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Floor Stoelinga, Karen van Loon, Davis Ellison, Ron Stoop and Dick Zandee
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Executive Summary

Over the past decade, strategic autonomy in defence has become a defining objective in European policymaking. At its core lies a clear but demanding proposition: Europe must be able to defend itself and sustain military operations without excessive reliance on external actors, most notably the United States (US). As Europe's security environment has deteriorated and transatlantic relations have become more uncertain, this challenge has become particularly acute in the defence-industrial domain. In practical terms, strategic autonomy depends on Europe's ability to design, produce, sustain and upgrade critical military systems under European control.

Despite unprecedented political attention and increased spending, the European Union (EU) continues to struggle to translate ambition into a coherent defence-industrial posture. Defence planning, production and procurement remain predominantly national, resulting in persistent coordination challenges across the European Defence Technological and Industrial Base (EDTIB). Dependencies on external suppliers, especially for high-end platforms, digital enablers[1] and critical inputs, remain a recurring concern.

At the same time, strengthening strategic autonomy raises difficult governance questions, notably how to balance short-term readiness with long-term industrial development, how to manage market consolidation without undermining competition, and how to sustain partnerships with non-EU allies while limiting critical dependencies.

1 Referring to the platforms, systems, and technologies that facilitate the integration and exploitation of digital capabilities – including cloud-to-edge computing for command and control, AI, autonomous systems, robotics, and machine learning – to ensure interoperability and enhance operational effectiveness and security.

About this report

The first part of the report maps Europe's defence-industrial capacity across military domains, strategic enablers[2], dual-use goods[3] and critical raw materials, assessing gaps between capability plans and production capacity and identifying key external dependencies.

The second part examines the governance of strategic autonomy, focusing on tensions between immediate readiness and long-term autonomy, national procurement logics and European coordination, consolidation and competition, the fragmented institutional landscape spanning the European Union, NATO and national authorities, and the management of partnerships with non-EU countries.

Methodologically, the report triangulates its findings through comprehensive desk research and a quantitative analysis of industrial capacity and dependencies. These findings were further validated through a series of expert interviews and a dedicated expert consultation session.

Findings

The report finds that across several capability areas, Europe remains dependent on the US for advanced platforms and technologies, while also relying on China for raw materials, components and supply chains underpinning defence production. Europe's defence industry is neither hollow nor uncompetitive but structurally misaligned with its strategic ambitions. This is most evident in a remaining gap between the immediate necessity for rapid rearmament and the long-term goal of durable autonomy. In areas such as air and missile defence, long-range strike and digital capabilities, demand signals, production scale and governance arrangements often fail to converge. Europe essentially finds itself in a double bind. For crucial military platforms it relies on the US, and the supply-chains on which it develops its own systems depend on China. Despite rising investments and a plethora of European initiatives, the industry also faces bottlenecks across capital access, production

2 Referring to the capabilities required to independently perform the full range of tasks associated with launched missions and operations, ensuring operational autonomy.

3 Referring to products and technologies that have both civilian and military applications.

efficiency, innovation, and workforce shortages. The legacy of European fragmentation persists as a rational outcome of multiple non-hierarchical structures, where member states view 'off-the-shelf' procurement and national control as the lowest-risk options. This leaves industry without the aggregated, long-term commitments required for scale and creates practical challenges to developing European alternatives through defence-industrial cooperation.

Moving forward does not necessarily require a grand overhaul, but rather pragmatic steps to balance readiness, industrial development, consolidation, competition and partnerships. This begins with taking stock of long-term dependency risks in national procurement choices – aligning not just with urgency and convenience, but with the broader autonomy objectives of the continent. Crucially, autonomy should not be framed as a pursuit of isolationist self-sufficiency, but as the active management of interdependence. This means securing the freedom to act through diverse, resilient partnerships and reciprocal safeguards. Ultimately, the 'strategic autonomy of the European defence industry' is not a fixed destination, but a long-term discipline of decision-making.

In line with these findings, the report puts forward the following overarching recommendations (see chapter 9 for the full overview):

1 Match industrial ambition with predictable demand and long-term funding
Embed strategic objectives in multi-year procurement to create predictable demand, sustain European defence-industrial scale, and enable durable capacity growth.

2 Strengthen the link between capability development and EU investments
Align EU-funded projects with national and NATO capability priorities, streamline instruments, and ensure funding translates into tangible industrial and operational outputs.

3 Prioritise strategic autonomy where control is most critical
Focus on areas that directly affect freedom of action – digital infrastructure, command-and-control systems, sensors, secure communications – and de-risk vulnerable supply chains in dual-use technologies and critical minerals, while recognising that complete decoupling from global supply chains is impossible.

4 Accept managed dependence in other areas
Mitigate risk through modular design, diversified sourcing, and contractual safeguards, while concentrating resources on strategically critical domains.

5 Reduce fragmentation through clusters and pragmatic prioritisation
Promote clusters of frontrunner states to harmonise requirements, reduce duplication, enable interoperable systems, and consolidate industry where it boosts scale, efficiency, and resilience.

6 Position smaller member states strategically within platform-driven dynamics
Secure early participation in major European programmes, align national industrial strategies with emerging capabilities, and anchor specialisation through minilateral partnerships.

7 Partner more, but on purpose
Deepen cooperation with aligned partners, manage dependencies in critical areas, and prioritise European-based value creation, exportability, and supply security.

Recommendations for the Netherlands

- Cooperate with trusted partners to create manageable scale, interoperability, and complementary capabilities.
- Commit early to selected European platforms to influence design, standards, and workshare.
- Accept managed interdependence to maintain sustained industrial access.
- Concentrate effort on a limited number of priority domains to generate scale, influence, and bargaining power.

Introduction – Strategic Autonomy in the European Defence Industry

Floor Stoelinga

Volatile geopolitics and the weaponisation of dependencies have propelled 'Strategic Autonomy' to the heart of the European Union (EU) policy agenda: from energy and agriculture to digital technologies and pharmaceuticals.[4] The core idea is clear: Europe must be able to stand on its own two feet and reduce its reliance on others.[5] This report reflects on what this means for its defence industry.

Drivers of the EU Strategic Autonomy debate

Europe's declining share of global wealth – down from over a quarter since the 1990s – combined with China's growing economic and military power, has shifted the global balance.[6] The US is facing the China challenge head-on, reverting to political and economic protectionism and re-enforcing a more multipolar and transactional world. The EU has been caught in the middle. In this context it is seeking to become a geopolitical actor. In 2016, the European Council defined this ambition as "the capacity to act autonomously when and where necessary, and with partners wherever possible". The 2022 Strategic Compass for Security and Defence reinforced this by highlighting the EU's "decision-making autonomy" as essential to security.[7]

4 Mario Damen, *EU strategic autonomy 2013-2023: From Concept to Capacity* , European Parliamentary Research Service, July 2022.

5 Dick Zandee, Bob Deen, Kimberley Kruijver, and Adája Stoetman, *European Strategic Autonomy in Security and Defence*, December 2020.

