotics with operational missions.
- ISR, electronic warfare and amphibious support.
- Testing of interoperability and adherence to EDA Best Practice Guides.

Frankenburg: **Rocket science** for the drone age

Kusti Salm is the Chief Executive Officer of Estonian-based Frankenburg Technologies and a former permanent secretary of the Estonian Ministry of Defence between 2021–2024. Salm – who worked at EDA in 2009 – talks to *European Defence Matters* about creating a tool against the drones that now dominate modern conflicts, and "redefining the economics of air defence."

Since September, European Union governments have faced an unsettling new reality: small Russian drones slipping into their airspace, halting airports, and probing military installations. The 19 drones that crossed into Poland were the worst violation of NATO skies in 75 years. Suspected Russian drones have since appeared in Belgium, Denmark, Germany and Romania, although the Kremlin denies any involvement.

Many of the drones are very cheap to make. Intercepting them with missiles designed for jets or ballistic threats, which cost hundreds of thousands or even millions of euros per shot, makes little financial sense. For the EU's armed forces, cheap drones demand a new, economically viable layer of air defence.

Might a defence start-up in the Baltics offer a solution?

Frankenburg Technologies seems to have impeccable timing at the very least. Founded in early 2024 by Estonian entrepreneur Taavi Madiberk and led by former senior Estonian Ministry of Defence official Kusti Salm, the company's goal is to develop affordable, scalable missile systems capable of countering drones. That means a missile that is more than 10 times cheaper than today's.

"It's about redefining the economics of air defence ... and this is, frankly speaking, the only reason why the Russians are putting all their efforts into drone manufacturing," Salm says. Estimates suggest that Russia produced more than 6,000 'one-way attack' unmanned aerial vehicles (UAVs) in 2024, with some days in 2025 seeing between 500 and 700 deployed.

Frankenburg had only been running for half a year when Salm was approached by the founder of the company. "It was where some of my closest co-workers in Estonian defence were already working, including the former chief of defence and former deputy chief of defence," he says, adding that other employees include a former Polish defence chief and retired German Lieutenant General Juergen-Joachim von Sandrart, a former NATO commander. Frankenburg has since grown to a team of over 60 specialists across its headquarters in Estonia, Denmark, Germany, Latvia, Lithuania, Poland, plus non-EU nations Britain and Ukraine.

"We want to produce rapid, cost-effective surface-to-air missile systems for a market that has never been affordable"

Salm stresses that this depth of experience is not merely ceremonial; it informs every engineering and operational decision. The company leadership team includes Director of Engineering Andreas Bappert, who was previously the chief engineer of the Iris-T system at Diehl Defence. Juhan Tenisson, who spent more than 20 years in the automotive industry managing large-scale production and supply chains, heads production. Recently, notable engineers from MBDA from Britain joined the Estonian team.

Mark my words

Salm does not underestimate the work ahead. "Building missiles is hard. It really is rocket science," he says. "There are no universities where you can actually learn to build guided missiles. There are only a few companies where this can be done, and there are very, very few people in Europe who have done it at the system level."

Still, Frankenburg's first breakthrough, the Mark 1 missile, came remarkably swiftly. Designed within a year of the company's foundation, the Mark 1's production costs are in the low five-figure range, Salm says. It is the smallest guided missile ever built, according to the company. Its development relied heavily on rapid prototyping, using an approach more akin to consumer tech than traditional defence programmes.

Kusti Salm

Unlike conventional projects, where test launches occur a few times a year, the Frankenburg team tested missiles several times a month on two NATO-authorised ranges. This allowed speedy iteration, integrating improvements in near real time and reducing development cycles from decades to months. Salm notes that sacrifices were made deliberately: the Mark 1 is not designed to withstand Arctic or Saharan temperatures, or for long-term warehouse storage. That can add up to 30% of a traditional missile's cost, he says.

Mark 1 is not intended to challenge conventional aircraft or ballistic missiles either; it is a tool against the drones that dominate today's wars.

SHELTER FROM THE SWARM

"Mark 1 is specifically designed for the age of drones. And this is where the main benefits of the missile system come from. If we look at the competition, those short-range systems were all built against helicopters, which means that many of the technologies are already 40 to 50 years old."

Already selling to one NATO ally, Frankenburg's pitch is scalability and simplicity. Production could reach 100 units per day, with aspirations for thousands. The system can be mounted on mobile platforms or static installations to protect critical national infrastructure. To defend the more than 2,000 critical infrastructure sites along NATO's eastern flank from a single large-scale attack, roughly 550 missiles would be required per site, analysts say.

"We are mission-oriented. Mark 1 is a short-range missile-based interceptor designed specifically to counter low- and low-flying drone threats," Salm says. It uses solid rocket fuel, an AI-powered guidance system, and is many times faster than other drone-based interceptors. Designed to detonate one to two metres from the target, it operates within a two-kilometre range.

Anti-cruise, anti-ballistic, anti-aircraft

Looking ahead, Frankenburg aims to develop a new generation of European missiles that promises even faster development cycles and greater affordability. "Our main innovation is not only the missile itself, but how we build it," Salm says.

"We want to bring fast development times and rapid feature iterations of the next variants of missiles – not after every 10 years, but essentially after every 10 months," Salm says. He adds that the aim is to make missile systems cheaper – including longer-range interceptors – and to address threats such as anti-cruise, anti-ballistic, and anti-aircraft missiles. "We want to produce high-speed, cost-effective surface-to-air missile systems for a market that has never been affordable," he says.

As the age of drones continues to unfold, Frankenburg Technologies could represent a model of innovation tailored to the modern battlefield: fast, scalable, and deeply informed by operational expertise. From a small start-up to a continental force in defence technology, it aims to demonstrate, at the very least, that agility and design can help redefine Europe's military capabilities.

Frankenburg at a glance

- **CEO:** Kusti Salm (former Permanent Secretary, Estonian Ministry of Defence).
- **Specialisation:** Development of low-cost, high-volume interceptor missiles for counter-unmanned aerial systems (C-UAS).
- **Product:** Mark 1 – a solid-fuel, AI-guided missile designed to neutralise drones and loitering munitions.
- **Production:** Scale up to several hundred units per week.
- **Partnerships:** Advanced Protection Systems (APS) – collaboration on integrated C-UAS.
- **Developments:** Initiated missile production in Ukraine; will invest €50 million in Britain for research and development into low-cost rocket motors.

FOCUS: UKRAINE'S UNMANNED SYSTEMS FORCES

Army of drones: nothing without **human control**

In December 2024, Ukrainian forces reportedly made history with the world's first fully unmanned assault on Russian positions, deploying ground-based robots alongside First Person View (FPV) drones, which are essentially the infantry of drone warfare. At the heart of this innovation is Ukraine's Unmanned Systems Forces, the first military branch in the world devoted entirely to unmanned operations, integrating aerial, ground and naval drones into a single, coordinated force.

Nemesis, Flying Skull, Rarog. These are some of the regiments and brigades of the world's first military branch for unmanned and robotic systems in combat operations.

Unwilling to follow Russia's lead and sacrifice horrendous numbers of casualties on the battlefield, Ukraine has produced an adaptation straight out of science fiction.

Formally organised into a 12-unit grouping in June 2025, the Unmanned Systems Forces consolidates air, land and maritime drones into a single operational framework, turning what began as ad hoc ingenuity into an integrated instrument of statecraft and combat. The aim is to scale up as fast as possible.

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> **"Every euro spent on unmanned systems can produce more than one hundred times that in terms of enemy losses"**

Dmytro Chumak, an officer in the Unmanned Systems Forces Command, is in a daily race to be one step ahead as Russia relentlessly adapts to the latest Ukrainian battlefield technology. He has been briefing the Autonomous Systems Community of Interest (ASCI).