6 Mikkel Barslund, Daniel Gros *Europe's place in the global economy – what does the last half century suggest for the future?*, Intereconomics, 2016. European Central Bank, *ECB staff macroeconomic projections for the euro area*, March 2025.

7 Council of the European Union, *A Strategic Compass for Security and Defence For a European Union that protects its citizens, values and interests and contributes to international peace and security*, 21 March 2022.

The past decade has already exposed Europe's economic vulnerability, fundamentally changing perceptions on economic interdependence.[8] The COVID pandemic, intensifying trade competition, and a now two-time Trump administration altered assumptions about the security of supply chains, the reliability of trade relations and the resilience of the free market economy. As countries increasingly use economic tools for political leverage – such as control over critical minerals, technologies, and supply chains – the risk of external reliance is magnified.

What is Strategic Autonomy in relation to the European Defence Industry?

Russia's full-scale invasion returned the strategic autonomy debate to Europe's security interests. For years, the EU benefited from a 'peace dividend' – in the absence of a direct threat it relied on the United States (US) security umbrella while curtailing defence and R&D spending.[9] That model is no longer viable. Europe must build the capacity to "deal autonomously with immediate and future challenges and threats."[10]

This understanding of strategic autonomy is closely linked to the strength of the European defence industry. Simply put, Europe can only defend itself independently if it manufactures and controls its own materiel, ammunition and weapons. As early as 2013, the European Council stressed the need for a "more integrated, sustainable, innovative, and competitive European Defence Technological and Industrial Base (EDTIB)" to enhance its autonomy. The 2022 Strategic Compass for Security and Defence, reaffirmed the "decision-making autonomy of the EU" as a key prerequisite for achieving overall security.[11]

It should be noted that 'European' in this report refers to the European Union framework, encompassing EU institutions, EU-NATO cooperation, and the

8 Josep Borell, *Why European autonomy matters*, European External Action Service, December 2020.

9 European Commission, *The economic impact of higher defence spending*, May 2025.

10 European Council, *European defence readiness*, n.d.

11 Council of the European Union, *A Strategic Compass for Security and Defence For a European Union that protects its citizens, values and interests and contributes to international peace and security*, 21 March 2022

member state level. The analysis also considers the wider European context, including non-EU NATO members with significant defence-industrial capacity – such as the United Kingdom, Norway, and Türkiye – as well as Ukraine.

Defence readiness vs. strategic autonomy

Reaffirming a shift toward independent defence capacity, European allies formalised a landmark commitment to boost annual defence spending to 5% of GDP by 2035 at the 2025 The Hague NATO Summit.[12] Paradoxically, efforts to strengthen European defence readiness have deepened its reliance on the US as an arms supplier: American weapon exports to European NATO members rose from 52% to 64% between 2015-19 and 2020-24.[13] This dependence is particularly true for countries like the Netherlands, where over 90% of weapon imports comes from the US.[14]

In essence, European defence planning suffers from a structural mismatch: the urgent need for short-term capability acquisition (5-10 years) conflicts with the long-term objective of building defence-industrial strategic autonomy (10+ years). Spain's deliberation over American F-35 jets illustrates this tension; the potential purchase sparked doubts about its commitment to the Future Combat Air System (FCAS) project with France and Germany.[15]

In early 2026, tensions peaked in a NATO crisis after President Trump repeatedly claimed the United States should "own" Greenland – an autonomous territory of ally Denmark.[16] The episode intensified concerns about dependence on the

12 NATO, The Hague Summit Declaration, 25 June 2025. The 5% target follows a "dual-track" model: 3.5% of GDP for core military capabilities and 1.5% for "resilience and innovation," specifically to strengthen the domestic defence-industrial base and critical infrastructure.

13 Mathew George, Katarina Djokic, Zain Hussain, Pieter D. Wezeman and Siemon T. Wezeman, *Trends in International Arms Transfers*, Stockholm International Peace Research Institute (SIPRI), March 2025.

14 Sergio Nieto, *Nee, lang niet alle extra NAVO-miljarden gaan naar Amerikaanse wapenindustrie (maar wel een aanzienlijk deel)*, Pointer (KRO-NCRV), 2025.

15 Ultimately, Spain ruled out buying American over increasing disagreements with Washington. Leila Abboud and Barney Jopson, *Spain shuns US F-35 jets as tensions grow with Washington* Financial Times, August 8 2025.

16 Sarah Smith, *Trump Says US Needs to 'own' Greenland to Prevent Russia and China From Taking It*, January 10, 2026.

US and potential 'kill switches' that could ground European assets. While no direct evidence points to remote-disabling features, Europe relies heavily on US-controlled maintenance, software, and supply chains. For example, the F-35's ODIN software is contractually bound to American updates.[17] So could the US effectively restrict the use of certain European-operated weapons systems by withholding software updates, specific munitions, or critical spare parts? In practice, the answer is yes.[18]

Defining 'Strategic Autonomy in the European Defence Industry'

These risks are an important driver for Europe to gain greater control over its own weapons, systems, materials, and the industries behind them. At the same time, the deep-rooted reliance on the US underscores the need for stable transatlantic cooperation. Autonomy, in this sense, is not absolute and requires careful management of layered dependencies.[19]

In this report *Strategic Autonomy in the Defence Industry* rests on three core elements: *strategic* refers to safeguarding Europe's long-term security interests; *autonomy* denotes the ability to act independently when necessary; and the *defence industry* comprises the design, research, production, and sustainment of military equipment and systems. The report therefore defines the term as follows:

> *Strategic Autonomy in the European Defence Industry*
> *is the capacity of EU to make independent defence industrial decisions, supported by a cohesive and self-sufficient industrial base that is free from critical third-party dependencies, enabling it to function effectively on its own and safeguard long-term security and defence interests.*

17 Peder Schaefer, Europe's defence reliance on the US runs deeper than weapons, 02 December 2025

18 Anna Desmarais, *Can the US turn off European weapons? Experts weigh in on 'kill switch' fears* EuroNews, March 13 2025.

19 Geopol.uk,*Understanding Strategic Autonomy: Origins, Principles, and the Debate in a Multipolar World*, May 2025.

Outline

To disentangle the quest for more strategic autonomy in the European Defence Industry this report views various angels and aspects of the debate.

- Chapter 1 discusses the structure and capacity of the European defence industry in the air, maritime, and land domains.
- Chapter 2 discusses strategic enabling capabilities, areas where the EDTIB is considered lacking.
- Chapter 3 looks into the potential of dual-use goods and components and how their supply chains currently relate to strategic autonomy aspirations.
- Chapter 4 reviews the defence industry’s dependency on critical raw materials.
- Chapter 5 addresses the requirements for a stronger European defence industry.
- Chapter 6 examines dilemmas and opportunities for defence-industrial consolidation.
- Chapter 7 maps the institutional landscape underpinning challenges to EU strategic autonomy in defence.
- Chapter 8 outlines EU external defence-industrial partnerships, their limitations and potential.
- Chapter 9 synthesises key analytical insights and derives policy recommendations.

1 Structure and Capacity of the European Defence Industry

Davis Ellison and Ron Stoop

The European Defence Technological and Industrial Base or EDTIB is a complex web of institutional and governance mechanisms, as well as of industrial linkages across the EU and beyond. Supply chains are complex both within and outside the Union, with most military capabilities being reliant on a variety of subsidiaries spanning across the continent. It is important to stress the complexity of the EDTIB to counter a 20th century view of defence production, wherein a major system is built within a single, contained complex of factories in a bespoke military-industrial area. Take a single Leopard 2A8 tank, a mainstay of the German *Bundeswehr* and other European land forces. The Leopard has its parts developed in factories across Germany, France, Norway, Greece, Poland, Italy, and the Netherlands before its final assembly outside Munich. The Leopard's holding company, KNDS, is itself a Franco-German corporation headquartered in Amsterdam.

In this chapter we map industrial linkages across the land, sea, and air domains as well as across national boundaries. We focus on the production capacities of European industries, both today and projected into the future. From this mapping, we continue to explore supply-chain dependencies for systems and parts originating outside Europe. This includes consideration of dual-use products and critical raw materials. It then considers these dependencies and capacities to develop gap analyses in production and supply. These will be generalised gaps drawn from underlying analysis of domain-specific gaps, reproduced in part in the annexes below. Together, these domains will provide a holistic overview of the industrial and technological capabilities of the EU, from the very start of the supply chain to the final product and its employability in a theatre of war.

Note that estimating, and especially forecasting, defence industrial production capacity is a difficult task. Public procurement plans are subject to inflation, delays, overruns, and supply chain disruptions. With challenges in Eurozone growth, the risk of a recession could impact future capacity.[20] While European governments are increasingly willing to specify future demand, this is still rife with uncertainties that apparently make it difficult for the defence industry to fully scale up. Furthermore, in a monopsonic market (one in which there is one buyer, the government, and several sellers) the political risk remains that procurement decisions favour national industry, even if this is less economical.[21]

Table 1 Overview of EDTIB analysis framework

	Description	Examples	Importance for EDTIB
Military systems	Physical systems used in warfighting or support	Tanks, Fighter Jets, 155mm shells	Physical base upon which warfighting is based
Strategic Enabling capabilities	Auxiliary systems used for coordination, communication, disruption	Cyber capabilities, Electronic warfare (EW) capabilities, Communication systems	Key for autonomy in communication, situational awareness and combat delivery
Dual-use components	Components inside military systems or enabling technologies	Electrical circuits, permanent magnets, specialised alloys	Form backbone of all military systems, and fed into EU-based production processes
Critical Raw Materials	Materials in their raw or processed form, but not a component/alloy yet	Neodymium, Steel, Copper	Material basis for all components, technologies and platforms

1.1 Military Systems

This section provides an overview of production lines of major weapons systems across the land, sea, and air domains. The following section will address enabling technologies such as cyber and electronic warfare.

20 *Four Recession Scenarios Stalk the Eurozone's Fragile Growth Path*, Research Briefing (Oxford Economics, 2025), https://www.oxfordeconomics.com/resource/four-recession-scenarios-stalk-the-eurozones-fragile-growth-path/.

21 Renaud Bellais and Daniel Fiott, 'The European Defense Market: Disruptive Innovation and Market Destabilization', *The Economics of Peace and Security Journal* 12, no. 1 (2017), https://doi.org/10.15355/epsj.12.1.37.

1.1.1 Air domain

The air domain is often treated as the decisive arena early in a conflict, setting the stage for land and sea operations once air superiority is achieved or denied.[22] Despite the current predominantly land-based nature of the war in Ukraine, air capability continues to be vital, especially for NATO operations.[23] This study considers the EU industrial base for a few key enabling platforms, which are fighter jets, transport aircraft and unmanned aerial vehicles (UAVs).

The EU has a solid industrial footprint in fourth generation multirole fighters. The main platforms that are used in Europe are the French Rafale, the pan-European Eurofighter and the Swedish Gripen, all of which incorporate predominantly European technology and are developed by European firms. These models have been updated over the years, and benefit from using increasingly advanced missile technologies, more on which below. While some EU member states have predominantly used American fourth generation fighter jets (Belgium, Bulgaria, Denmark, the Netherlands, Poland, Greece, Hungary, Portugal), other European states have used European-made fourth generation fighter aircraft (France, Germany, Italy, Spain, Sweden, Czech Republic).

Nevertheless, many EU states are now consolidating around the fifth generation F-35, and future combat aircraft efforts based in Europe are currently split between the Franco-German-Spanish Future Combat Air System (FCAS) program and the Global Combat Air Programme (GCAP) partnership involving Italy, the United Kingdom and Japan. These developments are inimical to the development of a convincing, universally used EU fighter platform, given that the F-35 network continues to centre on US-based Lockheed Martin. This does not necessarily mean there is a US-owned 'kill switch' to the F-35, but rather the concern is the long-term lock-in effects of basing European airpower on a non-European source. Further, it is a challenge to maintain supply across the European F-35 network. For example, a Dutch F-35 cannot use spare parts from

22 Jeremy Shapiro, 'Air of Superiority: What the Wars in the Middle East and Ukraine Can Teach Europeans about NATO Readiness', ECFR, 3 July 2025, https://ecfr.eu/article/air-of-superiority-what-the-wars-in-the-middle-east-and-ukraine-can-teach-europeans-about-nato-readiness/.

23 'New NATO Joint Air Power Strategy Reflects Central Role of Air in NATO's Collective Defence and Crisis Management', Ac.Nato.Int, accessed 16 November 2025, https://ac.nato.int/archive/2018/new-nato-joint-air-power-strategy-recognises-central-role-of-air-forces-in-natos-collective-defence-and-crisis-management-.aspx.

a Belgian or German airbase, as the supply line runs centrally through Lockheed Martin.

In drones, the EU manufactures a range of small UAVs through initiatives such as the Drone Coalition, led by Latvia and the UK, but these activities remain highly fragmented with limited standardisation in production. The largest capability gaps in Europe appear in medium- to long-range or high-altitude attack and surveillance drones. European forces lack sufficient medium-altitude long-endurance (MALE) and high-altitude long-endurance (HALE) strike and surveillance drones, and the few they have are vulnerable in contested airspace. They still depend heavily on US and Israeli systems, as European programmes have not reached the needed production scale or institutional autonomy.[24] Moreover, a Ukrainian drone commander warned in early 2025 that NATO forces remain unprepared for modern drone warfare and are struggling to keep pace with the scale and speed of unmanned attacks seen in Ukraine.[25] Worth mentioning are several programmes in Ukraine itself where EU member states co-develop and co-produce drones along with Ukrainian counterparts, such as the Dutch-Ukrainian joint development project.[26]

For transport aircraft, the EU maintains a partial production base through Airbus's A-400M multirole transport aircraft. It also relies on several legacy platforms for tactical airlift such as the American C-130 Hercules or the Franco-German Transall C-160.[27] Given the age of these tactical transport aircraft, and

24 'Minding the Drone Gap: Drone Warfare and the EU | European Union Institute for Security Studies', 11 October 2024, https://www.iss.europa.eu/publications/briefs/minding-drone-gap-drone-warfare-and-eu.