"Every day we are in the innovation cycle," says Chumak.

That iterative instinct of rapid prototyping, constant feedback from the front and an almost industrial tempo of learning underpins the force.

Between June and August the grouping accounted for more than 30% targets for the Armed Forces of Ukraine, a jump of roughly 15% on May. Open-source research cited by Ukrainian commanders estimate the Unmanned Systems Forces has destroyed Russian assets at a rate of about $2.5 billion a month.

As Chumak points out, the economics are stark: "Every euro spent on unmanned systems can produce more than one hundred times that in terms of enemy losses."

The Ukrainian-made Skyeton Raybird-3 reconnaissance drone in Kyiv on 25 August 2024.

"Open-source research cited by Ukrainian commanders estimate the Unmanned Systems Forces has destroyed Russian assets at a rate of about $2.5 billion a month"

Kill zone

But it is not a robot army or a gamer's dream.

Training Ukrainian pilots is at the heart of this force. Instructors move between the fighting line and the classroom, returning with fresh lessons that immediately reshape doctrine.

"The classroom is the place where a soldier's skills and mental discipline, become the fundamental condition for combat success," Chumak says. Those same operators must marry physical courage with nimble technical judgement, whether piloting FPV attack drones at night or coordinating multi-platform strikes beyond Russian lines.

For the moment, the Unmanned Systems Forces are at their best close to the frontline. Beyond 20 kilometres, engagements become sporadic. That matters because Ukraine aims to create a 15-kilometre drone-patrolled 'kill zone' – where enemy forces can be destroyed – along the front lines. That would make it highly difficult to mass troops for large-scale offensives.

Closing that gap has become the programme's strategic imperative. Extended-range strike and reconnaissance capabilities would push Ukraine's reach into the contested zones where enemy logistics and command nodes are concentrated.

Boundless ... at a cost

Autonomy, Chumak insists, is not a novelty but an operational necessity.

In practice that means building a system of sensors, high-speed data fusion and battlefield management so autonomous weapons can be reliable, rapid and responsive to changing conditions. The challenge is not merely technical; it is institutional and industrial. Interoperable standards, resilient supply chains and international partnerships will be required to scale systems beyond Ukraine's shores.

Perhaps the most consequential lesson is methodological. Ukraine's unmanned strategy is hybrid: ingenuity, training, state direction and private industry converging in an accelerated research and development loop. For the Autonomous Systems Community of Interest watching from abroad, the question is not if, but when, such a force could be part of EU arsenals.

Ukraine's Unmanned Systems Forces demonstrate how a nation under pressure can turn protection for human life and a limited manpower into an asymmetric advantage. But Kyiv and its European allies must be able to finance it. "The amount of money needed to develop this is extremely high, but the investments will deliver results immediately," Chumak says.

Estonians have posted anti-war banners outside the Russian embassy in Tallinn's historic centre.

When the most important value is **human life**

Since Russia's full-scale invasion in February 2022, the Ukrainian army has demonstrated just how decisive drones have become on the modern battlefield. The European Union and NATO have much to glean from Ukraine's experience.

Ukraine's military drone industry has transformed dramatically, evolving from a modest sector with less than seven companies producing unmanned aerial systems (UAV)s before 2022. Today, Ukraine boasts more than 500, according to official Ukrainian figures. From having no home-grown makers of unmanned ground systems (UGS)s, Ukraine now counts more than 100.

While exact figures are unavailable, the pace of change is stark: domestic drone production is now measured in millions rather than thousands.

New legislation, streamlined approvals and European investments have helped incentivise production.

State initiatives – notably a state-owned accelerator called Brave One – and targeted grant programmes have steered firms towards priority technologies, such as UAVs and missile development.

Training and testing schemes have widened participation too: specialist centres can provide operator instruction. The 'Iron Range' is a free service that allows Ukrainian arms and equipment manufacturers to quickly test and refine their products. It provides access to professional trials, evaluation by military research experts and fully equipped test sites. There is also feedback throughout the design process.

Problems remain. Lack of standardisation, speed versus intellectual property rights, and supply-chains are all daily issues. But officials argue the industrial surge has both strengthened Ukraine's defence and created capabilities of strategic value to Europe.

FOCUS: EDA PROJECTS

18 EU countries move forward in loitering munitions

In November 2024, 17 Ministers of Defence signed a letter of intent at EDA – joined by Spain in April 2025 – to purchase and develop loitering munitions. It was a political signal that the task could no longer be left to ad-hoc national buyers and foreign markets. EDA's remit was narrow and intentionally preparatory: to build a business case that would make joint procurement possible. Approved in September 2025, it serves as a lexicon, a market survey, a needs assessment and an overview of ways to buy together.

When is a drone not a drone? One answer, perhaps, lies in the new era of aerial warfare.

Built to operate above a battlespace, locate targets either autonomously or semi-autonomously and eliminate them through direct impact, loitering munitions are relatively new to EU arsenals. Despite being a technology pioneered by West Germany in the 1970s, such munitions are in short supply in Europe because development was discontinued after the Cold War.

Harder to detect by radar due to their small size, Ukraine and Russia started using such domestically produced munitions, as well as Iran, Israel and Turkey among others.

Loitering munitions are essential for EU Member States because they provide unmatched precision, real-time intelligence, surveillance and reconnaissance, and tactical flexibility that traditional fire-support systems cannot deliver in decentralised or urban operations. Many EU nations are ready to buy off the shelf.

The first task for the 18-country working group at EDA was to gain a common understanding. The group relied on expertise provided by organisations with expertise in munitions, think tanks, Member States and NATO allies.

The distinction matters beyond semantics: calling something a munition rather than a UAV carries legal, safety and operational implications. "The business case also acts as a lexicon, offering a solid foundation for jointly acquiring key capabilities and enhancing interoperability across the EU in delivering operational effects," says Giuseppe Dello Stritto, Head of Unit Land and Logistics at EDA, leading the team responsible.

"The aim of aggregating demand is to prevent fragmented procurement through multiple national contracts for similar capabilities, instead focusing investment on a few scalable systems," he says.

A Fly-R fixed-wing loitering munition is launched from the French Navy's Floréal-class frigate during a live maritime trial in June 2025.


© Julian Röpcke / X

Ukraine's Special Forces show the Helsing HF-1, a German-funded AI-supported strike drone, during its use in Sumy Oblast on 31 March 2025.

Munitions need not meet the same 'worthiness' certification as aircraft but still require rigorous testing under operational and environmental conditions. Since loitering systems operate across ground, air and maritime environments – some even loitering underwater – the definition covers a range of systems from short-range tactical kits to long-range strike platforms.

Want loitering munitions? Where to look in the EU...

The working group, chaired by Belgium and manned by military experts from the Member States, gathered information about the off-the-shelf market across the European Economic Area – all EU Member States plus Iceland, Liechtenstein and Norway – receiving responses from over 50 companies. "It shows that Europe's industrial base is not absent but fragmented: too many smaller companies operate alongside a few larger firms," says Mihai Ionita, EDA's Project Officer Land Programmes.

The information is classified, but Dello Stritto says potential demand is in the several hundreds of millions of euros over a five-to-ten-year horizon. The shared goal is buying loitering munitions jointly:

> **"What the past year shows is that when Member States speak with a single voice – even if only to define terms – industry responds and joint planning becomes possible"**

What are loitering munitions?

The EU's 18 participants adopted the following working definitions for loitering munitions:

- A Ground Loitering Munition is a self-propelled munition following an operator-influenced path (including idle periods) and is capable of non/beyond line-of-sight target verification and precision attack, has the ability to abandon an attack, can be re-assigned and is destroyed when exploding;
- An Aerial Loitering Munition is a munition following an operator's flight path or position and is capable of non/beyond line- of-sight target verification and precision attack, has the ability to abandon an attack, can be re-assigned and is destroyed when exploding;
- A Waterborne Loitering Munition is a self-propelled, munition capable of prolonged on- or underwater operation and potentially enabling targeting detection and precision engagement, dynamic re-tasking, and attack abandonment before being rendered unusable, whether through payload activation or neutralisation.