25 Max Hunder, 'NATO Armies Unprepared for Drone Wars, Ukraine Commander Warns', World, *Reuters*, 5 March 2025, https://www.reuters.com/world/nato-armies-unprepared-drone-wars-ukraine-commander-warns-2025-03-05/.

26 Kitsoft, 'Cabinet of Ministers of Ukraine – Ukraine's Defence Minister Announces Launch of Joint Ukrainian–Dutch Drone Production', accessed 7 January 2026, https://www.kmu.gov.ua/en/news/ministr-oborony-ukrainy-oholosyv-pro-spilne-ukrainsko-niderlandske-vyrobnytstvo-bezpilotnykiv; *First Joint Co-Production of Ukrainian Drones in Europe Launched by Quantum Systems and Frontline Robotics*, News, 15 December 2025, https://quantum-systems.com/news/first-joint-co-production-of-ukrainian-drones-in-europe-launched-by-quantum-systems-and-frontline-robotics/.

27 Colin Wall and John Christianson, *Europe's Missing Piece The Case for Air Domain Enablers* (CSIS, 2023), 4, https://csis-website-prod.s3.amazonaws.com/s3fs-public/2023-04/230417_Wall_European_Enablers.pdf?VersionId=iUbPOX8mfPa.UiJqPlb.PWItCb08sjur.

initiatives such as the Future Medium-Size Tactical Cargo (FMTC) not expected to be operational before 2035, a number of countries such as Portugal, the Netherlands, Hungary, and Sweden have started to operate the Brazilian C-390 Millennium, a medium transport aircraft for tactical airlift.[28] In operational terms, Europe continues to be dependent on American capabilities in the airlift domain due to a lack of domestic fleet size. For example, whereas the US has an inventory of strategic airlift aircraft of around 230, Europe only reaches a collective fleet size of 145.[29]

Manufacturers of heavy lift helicopters are also lacking. European states are forced to buy American products such as Chinook-47 helicopters if they want to field such systems. As is the case for the F-35, it is not only the platform itself that creates the dependency, but rather the life-cycle maintenance and software updates that come from American firms.

In general, the air domain is well-serviced when it comes to fourth generation aircraft, which presently form the backbone of European airpower. Beyond this, there remain significant dependencies that risk being further baked into defence architectures. Although European projects such as FCAS and GCAP are progressing, it is important to highlight that the planned service life of F-35s is 30 years, with the US intending to operate the system to 2088.[30] Such a service life includes software updates, maintenance life cycles, and repairs that are reliant on a US-based contract network. This planned reliance on US production across much of Europe runs counter to the goal of strategic autonomy.

1.1.2 Maritime domain

The EU industrial base in the maritime domain spans a variety of combat systems such as aircraft carriers, destroyers, frigates, corvettes, cruisers, amphibious

28 'European Defence Agency Supports Two PESCO Projects on Future European Airlift Capabilities', 31 January 2023, https://www.armyrecognition.com/archives/archives-aerospace-defense/aerospace-defense-2023/european-defence-agency-supports-two-pesco-projects-on-future-european-airlift-capabilities. Thomas Liebe, *Europe's Airlift Rejuvenation: Is It Enough? – European Security & Defence*, Allgemein, 12 June 2025, https://euro-sd.com/2025/06/allgemein/44781/europes-airlift-rejuvenation-is-it-enough/. Colin Wall and John Christianson, *Europe's Missing Piece The Case for Air Domain Enablers*.

29 Colin Wall and John Christianson, *Europe's Missing Piece The Case for Air Domain Enablers*, 4.

30 U. S. Government Accountability Office, 'F-35 Sustainment: Costs Continue to Rise While Planned Use and Availability Have Decreased | U.S. GAO', 15 April 2024, https://www.gao.gov/products/gao-24-106703.

assault ships, submarines, patrol vessels and support ships. This study looks at a few key platforms: destroyer-frigates and submarines. The EU retains strong naval production capacity across countries such as Italy, Spain, France, Germany, the Netherlands and Poland, with firms like Fincantieri until recently building vessels for the US.[31] European firms also remain competitive in global frigate and submarine exports.

European frigate production is concentrated in a small group of major shipbuilders with established industrial capacity across the continent. Italy's Fincantieri stands out as one of the most capable producers, building multiple classes such as FREMM variants and the Constellation-class for export customers, reflecting the strong outward orientation of the sector.[32] France's Naval Group is another central player, also delivering FREMM and the FDI series for both domestic needs and partners like Greece.[33] The Dutch company Damen contributes to European output by producing frigates for the Netherlands and Germany that are largely constructed in German and Romanian yards.[34] Germany's Blohm+Voss and ThyssenKrupp Marine Systems are key producers of new frigates for the German Navy.[35] Spain's Navantia continues to produce advanced frigates for the Spanish Navy and Poland is building new frigates in

31 wuzh, 'Trump-Class Warships & Fincantieri Cancellations: Uncertainties Cloud S. Korean Shipbuilders' U.S. Push', *iMarine*, 5 January 2026, https://www.imarinenews.com/30956.html.

32 Fincantieri, *Annual Report* (2022), https://www.fincantieri.com/globalassets/investor-relations/bilanci-e-relazioni/2022/eng_fincantieri_annual_report_2022.pdf. 'Constellation Class Frigate | Fincantieri', accessed 4 December 2025, https://fincantierimarinegroup.com/products/constellation-class-frigate/.

33 'Greece Orders a Fourth FDI Frigate from Naval Group – Naval News', accessed 4 December 2025, https://www.navalnews.com/naval-news/2025/11/greece-orders-a-fourth-fdi-frigate-from-naval-group/.

34 'Introducing the F126 Frigate Project | Damen', accessed 4 December 2025, https://www.damen.com/vessels/defence-and-security/custom-built-combatants/introducing-the-f126-frigate-project. 'Romania to Build 6 Frigates for the Netherlands and Belgium', *Militarnyi*, n.d., accessed 4 December 2025, https://militarnyi.com/en/news/romania-to-build-6-frigates-for-the-netherlands-and-belgium/.

35 'Thyssenkrupp Marine Systems and NVL Agree on Cooperation to Build New Frigates for the German Navy', Thyssenkrupp, accessed 4 December 2025, https://www.thyssenkrupp.com/en/newsroom/press-releases/pressdetailpage/thyssenkrupp-marine-systems-and-nvl-agree-on-cooperation-to-build-new-frigates-for-the-german-navy-280844.

Gdańsk based on a British design.[36] Overall, European capacity is robust but dispersed, relying on a handful of major shipyards supported by smaller national programs.

European submarine production is concentrated among a few specialised shipyards with long-standing expertise and export reach. Naval Group in France is a central producer, delivering Suffren-class submarines for its own navy and developing a diesel-electric variant for the Netherlands.[37] It also maintains a strong export portfolio through the Scorpène line which has been supplied to India, Brazil and Indonesia.[38] ThyssenKrupp Marine Systems in Germany is another major builder, producing classes such as the Invincible and cooperating with Norway's Kongsberg on the 212CD programme.[39] Saab in Sweden manufactures advanced submarines, while Spain and Italy both have their own design and production capabilities. Nevertheless, construction timelines remain lengthy, with many European submarines scheduled for delivery only within the next five to ten years.