SHELTER FROM THE SWARM

A soldier controls a loitering munition from Rheinmetall's HERO series.

several like-minded states become a credible customer for EU industry.

But turning clusters of potential buyers into contracts requires technical specifications, testing protocols and an acceptance process. "For loitering munitions, NATO standards and certification frameworks are largely absent," Dello Stritto says.

Simultaneously, a broader capability development programme is being prepared to create a clear pathway for a structured cooperative framework, enabling partners to jointly develop all elements needed to transition from equipment to full military capability.

Coalition of buyers or list of good intentions?

When will joint purchases start? "EDA can convene, draft taxonomy, collect market data and harmonise operational requirements, aggregate national demand," Dello Stritto says. "But it lacks the engineering, test centres and contracting power to act as an acquisition entity."

Several solutions are under consideration in the concerned Member States. One is to assign contracting and testing to organisations with existing engineering capacity, such as the NATO Support and Procurement Agency (NSPA) or OCCAR, the Organisation for Joint Armament Co-operation.

The other may be to rely on lead nations – France, Germany and Italy – leading work on Ammunition and Missiles under the Defence Readiness 2030 roadmap, using national facilities and technical staff to validate prototypes and refine specifications.

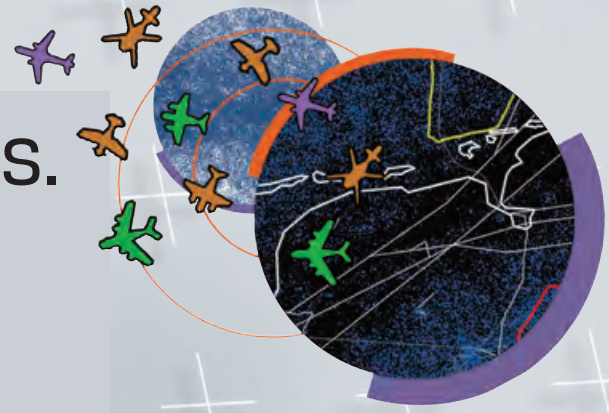
Beyond short-term action like procurement, Member States gathered under the EDA framework are also considering medium to long-term collaborative objectives to be achieved together. The long-term vision is to combine everything from concepts and shared facilities to research, eventually leading to the development of a European family of loitering munitions.

Will the business case produce a coalition of buyers or a list of good intentions? "What the past year shows is that when Member States speak with a single voice – even if only to define terms – industry responds and joint planning becomes possible," Ionita says.

The initiative at a glance

- **What?** Capability Development of loitering munition, including preparation of Joint procurement– EU Member States aim to buy available products and develop the thorough military capability together rather than individually.
- **Where?** In EDA framework, considering input from all EU/EEA states, plus Iceland, Liechtenstein and Norway.
- **Who?** 18 countries: Belgium, Bulgaria, Cyprus, Czechia, Germany, Estonia, Greece, Finland, France, Hungary, Italy, Latvia, Lithuania, Netherlands, Poland, Romania, Slovenia and Spain.
- **Why?** To harmonise requirements, achieve economies of scale, improve armed forces interoperability and strengthen European defence industry, and ensure credible deterrence with modern munitions.
- **How?** Through a business case; followed by a broader capability development programme to address essential elements to deliver effects on the battlefield.

FOCUS: EDA PROJECTS



Under the same skies. Military drones must find their place in civilian airspace

With more warm getaway destinations, flights to visit far-flung family and business travel, the airspace above us is beginning to look like the city streets around us: heavily congested. Now military drones are entering the mix. How can these two worlds safely coexist under the same skies? EDA is working on an answer.

Railways and road convoys come first to mind when thinking about military mobility. But the airspace above the continent is important too. Military drones are transforming defence operations and will test NATO's ability to move armed forces swiftly across European skies.

EDA has led a series of cross-border test flights to demonstrate safe Unmanned Aircraft Systems (UAS) integration into shared airspace. The first operational flight took place between France and Spain in 2021, followed by tests between Germany and the Netherlands in mixed civilian and military controlled airspace in 2025. More complex flights are planned in 2026, involving more drones and multiple countries.

Not just a good idea

As demand grows, drones will increasingly need to fly across borders, for example, "taking off from one country to carry out a maritime surveillance operation in another's airspace, to protect undersea cables," says Stephen O'Sullivan, EDA's Project Officer UAS Integration Research. He notes that the issue arises during the UAS's transit to and from its mission area.

While the actual missions take place in segregated airspace, UAS must cross the same skies as commercial and civil aircraft to reach their destination and return. "Each time we transit from the take-off airport to the mission area an isolated airspace must be established, potentially disrupting other flights," says O'Sullivan. EDA is working with Member States to demonstrate the safety of these systems and to integrate them safely into shared skies.

'U-space': not a social media app

Separately, smaller drones, such as quadcopters, are being integrated into 'U-space', a low-level (<120m), locally managed system for unmanned aircraft, separate from standard air traffic. U-space supports drone deliveries, surveillance and 'beyond-visual-line-of-sight' operations through automated systems with human oversight.

> **"Each time these drones operate, an isolated airspace must be established, potentially disrupting other flights"**

A German Heron TP RPAS flew in military- and civilian-controlled airspace between Germany and the Netherlands on 3 February 2025, marking another step towards RPAS being allowed to fly safely alongside commercial airlines and other manned aviation.

(Top) The German Heron TP drone used in the February 2025 test flight.

(Left) The Heron TP's route from Schleswig to Leeuwarden and back again.

- **First of its kind:** German Heron TP completed a round trip from Schleswig (Germany) to Leeuwarden (the Netherlands) – the first European flight in non-segregated upper airspace.
- To allow remotely piloted aircraft to navigate shared skies.
- **Who was involved:** Led by German Aerospace Center (DLR), with the Netherlands Aerospace Centre (NLR) and German Armed Forces. Plus Eurocontrol and Maastricht Upper Area Control Centre (MUAC) controlling the airspace.
- **The RPAS:** 26-metre wingspan, over 24 hours of flight endurance.
- **Flight details:** Started in military airspace, handed to civil and upper airspace controllers.
- **Altitude:** Reached 8,500 metres, above the 1,000-metre upper airspace threshold.
- **Route:** German coastline into Dutch airspace, landing in Leeuwarden, then back to Schleswig.

And now, U-space is gradually being rolled out across Europe.

For the military, however, U-space introduces unique challenges. Chief among them is conspicuity: the requirement for drones to broadcast their location and other flight information such as altitude, direction and speed, ensuring visibility to other aircraft. This transparency is essential for safety. It ensures that aircraft and air traffic controllers can see the drones and vice-versa.

However, conspicuity can conflict with a military and police need for discretion. Military drones must not be easily tracked, especially given the current security situation in EU skies, where drones are becoming more of a security threat. "Drones get jammed, spoofed*, or shot down, and operators can be located by tracing their flight paths," says O'Sullivan.

Solutions for the European sky

The European Union Aviation Safety Agency (EASA) has been developing U-space for several years. EDA was involved from the start to ensure military considerations are built in. EASA is now introducing so-called dynamic airspace reconfiguration, a system that will allow special operations or flights within the U-space airspace, while maintaining safety for all airspace users.

In relation to the larger drones, EDA's Concept of Operations (ConOps) for cross-border Remotely Piloted Aircraft System (RPAS) flights will guide the next phase: expanding flight activities, supporting the creation of safe air corridors, and fully integrating RPAS with commercial aviation.