Contrary to airborne platforms, most European states either field domestically produced systems or purchase platforms of European origin. However, European navies still need to adapt to a changing security environment that adds more demand to their navies, both stemming from the increased likelihood of a conflict

36 Admin A, 'Navantia Begins the Construction of the New F-110 Class Frigate for the Spanish Navy', Defense Here – Savunma Haberleri, 8 April 2022, https://defensehere.com/navantia-begins-the-construction-of-the-new-f-110-class-frigate-for-the-spanish-navy. NavyLookout, *Miecznik – Poland's Ambitious Adaptation of the Arrowhead 140 Frigate – Navy Lookout*, 24 February 2025, https://www.navylookout.com/miecznik-polands-ambitious-adaptation-of-the-arrowhead-140-frigate/.

37 'Naval Group Rolls out 4th Suffren-Class Submarine – Naval News', accessed 4 December 2025, https://www.navalnews.com/naval-news/2025/05/naval-group-rolls-out-4th-suffren-class-submarine/. 'Orka Class Attack Submarine SSK – Royal Netherlands Navy', accessed 4 December 2025, https://www.seaforces.org/marint/Netherlands-Navy/Submarine/Orka-class.htm.

38 'Delivery of the Third and Launching of the Fourth Brazilian Scorpène® Submarines', Naval Group, accessed 4 December 2025, https://www.naval-group.com/en/delivery-third-and-launching-fourth-brazilian-scorpener-submarines. 'India Submarine Capabilities', *The Nuclear Threat Initiative*, 25 March 2025, https://www.nti.org/analysis/articles/india-submarine-capabilities/.

39 Alex Luck, 'Four Type 212CD Approved As Germany Increases Order', *Naval News*, 19 December 2024, https://www.navalnews.com/naval-news/2024/12/germany-approves-additional-four-type-212cd-submarines/.

with a traditional navy and technological advancements such as in the field of precision guided munitions.[40]

These developments increase demand for defensive capabilities since naval surface ships are increasingly vulnerable to anti-ship missiles and attack drones. This is the more pressing since European navies tend to be comparatively lightly armed with shallow magazines and launch platforms to defend themselves.[41] Furthermore, most navies do not have long range offensive missiles to engage targets at a distance.[42] A persistent issue for European defence efforts is the high degree of fragmentation of the European defence market. This challenge is particularly acute in the maritime domain, where there is little cross border cooperation and co-developed systems need to grapple with conflicting export regulations between partner nations.[43]

1.1.3 Land domain

Out of the many types of land systems that could be covered here, we selected four: tanks, Infantry Fighting Vehicles (IFV), self-propelled howitzers and 155mm artillery munitions. The first three were selected given their backbone role as combat capabilities for land forces and receive detailed coverage. Furthermore, the EU has a robust industry for these types of systems, particularly centred around giants KNDS and Rheinmetall. These two company's products include the Leopard tank variants, the Puma, Boxer, and Fennek IFVs and PzH 2000 howitzer, system in wide use across Europe and abroad. The 155mm munitions is an example of a consumable playing an important role in the Ukraine war, and is covered in Box 1 below.

Europe's tank production base is dominated by Franco-German KNDS and German Rheinmetall Landsysteme. Both companies partner with other national companies to develop products outside of their main production lines. An

40 Jeremy Stöhs, *How High? The Future of European Naval Power and the High-End Challenge* (CENTRE FOR MILITARY STUDIES, 2021), 31, https://cms.polsci.ku.dk/publikationer/hvor-hoejt-fremtiden-for-europaeisk-maritim-militaermagt-og-udfordringen-fra-stigende-kapacitets taerskler/CMS_Report__2021_1_-_How_High_-_The_Future_of_European_Naval_Power__updated_15_FEB_2021_.pdf.

41 Jeremy Stöhs, *How High? The Future of European Naval Power and the High-End Challenge*, 36.

42 Jeremy Stöhs, *How High? The Future of European Naval Power and the High-End Challenge*, 39-40.

43 Luca Urciuolo, *Navigating European Naval Power: The Role of the European Patrol Corvette in EU Maritime Security* (2024), 4, https://finabel.org/wp-content/uploads/2024/11/IF-PDFs-Luca-Urciuolo-21-11-.pdf.

example is the Rheinmetall-BAE Systems Land joint venture formed to develop the replacement to the UK's Challenger 2 tank. Across Europe, the Leopard system – with its nationally tailored variants – is the leading tank platform. Exceptions are the French LeClerc (from KNDS), the Polish procurement of the South Korean K2 Black Panther, and the planned Romanian purchase of American M1 Abrams tanks. Towards the future, there is the Franco-German Main Ground Combat System (MGCS) project aimed to replacing both the Leopard and LeClerc tank with a common system, with others such as the Netherlands and the UK joining in as observers. As of this writing, MGCS is stalled in discussions, with no contracts developed or suppliers identified. Given the amount of tank procurement ongoing, including by France and Germany, MGCS is at risk of becoming overtaken by events.

There is a much greater variety across IFVs, differentiating in e.g., amphibious, tracked/non-tracked. Procurement demand has increased markedly since 2022, with Germany and the Netherlands looking to jointly procure and produce 222 Schakal variants of the Boxer IFV (made jointly by KNDS and Rheinmetall), coordinated through the Organisation for Joint Armament Cooperation (OCCAR).[44] Meanwhile, Denmark, Estonia, Finland, Lithuania, the Netherlands, Norway and Sweden have joined to procure CV90 IFVs (made by the Swedish subsidiary of BAE Systems), with each purchasing different numbers to replace systems donated to Ukraine. This procurement plans to specifically acquire the CV9035 MkIIIC variant, which can take advantage of existing assembly lines to shorten production lead times.[45] Similar to the MGCS above, there is a PESCO project led by Italy and backed by Greece and Slovakia to create common Armoured Infantry Fighting Vehicle / Amphibious Assault Vehicle / Light Armoured Vehicle (AIFV/AAV/LAV).[46] Also similar to MGCS, the drive to acquire off the shelf systems like the CV90 may overtake this project before it delivers.

44 Richard Thomas, 'New European Boxer Deal Includes Schakal IFV Production', Army Technology, 20 October 2025, https://www.army-technology.com/news/new-european-boxer-deal-includes-schakal-ifv-production/.

45 'Förprojektering För Ersättningsanskaffning Av Stridsfordon', Försvarets Materielverk, 11 October 2023, https://www.fmv.se/aktuellt--press/aktuella-handelser/forprojektering-for-ersattningsanskaffning-av-stridsfordon/.

46 'Armoured Infantry Fighting Vehicle / Amphibious Assault Vehicle / Light Armoured Vehicle (AIFV/AAV/LAV)', European Union PESCO Secretariat, 2025, https://www.pesco.europa.eu/project/armoured-infantry-fighting-vehicle-amphibious-assault-vehicle-light-armoured-vehicle/.