"The goal is simple," says O'Sullivan. "We need to reach a point where sophisticated military drones operate like any other aircraft: filing flight plans, taking off, completing missions, and returning, all seamlessly integrated into the airspace system."

*Spoofing is the act of substituting a genuine signal with a deceptive one so that the receiver interprets false information as real.

To listen to a podcast with EDA's Stephen O'Sullivan, go to: https://eda.europa.eu/news-and-events/podcast

EU countries ask EDA to establish a **pilot training school** for drones

The blades could begin spinning again

For years, anyone associated with EDA could not escape mention of one of its most ambitious projects: The Multinational Helicopter Training Programme. Now hosted by Portugal at Sintra Airbase Nº 1, the programme schooled thousands of helicopter crews from 16 European countries. The annual 'Blade' exercises were a fixture of the European military training calendar.

In the drone age, the moment may be ripe for a multinational school for drone pilots. Simulators, joint exercises, and carefully coordinated syllabi were the helicopter approach. Could the European Union create a cadre of drone crews who move seamlessly from simulator to real-world exercise, across borders and airspaces, with shared licences and standardised procedures?

Learning to fly

EDA and Latvia are set to deliver the first 'Advanced Course for Remote Pilots' in May 2026, at the Latvian Autonomous Systems Competence Centre. Discussions are focused on the curricula, which can span from basic training to advanced tactics, techniques and procedures, tactical deployment, and even operations in counter-drone environments. Some countries have indicated a willingness to host exercises, set up training areas with all the necessary infrastructure or provide instructors; others are evaluating whether their resources could contribute.

Harmonisation with NATO standards is under consideration, as is the question of how best to integrate lessons from complex operational environments. Planners are weighing questions of interoperability, logistics, and the practicalities of turning theory into experience.

The concept is compelling because the face of warfare has changed so extensively over the past four years. Drones are no longer toys, they are now instruments of death and destruction that can remove a main battle tank or a helicopter worth tens of millions of euros from the battlespace.

Future pilots could learn to manoeuvre swarms, navigate denied airspace, and execute precision missions, all under the guidance of instructors drawn from multiple nations, blending expertise with innovation.

There is also a cultural dimension to consider. A school like this could build not just skills, but a community, a network of operators fluent in shared European tactics, bound by mutual understanding, training as they fight, and fighting as they train.

ASD: The voice of the European aerospace, security and defence industry.

Camille Grand is Secretary General of the European Aerospace, Security and Defence Industries Association (ASD). A leading expert, he previously served as NATO Assistant Secretary General for Defence Investment, directed France's strategic think tank FRS, and held senior roles at the French Ministry of Defence. He gives *European Defence Matters* an industry perspective.

Not a **passing storm**: why defence investment must endure

EDM: **Defence spending is on the rise – would you say the EU's current investment levels are up to scratch?**

The rise in defence spending across Europe is spectacular but uneven. Some countries, such as Poland and the Baltics, already exceed NATO's 3.5% of GDP benchmark. A second group, including the Nordics and notably Germany, is catching up quickly and plans to reach 3–3.5% within a few years. A larger group, including France and Greece, is committed but fiscally constrained, with slower timelines. Finally, some countries are hesitant, hovering around 2%, with domestic debates limiting faster growth. But I think the trend is clear: spending is rising substantially, which means more resources to strengthen Europe's ability to defend itself. We already perceive this as industry with the fast expansion of production and orders, already visible in our figures *(see overleaf)*.

EDM: **But is it enough?**

I believe that the new NATO 3.5% target, and the extra 1.5% of GDP for security and resilience, are transforming Europe's defence landscape and allow implementing the necessary plans for the defence of Europe. So yes, the funding is sufficient, with one caveat: efforts must be sustained over time. Two decades of the peace dividend created gaps that will take years to repair. Sustained commitment is vital, especially from industry, and must not fade with a potential ceasefire in Ukraine.

(Left) Robotic arm operating on an artillery ammunition body production line.

(Below) An operator moving 155mm shell bodies inside an industrial production hall.

On the contrary, depending on conditions, a ceasefire could even embolden Russia, requiring the Europeans to do more. A long-term effort is therefore absolutely critical.

EDM: **The EU's 'White Paper for European Defence – Readiness 2030' urges "a massive ramp-up of European defence industrial production capacity". What is your view?**

My plea is for investment across all four areas: support for Ukraine, rebuilding mass and readiness, developing strategic enablers, and driving innovation in disruptive technologies. Only by sustaining effort in each can Europe secure its future.

I believe we must continue supporting Ukraine. This is vital not only for Ukraine's future but for Europe's security.

We must also rebuild mass and readiness. This includes the unglamorous but essential task of buying ammunition and spare parts. As I often joked at NATO, no minister wore a T-shirt saying "I bought ammunition," yet without stockpiles, Europe cannot face the risk of major conflict. Only a handful of countries, starting with Finland, have done this properly, and we should all be a little more Finnish. Europe must regain the ability to surge in a crisis, whether on land, at sea, or in the air.

> **"Sustained commitment is vital, especially from industry, and must not fade with a potential ceasefire in Ukraine"**

Then there are the strategic enablers – the technologies that bind systems together: space assets, strategic airlift, air-to-air refuelling, intelligence, surveillance and reconnaissance capabilities, command and control... *(see EDM pages 42-43)*. Many of these capabilities are primarily provided by the United States, but Europe must now reduce this dependancy.

Finally, we must invest in innovation. Ukraine has demonstrated how unmanned systems and artificial intelligence are transforming warfare. Europe must learn these lessons, even if future conflicts will differ.

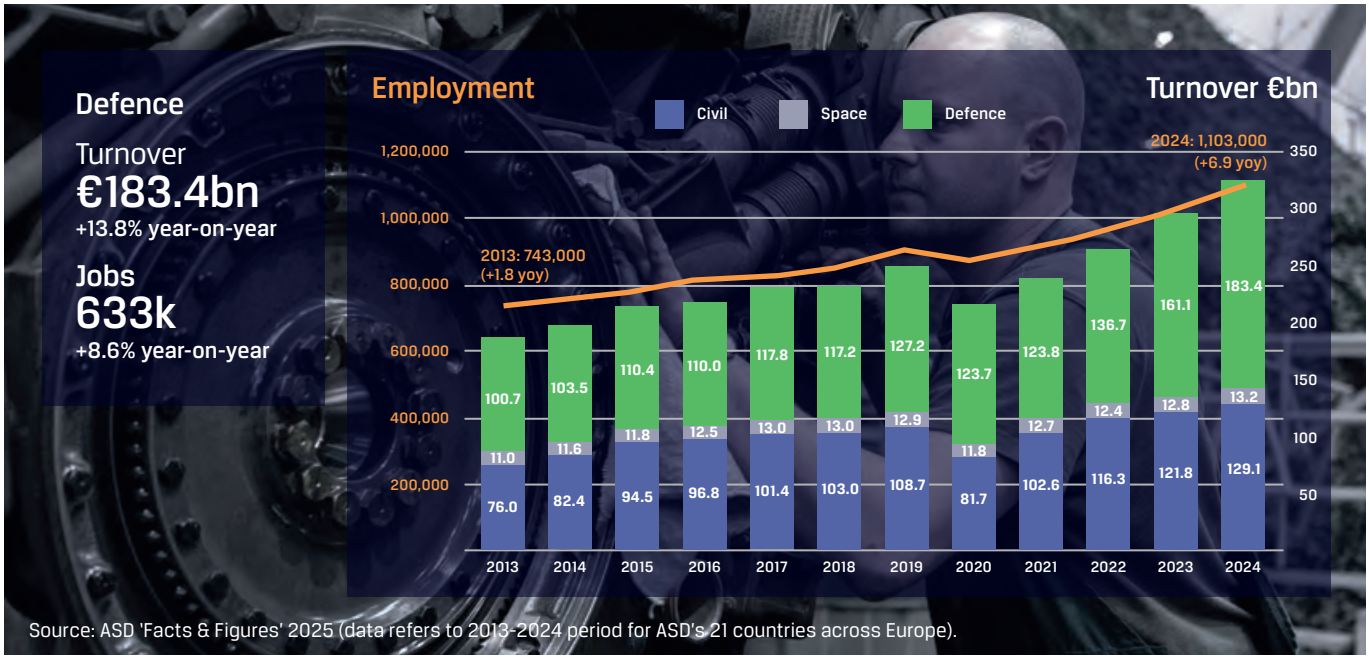
EDM: **Is there enough of an incentive to encourage long-term orders?**

The demand signal is there – from Member States, the EU and NATO. Still, industry rightly seeks greater certainty, since expanding production capacity requires vast investment.