On self-propelled howitzers, two KNDS systems are widely used across Europe: the PzH2000 and the CAESAR. The French-built CAESAR in particular has increased production markedly, with a reported monthly output of eight systems per month. Much of this has been sent to Ukraine, with the 2025 output being entirely dedicated for delivery to Kyiv.[47]. In the Ukraine war, where artillery has been pivotal for both sides, expenditure and attrition of artillery systems has been significant. This generates a heavy need for replacement parts, especially barrels which overheat and degrade over time. For reference, by 2023 the Ukrainian Army was firing approximately 6,000-7,000 artillery shells daily. The same reporting noted that Russia was expending potentially triple this amount.[48] As drones have become increasingly important, these relatively static artillery systems, though mobile, present high value targets.[49] Nevertheless, few have been lost in combat, partly due to dedicated repair capacity in European partner countries.

Another type of artillery system, the multiple launch rocket system (MLRS), has played a significant role in Ukraine and constitutes a serious dependency for Europe. The American High Mobility Artillery Rocket System (HIMARS) or the Israeli Precise & Universal Launch System (PULS) are a point in case. Currently there are no viable European alternatives, even though several systems are currently under development. France is reportedly testing its domestically developed rocket artillery system mid-2026.[50] Lockheed Martin and Rheinmetall are jointly developing the Global Mobile Artillery Rocket System (GMARS) by combining technology of the original HIMARS with a new chassis of Rheinmetall

47 'France Commits All Its 2025 CAESAR Howitzer Production to Ukraine', *Kyiv Post* (Kyiv), 14 May 2025, https://www.kyivpost.com/post/52629; Stéphanie Gallo Triouleyre, 'Blindés : KNDS Prêt à Monter La Cadence', Defense-Aeronatique, *La Tribune* (Paris), 7 April 2025, La Tribune Aura Edition, https://www.latribune.fr/auvergne-rhone-alpes-75/strategie/defense-aeronautique/2025-04-07/blindes-knds-pret-a-monter-la-cadence-1021945.html.

48 'NATO Chief Says Ukraine's Ammunition Use Outstripping Supply', *AP News* (New York), 13 February 2023, https://apnews.com/article/russia-ukraine-nato-politics-jens-stoltenberg-business-c50b44b430ae86f289baee9da5e35345.

49 Stacie Pettyjohn, 'Drones Are Transforming the Battlefield in Ukraine But in an Evolutionary Fashion', War on the Rocks, 5 March 2024, https://warontherocks.com/2024/03/drones-are-transforming-the-battlefield-in-ukraine-but-in-an-evolutionary-fashion/.

50 Rudy Ruitenberg, 'France Plans to Test Homemade HIMARS Alternative by Mid-2026', Defense News, 10 April 2025, https://www.defensenews.com/global/europe/2025/04/10/france-plans-to-test-homemade-himars-alternative-by-mid-2026/.

and is expected to be operational at the end of 2025.[51] Israeli arms manufacturer Elbit systems and KNDS are taking a similar approach with the "EuroPULS" with full operationality to be realised in 2027.[52]

As of this writing, production capacity across all three systems is set to benefit from defence spending uplifts across major platform producing states, with new factories being built and more serial production license agreements for local manufacturing. For example, the Czech Republic-based Czechoslovak Group (CSG) is beginning to produce CAESAR systems in partnership with KNDS, anticipated to increase yearly output of the CAESAR from approximately six to twelve per year.[53] This is in addition to the increased output cited above, likely to offset deliveries to Ukraine, though it has been reported that the offset has yet to be achieved and production has slowed. On tanks, planned delivery is even slower. Norway will receive its 2023 Leopard 2 order of 54 in the 2026-2028 timeframe.[54] 105 Leopard 2's for the German *Bundeswehr* ordered in 2024 are expected to be available only by 2030.[55] With the wider variety of IFVs, it is more difficult to gauge production capacity. Because IFSs are less complex, output is higher and delivery times likely shorter than for artillery systems or tanks. In central Europe, there are a number of planned expansions to land forces' IFV fleets, including in Germany (579 *Pumas* and 1,123 *Lynxs* by 2040) and 1,400 (*Borsuks*), and the Czech Republic and Slovakia (approximately 400 CV90s).

51 Jérôme Brahy, 'Eurosatory 2024: Rheinmetall and Lockheed Martin's GMARS MLRS Steps up as European Competitor to M142 HIMARS', accessed 24 November 2025, https://www.armyrecognition.com/archives/archives-land-defense/land-defense-2024/eurosatory-2024-rheinmetall-and-lockheed-martins-gmars-mlrs-steps-up-as-european-competitor-to-m142-himars.

52 'How Europe Is Vying for Rare Earth Independence from China', 6 August 2025, https://www.bbc.com/news/articles/cm2zp6m4gy7o.

53 Juster Domingo, 'Caesar 8×8 Howitzer to Begin Production in Czech Republic', The Defense Post, 30 May 2025, https://thedefensepost.com/2025/05/30/caesar-8x8-knds-czech-republic/#:~:text=KNDS%20has%20announced%20that%20the,Fair%20in%20Brno%2C%20southern%20Czechia.

54 Paolo Valpolini, 'Norway Orders Delivery of 54 New LEOPARD 2 A7 Main Battle Tanks', *EDR Magazine*, 17 February 2023, https://www.edrmagazine.eu/norway-orders-delivery-of-54-new-leopard-2-a7-main-battle-tanks.

55 Guntram Wolff et al., *Fit for War in Decades: Sluggish German Rearmament versus Surging Russian Defence Production* (Bruegel, 2024), https://www.bruegel.org/analysis/fit-war-decades-sluggish-german-rearmament-versus-surging-russian-defence-production#:~:text=For%20the%20main%20battle%20tank,be%20fully%20delivered%20by%202030.

These long lead times impact capability choices, favouring non-European off the shelf products. European nations have placed large orders for K-2 tanks (84) and K-9 artillery (192) from South-Korea and for Abrams battle tanks (144) and troop carriers (1200) from the US. Purchases of land combat systems from outside Europe are motivated by a variety of different reasons. In 2022, for example, there was a sense of urgency in some European capitals to fill capability gaps quickly instead of reflecting on long-term European capacity shortfalls and lack of know-how. Most land systems were destined for Poland, rapidly expanding its armed forces since Russia's full-scale invasion of Ukraine early that year.[56] The acquisition of South Korean defence products over European competitors is a function of the speed at which Poland's capability gaps can be filled.[57] Out of an order of 180 placed in 2022, Korea's Hyundai Rotem had already delivered 84 K-2 tanks at the end of 2024 and was reportedly able to produce 10 tanks per month by July 2025.[58]

In land systems, then, there is a mixed situation for future production capacity. Given that much of the existing data is skewed because of the ongoing materiel support to Ukraine, the present situation is not considered categorical. Since the Ukraine war will inevitably end, the production capacity available for European armies for each of the types of systems discussed above is set to increase in over the coming decade. Given their relative complexity and the high demand for a smaller number of products across the continent, the increase will be slower for tanks. To some extent, off the shelf, non-EU provision will likely persist into the future, as is case for fragmentation due to member states continuing to develop national solutions. However, the general picture is one of markedly improved, independent European capacity by the mid-2030s.