Ammunition is the most straightforward example: demand grew due to Ukraine. Production capacity is expanding across Europe. Yet clarity from governments regarding their future stockpiles and expectations with regards to future production capacity remains essential.

For years, 'just-in-time' delivery was considered acceptable, but in defence it risks becoming 'just too late.' A stronger partnership between governments and industry – with the EU helping to mitigate risks – is needed.

You can see how recent declarations of intent on the future of the Ukrainian air force with European fighter jets will require the need to expand production capacities. →



Source: ASD 'Facts & Figures' 2025 (data refers to 2013-2024 period for ASD's 21 countries across Europe).

© Dutch Ministry of Defence

The goal is to move from blame games, where governments fail to signal demand, or industry is accused of chasing short-term contracts, to a genuine long-term partnership.

***EDM:* Is access to financing improving? Investors were wary of defence in the past.**

The debate is far better than three years ago, but not fully settled: the financial sector is increasingly interested in defence and more willing to partner and invest. This matters, because expanding production facilities requires major investments and the support of the financial sector. Yet challenges remain, especially for SMEs. Major primes can manage financing reasonably well, but SMEs face a two-fold problem as the debate is not fully resolved: some rating agencies and institutions still treat defence as a grey zone, and some funds remain hesitant to include the defence industry in their portfolios.

A recent Belgian case illustrates this: depleted uranium is legally labelled 'controversial' despite being a non-nuclear NATO munition used to pierce armour. Such debates, even if marginal, deter investment. The financial community often relies on information that is questionable, which is why dialogue is essential.

***EDM:* From your time in NATO, how do you see see the European Defence Agency (EDA) as it steps up its role in capability development?**

In fact let me go back further in my career. I was at the French Ministry of Defence when EDA was established in 2004, and we – alongside other countries – had great ambitions for it. EDA has significant untapped potential. So it's good news to see EDA becoming more central to EU efforts. Our governments trust EDA as their prime venue for defence conversations within the EU framework.

EDA's understanding of defence and capability development is very solid within the EU ecosystem, making it a natural partner for NATO. EDA is also the body most closely connected to Ministries of Defence. So there is room to oversee more substantial cooperation: initiatives like Permanent Structured Cooperation have been too focused on small projects.

***EDM:* And finally, how do you see Europe's defence industry shaping up over the next decade?**

I would make two points. Firstly, we must acknowledge that the United States will not invest in the defence of Europe as much as it has over the past eight decades. The U.S. is asking Europeans to be more capable of defending themselves, and industry has a critical role to play.

Secondly, U.S. industry is itself struggling to meet demand. I'm confident European industry has the capacity, expertise and innovation to step up over time. What's more, global demand creates more room for our defence industry, and we must be ready to meet it. Industry can do this, but as I said earlier, it requires a European cooperation mindset, involving both EU and non-EU countries, such as Britain.

What deterrence and defence really means. Camille Grand shares his priorities:

1. **Support to Ukraine:** Backing Ukraine is essential for its survival and for Europe's security. Money and industrial capacity must continue to prioritise this support.
2. **Mass and readiness:** Europe needs to rebuild military strength by stockpiling ammunition and spare parts, while expanding the number of brigades, aircraft and naval assets. European nations must now deliver the bulk of conventional deterrence and defence, and surge capacity.
3. **Strategic enablers:** Europe must invest in strategic enablers and reduce its reliance on the United States. These capabilities now need to be developed in Europe, with the MRTT joint tanker fleet serving as a successful model.
4. **Innovation in defence tech:** It is vital. Europe must keep pace in defence innovation and disruptive technologies to remain competitive in a world dominated by a fierce tech competition between China and the U.S..

Season 3 of EDA's podcast is out now!

01 RECORD-BREAKING DEFENCE DATA

Aleksandra Walczak
European Defence Agency

Juan Mejino-López
Bruegel

02 MILITARY DRONES IN BUSY EUROPEAN SKIES

Stephen O'Sullivan
European Defence Agency

Mikk Murumäe
Threod Systems

03 AI FOR MILITARY DECISION MAKING

Judith Dijk
European Defence Agency

Liisa Janssens
Technical University Delft

04 3D PRINTING ON THE BATTLEFIELD

Martin Huber
European Defence Agency

Frederic Creusen
Ministry of Defence, The Netherlands

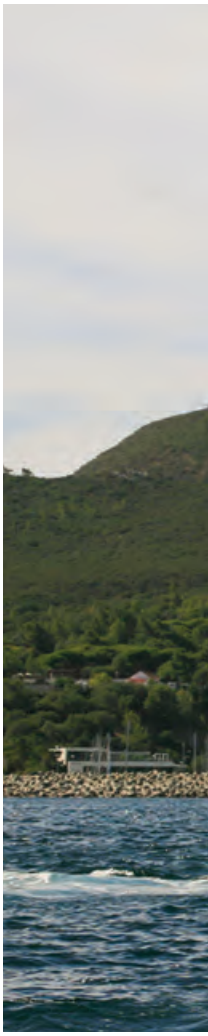
05 SAT COM FOR OPERATIONS

Heinrich Krispler
European Defence Agency

Holger Lueschow
European Defence Agency

06 THE ART OF MILITARY DIPLOMACY

General Seán Clancy
Chairman of the EU Military Committee



A Portuguese patrol ve

Soldiers take part in EDA's Black Blade helicopter training exercise in 2016.

Master or servant? When money alone is not enough

© Juan Mejino-López

Juan Mejino-López is an economist and research analyst at Brussels-based think tank Bruegel, specialising in the economics of defence-related topics. Mejino-López talks to *European Defence Matters* about Bruegel's work on Europe's rearmament, dependence on the U.S., and how years of underinvestment have left a gap of €200 billion between what the EU should have spent – and what it actually did.

EDM: **The European Union's defence spending has surged since Russia's invasion of Ukraine. Are we catching up on the lost years after the 2008 financial crisis?**

Yes and no. Europe has certainly increased spending – some countries, such as Poland and the Baltics, are now dedicating close to 5% of GDP – but much of this is still about refilling stocks and replacing obsolete equipment. After the Cold War and the global financial crisis, defence budgets were cut, hitting equipment investment hardest. By 2014, most countries spent just 1.2% of GDP (the European Defence Agency (EDA) data shows a €200 billion underinvestment gap) often with less than 20% going to equipment. Today, that figure is closer to 40%, but compared to Russia's war economy, we are still behind.

EDM: **NATO recently set targets beyond the traditional 2% of GDP. What does that mean?**

European NATO members are aiming for 3.5% of GDP on core defence, such as personnel, equipment and infrastructure, plus 1.5% on broader security measures, including cybersecurity and critical infrastructure. That is effectively 5% of GDP, to be achieved gradually by 2035. The target will be reassessed by the end of the decade.

EDM: **How does the EU's defence ramp-up look with a more critical eye?**

Russia remains formidable. Adjusted for purchasing power, it is the largest economy in Europe, capable of sustaining large-scale military production even under sanctions. Europe's delivery times for many defence systems average three years, and we cannot simply buy now and deploy by next month.