56 Krystyna Marcinek and Scott Boston, *Polish Armed Forces Modernization: A New Cornerstone of European Security?* (RAND Corporation, 2025), 2, https://www.rand.org/pubs/research_reports/RRA2971-1.html.

57 Stuart Dee and Kiran Suman-Chauhan, *Missiles, Markets, and Mutual Interests: Poland and South Korea's Evolving Defence-Industrial Cooperation* (RAND Corporation, 2025), https://www.rand.org/pubs/commentary/2025/09/missiles-markets-and-mutual-interests-poland-and-south.html.

58 ; 'South Korea Directs Entire K2 Black Panther Tank Production to Poland amid Exclusive Production Shift', accessed 24 November 2025, https://www.armyrecognition.com/news/army-news/2025/south-korea-directs-entire-k2-black-panther-tank-production-to-poland-amid-exclusive-production-shift.

Box 1. 155mm artillery ammunition production – a labyrinthian maze
Production capacities for a crucial capability, 155mm artillery ammunition, is heavily used in the Russo-Ukrainian war and is a mainstay of modern artillery systems. It is treated separately here due to its especially complex procurement, development, and delivery web across Europe. 155mm munitions have been heavily in the Russo-Ukrainian war and are a mainstay of modern artillery systems.

What adds to the complexity is the variety of 155mm munitions used across Europe. They are:

- High-explosive (Unitary HE) rounds
- Extended-range (including ERFB, ERFB-BB, and V-LAP) rounds
- Rocket-assisted projectiles
- Guided/precision rounds
- Cluster/submunition rounds
- Sensor/smart submunition rounds
- Anti-armour rounds
- Mine-scattering/area denial rounds
- Illumination
- Smoke/signalling
- Training/inert
- Practice-with-Telemetry
- Penetration/bunker-busting
- Thermobaric/incendiary

In a single case, the Czechoslovak Group (CSG), a major 155mm supplier to NATO states and Ukraine, has the capacity to produce 100,000 shells per year. To highlight the complexity of production chains, that ammunition supplied to Ukraine is only 50% built in the Czech Republic (fuses, chargers, and initiators), while the final assembly is done in Ukraine itself. Widespread use of foreign licensing has helped to increase production since 2022 by making more facilities available for final assembly.

Despite this, current production has lagged as the building of new facilities has slowed. New plants in Sweden and Finland are expected to only come online in 2027 and 2028, respectively, due primarily to permitting procedures and the need to build far from cities. Meeting the European

Commission's production target of 2 million per year will remain a challenge, especially given much higher Russian and North Korean output.

Germany's 2026 defence budget however could remedy some of this, with reports highlighting a significant investment in European munitions production, with German firms (almost certainly Rheinmetall and KNDS) seemingly playing a dominant role in this. The challenge for all, both government and industry, is not only ensuring sufficient production capacity to fill existing orders, but also to stockpile munitions and maintain these stocks over time. Whether this can be done effectively has yet to be seen.

2 Strategic Enabling Capabilities

Davis Ellison and Ron Stoop

The EDTIB has significant gaps in the ability to manufacture and field 'strategic enablers'. While there is no shared definition, strategic enablers are commonly understood as capabilities that allow other combat functions to work.[59] Key strategic enablers are integrated missile defence capabilities, cyber and information warfare, command and control infrastructure, electronic warfare and space support. This chapter provides a brief overview of the EU's strategic enabling capabilities and the capacity gaps that exist.

2.1 Integrated Missile Defence and Long-range Strike Capabilities

Europe has a production base for short to medium-range missile and launcher capabilities, primarily through MBDA's Franco-Italian industrial base, which produces the Mistral, Aster and Exocet systems. Additional capacity is present in Norway's Kongsberg, maker of the Naval Strike Missile, and Sweden's Saab. Overall production figures remain opaque: missile manufacturers rarely disclose output volumes.

For medium to long-range strike capability, Europe has launched several initiatives, but progress is hindered by fragmentation. One initiative is the German-led Sky Shield initiative, which incorporates the US Patriot and Israeli Arrow-3 systems, as well as the German-Swedish IRIS-T system. This initiative is supported by 18 EU member states plus others such as the UK, Türkiye, and Norway. The alternative is the Franco-Italian SAMP/T, Europe's own medium-range air-defence system, developed by MDBA. In 2025, after the US-Denmark dispute over Greenland, Denmark opted not to purchase the Patriot system and instead selected the SAMP/T air-defence platform, a move away from the US-

59 Colin Wall and John Christianson, *Europe's Missing Piece The Case for Air Domain Enablers*, 9.

based medium range missile system.[60] Despite this, a political and industrial split remains between Germany and France-Italy, slowing the emergence of a unified European missile ecosystem.

For the foreseeable future, the EU will continue to depend heavily on non-European suppliers for missile capabilities, particularly US and Israeli systems such as Tomahawk for long-range strike, HIMARS for precision fires, and the exo-atmospheric Arrow-3 for high-altitude missile defence. The acquisition of anti-tank missile systems like the Israeli Spike or the American Javelin is probably also due to the availability of these missiles. European alternatives like the French "Missile Moyenne Portee" (MMP) are less attractive because production can less readily be ramped up.[61] Moreover, European arms manufacturers are currently developing a comparable capability to the Israeli and American multiple rocket launchers.[62] For the time being, European states are locked into buying the necessary American ammunition for rocket launchers. A similar logic is probably at play in the choice to purchase the American AIM 120 air-to-air missiles. While the European Meteor missile could be an alternative, the missile will only be integrated with the American F-35 in the early 2030s.[63]

2.2 Cyber and Information warfare

Cyber and information warfare are becoming increasingly important on the battlefield. The 'production' part of cyber capabilities could be seen as a combination of necessary hardware and software to enable effective cyber warfare operations. Operational use and 'production' are closely aligned, with virtual assets (code) being developed and used almost simultaneously. In terms of industrial and technological capacity, this means cyber warfare requires

60 Rudy Ruitenberg, 'Denmark Picks French-Italian SAMP/T Air Defense System over Patriot', Defense News, 12 September 2025, https://www.defensenews.com/global/europe/2025/09/12/denmark-picks-french-italian-sampt-air-defense-system-over-patriot/.

61 Doug Richardson, 'The World of Saint Javelin', 20 March 2023, https://euro-sd.com/2023/03/articles/30023/the-world-of-saint-javelin/.

62 Rudy Ruitenberg, 'France Plans to Test Homemade HIMARS Alternative by Mid-2026', Defense News, 10 April 2025, https://www.defensenews.com/global/europe/2025/04/10/france-plans-to-test-homemade-himars-alternative-by-mid-2026/.