Europe's dependence on the U.S. adds another layer. Bruegel's latest work shows that European countries have dramatically increased purchases from the U.S. Foreign Military Sales (FMS) programme, especially for fighter jets, air defence systems and missiles. In 2024, FMS notifications

ssel takes part in the REPMUS exercise in September 2025.

(proposed arms sales) to Europe hit $76 billion, with Poland alone accounting for over $45 billion between 2023 and 2024. While this addresses immediate capability gaps, it creates long-term strategic and technological dependencies.

EDM: **Is this reliance on the United States an obstacle to the EU's autonomy?**

In the short term, European rearmament does benefit from U.S. military production. In the mid and long term however, these purchases create lock-in effects and can pose an obstacle to the development of European alternatives. Moreover, these purchases also provide the U.S. with a high leverage, which can be used in policy areas other than defence.

Our research shows that Europe depends on the United States not only for hardware but also for critical software, command-and-control systems, and advanced technologies. Systems like the F-35's ODIN software or the AEGIS Combat System are essential, and delays or restrictions could significantly lower operational effectiveness. U.S. production priorities can also shift – for instance, towards Asia – adding geopolitical uncertainty.

EDM: **So, what should the EU do?**

The EU needs to develop and execute a strategy to scale up domestic production and sustained research investment, particularly of rapidly evolving technologies such as drones, and high-tech equipment such as air defence systems, missile technologies and AI-enabled weapons.

Europe should foster cross-border collaboration to decrease market fragmentation and achieve scale, cut costs and strengthen European autonomy. We also see opportunities: Ukraine's highly developed defence industry can be a partner. Investment in startups focused on advanced technologies can help the EU to catch up.

EDM: **Can Europe take the edge off dependence on the United States?**

It's possible, but it requires a strategic approach. Europe needs to prioritise domestic investment in areas where the U.S. and other countries such as China have technological dominance. It should also invest in new capabilities like hypersonic weapons and coordinate procurement across countries for greater efficiency. Without agreements on command-and-control systems, procurement standards, and export policies, we risk fragmentation and lost autonomy.

Reducing dependence can have economic benefits. Defence research and →

"The EU has woken up to the security threat, but 'reshoring' EU defence will take more than money. We need industrial scale, technological investment, and cross-border integration"

A firefighting helicopter drops water over heavy smoke after a Russian missile strike on Kyiv, June 2025

development can stimulate growth, but the effect is diminished if spending goes abroad.

***EDM:* Are there positive signs for European defence integration?**

I'm cautiously optimistic. Europe is far more integrated than in the past. NATO and EU structures allow cooperation and joint procurement, and European companies are starting to achieve scale. There are significant new EU initiatives. But trust is so important. EU countries still prefer to buy from their own national defence companies and sometimes from the United States. Greater EU market integration, joint planning, transparency and better data are essential.

***EDM:* So, what's your conclusion for the time being?**

The EU has woken up to the security threat, but 'reshoring' EU defence will take more than money. We need industrial scale, technological investment, and cross-border integration. Otherwise, we risk relying on non-European capabilities in ways that compromise our autonomy and freedom.

European policymakers need to assess their foreign military dependences on supplies of weapon systems critical for Europe's self-defence, and to develop and execute a strategy on how to narrow it. Failing to do so means putting the EU's freedom and independence at risk.

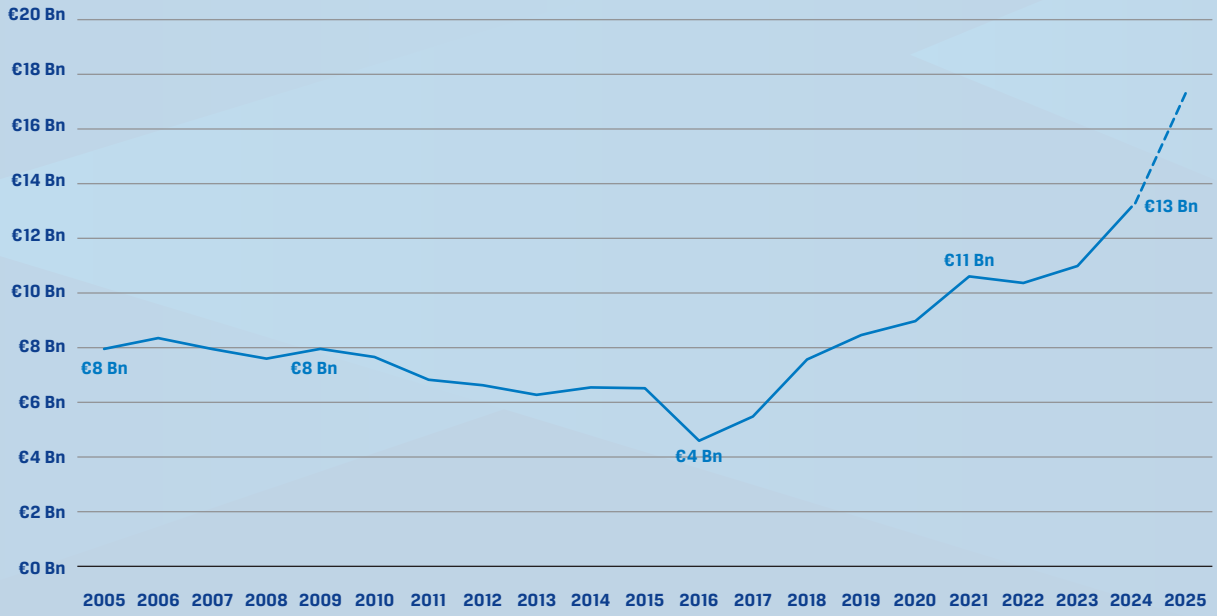
To listen to an EDA podcast with Juan Mejino-López, go to: https://eda.europa.eu/news-and-events/podcast

Smoke rises over Kyiv following a Russian missile attack in July 2024.

"The way forward is clear: Europe must build the capacity to defend itself while maintaining strong transatlantic ties – but not at the expense of its independence"

EDA collects defence data on an annual basis, and has done so since 2006. The Ministries of Defence of the Agency's 27 Member States provide the data.

Defence R&D



Total Defence Expenditure vs the previous 2% of GDP NATO Guideline

For more, see EDA's website: *www.eda.europa.eu*

As of today, nine Common Security and Defence Policy (CSDP) military operations and missions are ongoing. The total number of military operations and missions conducted since 2003 is 19.

Twenty-five years on from the European Union's **military awakening**

EUNAVFOR ASPIDES is an EU military mission th

Major General **Gábor Horváth** is Deputy Director General and Chief of Staff of the European Union Military Staff (EUMS). With extensive operational and strategic experience, he has held senior EU and NATO roles, including as Hungary's Military Representative to NATO and the EU Military Committee. Having helped build up the EUMS from its beginnings, he talks to *European Defence Matters* about developing the EU's military capacity to act abroad.

It began, somewhat improbably, with a lesson in basic military vocabulary. In 2003, Major General Gábor Horváth found himself desperately explaining what a battalion* was to diplomats, as the EU debated sending troops to the Democratic Republic of Congo and Bosnia. "They were so new to it all," he recalls almost a quarter of a century later.

That is not an understatement. Only two years earlier, the European Union had established its first-ever military staff. Political approval to intervene abroad was now debated by national envoys in Brussels, who had little knowledge of what it took to deploy a multinational force.

Horváth arrived in Belgium in 2003 as a deputy military representative – with observer status – to the newly created EU Military Committee. The EUMS had already started to plan its first EU military mission – to North Macedonia, then known as the Former Yugoslav Republic of Macedonia (FYROM).

The wars in Bosnia and Kosovo had exposed Europe's dependence on NATO, and the severe limits of the EU's geopolitical agency. Operation Allied Force, to stop ethnic cleansing in Kosovo in 1999, was conducted by NATO because the EU lacked the means to do it itself. This dependency spurred decision-makers – including in the 1998 Saint-Malo Declaration between Britain and France – to insist that Europe "must have the capacity for autonomous action, backed up by credible military forces."

Artemis, Althea, Atalanta...

After some interim arrangements, the Union formally established its military committee and military staff on 22 January 2001.

"We were jumping into the unknown"

"There was now political will to go beyond the EU's soft power," Horváth says from his office, with its white walls covered with maps of today's EU missions and photos of soldiers from past ones. It is an

at upholds freedom of navigation and ensures maritime security, particularly for commercial ships, in the Red Sea, the Indian Ocean and the Gulf.

understated place whose anonymity belies the ambition inside.

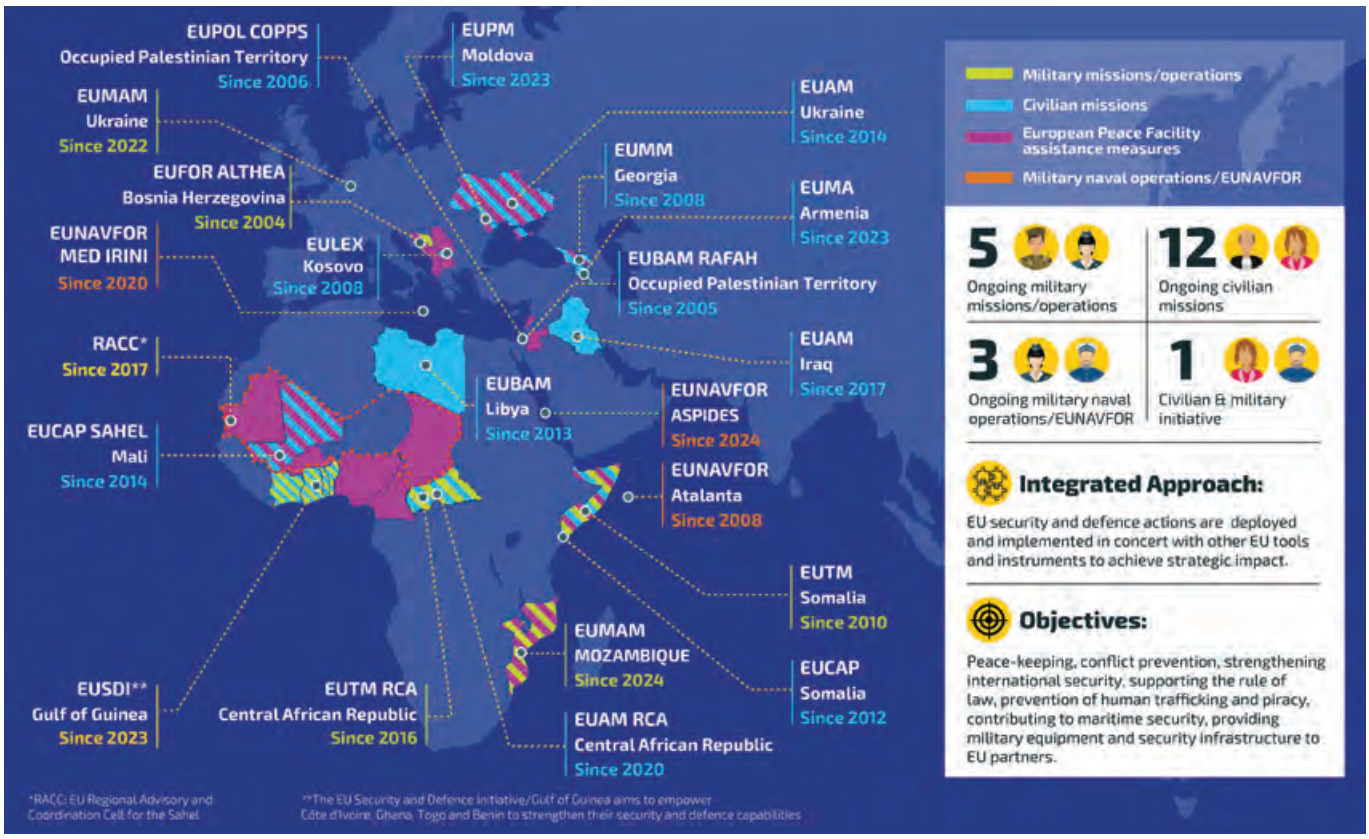
The early days were shaped by modest resources and high expectations. A handful of generals and colonels managed strategic planning for humanitarian operations, peacekeeping, and crisis management: the Petersberg Tasks agreed in the 1990s served as the EU's non-combat military remit.

The first operation, Concordia in 2003 in FYROM, was small. The decisive shift came in 2004. That year, the EU ran Operation Artemis in northeastern Democratic Republic of Congo – its first independent, rapid-reaction mission outside Europe – and took over NATO's stabilisation mission in Bosnia, creating EUFOR Althea.

Artemis became formative. Its lessons hardened into doctrine: Europe needed to deploy quickly, act decisively, and withdraw before situations became quagmires. "The EU battlegroup concept was created on the basis of the lessons learned from Operation Artemis: quickly in and out."

The same year saw the creation of the European Defence Agency and the accession of 10 new EU members, including Horváth's own, Hungary. "We were jumping into the unknown," he says. New Member States remained unclear about the EU's scope, its ambitions relative to NATO, and how a Union with no standing army could command forces. →

German soldiers stand on a parade ground during the 2025 live exercise of the EU's Rapid Deployment Capacity in Hungary on 10 April 2025.



EU security and defence engagements around the world.

Operation HQ... Brussels

The next major change came with the 2009 Lisbon Treaty, when the EUMS moved into the new European External Action Service (EEAS). Still, the EUMS had to operate without a permanent command structure. "As opposed to NATO, the EU doesn't have one. We create one for each mission," he explains.

Five national headquarters – Paris, Rome, Rota, Ulm and Larissa – offered standing operational capacity. Today, out of the five, three are occupied, running EU naval operations Atalanta, Irini and Aspides. For Operation Althea, the longest-running EU military operation, this role is played by the EU Staff Group embedded in the NATO Allied Command Operations (SHAPE) in Mons.

In 2017, the EU created the Military Planning and Conduct Capability (MPCC), giving it a permanent structure for commanding military training missions. The MPCC, alongside its civilian counterpart, split from a planning-only body to a strategic command, now also responsible for the eventual deployment of the new Rapid Deployment Capacity. "It is a rather complicated name. But in those times, there was a need to avoid any sign of duplication with NATO," Horváth says. He would like it called 'Military Operation HQ Brussels'.

Horváth sees a world demanding more from the EU, citing three reasons:

- the global proliferation of conflict;
- the refocusing of NATO on territorial defence;
- the general decline of the United Nations' potential.

"When I look around, I see fragile states and war. We have to react when our interests are in danger or threatened."

To meet this, the EU must become more agile, bolder, and quicker in giving political mandates. "Too often, the tactical situation is already military history when addressed at the strategic level," he says.

So the EU's military machinery is still evolving. Horváth sees missed opportunities for interventions in the 2010s. Its battlegroups remain largely unused. Yet the EUMS' evolution shows how far the EU has come in 25 years. The question now is whether the political will that gave birth to the system can be as strong as the world it must confront.

*A batallion is up to 1,000 soldiers

A helicopter lands on an Italian frigate during EUNAVFOR ASPIDES in July 2024.

A BRIEF HISTORY OF THE EUROPEAN UNION'S MILITARY AWAKENING

1991 – Breakup of Yugoslavia
• Europe faces its first major post-Cold War conflict.

1992 – Petersberg Declaration
• EU defines the full range of crisis-prevention and crisis-management missions.

1995 – NATO's Operation Deliberate Force
• U.S.-led action ends the Bosnian war, highlighting Europe's limited military weight.

1998 – Saint-Malo Declaration
• France and Britain agree Europe must be able to act autonomously with credible military forces.

1999 – NATO's Operation Allied Force
• Kosovo intervention exposes gaps in European crisis-management capability.

2001 – EU Military Committee (EUMC)
• Chiefs of Defence form the EU's senior military body.

2001 – EU Military Staff (EUMS)
• EUMS becomes operational. Responsible for early warning, situation assessment and strategic planning for peacekeeping missions.

2003 – First EU missions
• EUFOR Concordia and Artemis signal Europe's move into military crisis management.

2004 – European Defence Agency (EDA)
• EDA is established to strengthen EU defence capabilities and foster cooperation between Member States.

2009 – Lisbon Treaty / European External Action Service (EEAS)
• EUMS joins the EEAS and gains a combined military and diplomatic advisory role.

2013–2016 – Crises bring EDA and EUMS closer together
• New crises in Ukraine, terrorism and migration prompt closer work on mobility and preparedness.

2017 – PESCO & MPCC
• Permanent Structured Cooperation launched with Secretariat of EDA-EUMS-EEAS.

• Military Planning and Conduct Capability (MPCC) established in EUMS as HQ for training and non-combat missions.

2020 – MPCC upgrade
• EUMS gains the ability to run small executive operations.

2022 – Ukraine war / New political guidance
• EU Military Assistance Mission in support of Ukraine (EUMAM) launched; MPCC directs and coordinates.

• EUMS develops military-strategic planning, readiness, and the Rapid Deployment Capacity.

• EDA ensures capability development, industrial support. R&T priorities match these aims.

In late 2022, the European Defence Agency (EDA) began a new research project with Spain and Germany to develop an automated air-to-air refuelling operation with the so-called hose and drogue system. Initially a two-year project, it is now embarking on a second phase, joined by Belgium. *European Defence Matters* spoke to those involved to find out more.

A Spanish A330 MRTT flies alongside two Eurofighter Typhoons.

A German Eurofighter takes on

Take It Easy: Loosening the load on pilots refuelling in the air

Threading a sewing needle is hard enough. Imagine doing it in the dark. Then try doing it in the dark in a moving car on a bumpy road. Finally, repeat the task again and again as fatigue from a long journey sets in.

That is how difficult it can be for a fighter pilot to refuel in the air using a hose and drogue system: a thin, flexible hose trailing from a tanker aircraft, with a small basket at its end wobbling in strong winds. The pilot must guide their jet to the tanker's basket with centimetre-level precision while both planes hurtle through the sky at hundreds of kilometres per hour. Failure to get it right can abort missions, lead to emergency landings or, very occasionally, damage to aircraft.

Recognising these difficulties, EDA, with Spain and Germany, kicked off a project in 2022 to develop automated refuelling with the hose and drogue system. The project introduces new features, enabling greater efficiency and reducing the burden on tanker and receiver crews.

"Up until today, we've relied on the effectiveness and skills of the pilot," says Samuel de la Fuente Lopez, Head of Fuel Delivery Systems at Airbus Defence & Space. "Automation will allow us to reduce the workload on pilots and provide steady refuelling, even in turbulent or unstable conditions."

The project's goals are precise. They include improving the identification and tracking of both the hose and drogue system and the receiver aircraft. A concept to enhance the drogue's stabilisation is also being developed, using cameras and motors to connect the aircraft to the hose. In parallel, engineers are simulating ways to study the best trajectory of the receiver aircraft as it approaches a tanker, looking closely at its interaction with the drogue.

The project is studying sensor performance, computing capability and suitability under all weather conditions. Ideally, European refuelling tankers, including the Airbus A330 MRTT, A400M and C295, would be able to support the most demanding operations, even potentially including those involving next-generation unmanned aircraft.

Meeting of minds

Spain and Germany emerged as early champions of automated air-to-air refuelling, driven both by industrial capability and operational necessity. Spain houses the core manufacturing and conversion facilities for the Airbus A330-based tankers, while Germany contributes expertise from its Eurofighter and Tornado fleets. "Both countries are clearly committed to keeping leadership in this domain," says Daniel Mosquera, EDA's Project Officer Air Systems Technologies.

The consortium comprises industrial and research entities across these countries, including Airbus Defence & Space, GMV of Spain, the German Aerospace Center (DLR) and AES Technology of Germany.

Why not use the boom system, a technique deployed by the U.S. Air Force? That is a rigid telescoping tube operated by a tanker to transfer fuel into a receiving aircraft. While automated boom systems exist in Europe, Germany and Spain primarily operate the hose and drogue. "The different systems have advantages and disadvantages," says Ricarda Freund, a technical specialist at the German Ministry of Defence. "For Germany, it's historically based. We've always used hose and drogue, and it made sense to maintain continuity."

"Automated doesn't mean replacing the pilot. It means the tanker can communicate with the fighter, guiding it without human intervention to the refuelling point, while the pilot remains in full control and as a safety backup"

fuel mid-flight during a February 2023 refuelling manoeuvre.

High-flying aspirations

EDA is the facilitator. "Our role is to bring the nations together, agree on requirements, and monitor risk," says Mosquera. "If delays happen, say, in wind tunnel testing or flight schedules, we have to anticipate and resolve them; otherwise, the project cannot continue."

Phase One focused on proving that automation was technically feasible. Engineers and researchers worked on three core pillars: stabilising the drogue during operation, equipping the system with cameras to detect and track fighter jets, and developing algorithms to interpret the plane's position. Flight tests were carried out using an Airbus A330 MRTT tanker and Tornado aircraft, giving teams invaluable data in a real operational environment, although it was not always straightforward.

For the first flight test, the German Tornado aircraft suffered a technical fault and was unable to take off; thanks to Freund's dedication, a second test was arranged in Germany.

De la Fuente Lopez highlights Airbus' role: "Phase One taught us how fast algorithms must respond to track the receiver aircraft. These insights were only possible in real flight conditions; simulation alone couldn't capture the subtleties of movements or the environmental factors that affect contact," he says.

When hands aren't needed at the pump

Phase Two expands the scope to refuelling unmanned aircraft, including a future use of unmanned tankers, and seeking more data on which to expand trials. "Automated doesn't mean replacing the pilot. It means the tanker can communicate with the fighter, guiding it without human intervention to the refuelling point, while the pilot remains in full control and as a safety backup," says Mosquera.

The Phase Two consortium is led by Spain, with Germany and Belgium participating, and is again contracted through EDA. Belgium's participation adds aerodynamic simulation expertise crucial for refining control laws and understanding receiver dynamics. Freund adds: "Beyond the operational benefits, this project means that Germany gets a real understanding of how the system is built and how it behaves, even when other militaries will buy the final technology too."

If all goes well, automated refuelling will mean more than operational efficiency and fewer unexpected overnight pilot stays in unfamiliar airbases. It will represent a leap in European aerospace capabilities. "Our goal is to keep Europe at the forefront of air refuelling technology," Mosquera says.

At a glance: Automated hose and drogue air-to-air refuelling

- **Lead nations:** Germany, Spain; Belgium joined Phase Two.
- **Coordinator:** EDA.
- **Partners:** Airbus Defence & Space, GMV (Spain), German Aerospace Centre, AES Technology (Germany).
- **Tankers:** Airbus A330 MRTT, A400M and C295.
- **Objective:** Reduce pilot workload, improve operational efficiency, and enhance European capabilities.
- **Scope:** Stabilisation of drogue, tracking receiver aircraft, algorithm development, simulations, and possible trials with unmanned aircraft.

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