63 'Germany Pays More for AIM-120 Than Its Own Meteor But There's No Other Option | Defense Express', 26 September 2025, https://en.defence-ua.com/analysis/germany_pays_more_for_aim_120_than_its_own_meteor_but_theres_no_other_option-15949.html.

investments into physical systems (secure data centres, high-speed networks, encryption, space-based systems), personnel, and continuously updated and experimental software.

Cyber warfare employs a range of offensive and defensive tactics. A cyberattack could consist of studying the target and looking for weaknesses, scanning systems and gathering personal information. A break in may follow, often through tailored spear-phishing or by placing malware on websites the target is likely to visit. Once inside, attackers communicate with the compromised system, install more malware and may spread the attack. Finally, they collect, encrypt and extract the stolen data.[64] Defensive cyber measures include placing beacons on (important) digital files. These beacons provide information on the details of the file's current location and can thus help to discover the location of stolen or leaked files. Another technique is to intentionally place malware on certain files that are normally not interacted with. In case the file gets accessed, the malware could, for example, send back information about the attacker.[65]

Many countries have established dedicated cyber commands with their own command structures and authorities to coordinate cyber warfare. There are a variety of legislative and judicial considerations related to cyber operations, such as compliance with martial law. What makes cyberspace stand out is that both civil and military actors make use of it, therefore creating a clear linkage between the two sectors and necessitating cooperation and alignment on cyber policies.[66]

The EDTIB required for cyber warfare remains strongly dependent on foreign systems and expertise. Despite its invisible nature to its users, it is important to be aware of the physical infrastructure that underlies all cyber warfare. Even though data centres are physically present in Europe, they are often owned

64 Joseph Gardiner et al., *Command & Control Understanding, Denying and Detecting* (University of Birmingham, 2014), https://arxiv.org/ftp/arxiv/papers/1408/1408.1136.pdf.

65 Donnie W. Wendt, 'Part III. Active Cyber Defense to Slow the Adversary', in *The Cybersecurity Trinity: Artificial Intelligence, Automation, and Active Cyber Defense* (Apress, n.d.), accessed 19 November 2025, https://learning.oreilly.com/library/view/the-cybersecurity-trinity/9798868809477/html/Part_3.xhtml.

66 'CIMIC in the Cyberspace Domain', *CIMIC COE*, n.d., accessed 9 January 2026, https://www.cimic-coe.org/publications/cimic-in-the-cyberspace-domain/.

by US companies, rely on US firmware and use US software.[67] Through this ownership structure, EU data centres actually have to comply with US law.[68] Furthermore, Europe imports most of its auxiliary hardware (chips, components) and a substantial amount of its software components.[69]

Cloud computing is essential for armed forces because it supports scalable data processing for cyber warfare, including AI, automation and big-data analytics. Core physical components of cloud infrastructure are servers, storage systems and physical networking equipment such as switches and routers.[70] Another important physical layer of cloud infrastructure are fibre optic cables that transport internet traffic and can be sabotaged in wartime.[71]

The hyperscale cloud market is dominated by US firms such as AWS, Microsoft and Google, leaving Europe dependent on external providers. European cloud companies offer mostly niche services, with OVHcloud being the largest regional player.[72] European attempts to build independent military cloud systems still rely heavily on US hyperscale services. The UK's MODCloud uses Microsoft Azure, and Germany's pCloudBw depends on Google Cloud for key functions. France follows a hybrid model in which Thales operates a sovereign cloud that uses Google's hyperscale infrastructure but remains controlled and hosted in France.[73]

67 Aris Richardson et al., 'How Sovereign Is Sovereign Compute? A Review of 775 Non-U.S. Data Centers', arXiv:2508.00932, preprint, arXiv, 30 July 2025, https://doi.org/10.48550/arXiv.2508.00932.
Ray Le Maistre, 'Europe's Cloud Players Are Minnows on Their Home Turf', TelecomTV, 28 July 2025, https://www.telecomtv.com/content/digital-platforms-services/europe-s-cloud-players-are-minnows-on-their-home-turf-53521/.

68 'CLOUD Act – What It Means for EU Data Sovereignty', accessed 9 January 2026, https://wire.com/en/blog/cloud-act-eu-data-sovereignty.

69 'European Software and Cyber Dependencies | Think Tank | European Parliament', accessed 9 January 2026, https://www.europarl.europa.eu/thinktank/en/document/ECTI_STU(2025)778576.

70 https://cloudnativejourney.wordpress.com/2023/06/23/a-comprehensive-look-at-hardware-components-in-a-cloud-computing-data-center/

71 https://www.atlanticcouncil.org/wp-content/uploads/2020/09/CLOUD-MYTHS-REPORT.pdf (PAGE 21) https://www.bbc.com/news/articles/cn52rglxr62o

72 'Top 10 Cloud Computing Providers in Europe | 2025', Claight Corporation (Expert Market Research), accessed 7 October 2025, https://www.expertmarketresearch.com/blogs/top-cloud-computing-it-companies-in-europe.

73 *Closing the Software Gap* (IISS, n.d.), 2-3, https://www.iiss.org/globalassets/media-library---content--migration/files/publications---free-files/strategic-dossier/pds-2025/chapters/iiss_progress-and-shortfalls-in-europes-defence_-2025_ch-2-closing-the-software-gap.pdf.

In practice, it appears challenging for European countries to develop uniquely sovereign software solutions for their armed forces without relying on capabilities from the US. In order to not rely on US-based Palantir, France initiated the ARTEMIS.IA program, (Architecture de Traitement et d'Exploitation Massive de l'Information Multi-Sources et d'Intelligence Artificielle) to make use of the massive amount of data from various sensors and make it available for the French Ministry of Defence.[74] However, the program still needs to be fully deployed and has faced several challenges such as choosing the right contractors through a competitive bidding process, and integrating startups into ARTEMIS.IA. This showcases even relatively technological capable countries such as France face challenges to develop sovereign and sophisticated technological platforms.[75]

These challenges are, however, not unique to France. The UK possesses some of the most advanced digital capabilities but does not have sufficient digital skills to develop its digital capabilities entirely on its own, in part due to recruitment challenges arising from discrepancies in salaries between the private and public sector.[76] Consequently, just as France, the UK relies to some extent to US-based hyperscale cloud infrastructure and struggles to harness the full potential of small and medium-sized enterprises into its procurement cycles. Furthermore, the Ministry of Defence often lacks a specific vision of what exact objectives its desired technologies should be able to deliver, resulting in delayed deliveries and increasing costs.[77]

Europe also faces challenges in delivering tactical cloud solutions that combine cloud services with localised computing of data (edge computing) for decentralised communication of units on the frontline. However, it is building capacity in this segment. Major programmes like FCAS and the Main Ground Combat System will rely on tactical clouds to integrate data from onboard sensors and other systems. Airbus is developing a multi-domain combat cloud to

74 Kévin Martin and Lucie Liversain, 'A Winding Road Before Scaling-Up? Defense AI in France', in *The Very Long Game: 25 Case Studies on the Global State of Defense AI*, ed. Heiko Borchert et al. (Springer Nature Switzerland, 2024), 247, https://doi.org/10.1007/978-3-031-58649-1_11.

75 Noah Sylvia, *European Digital Defence Priorities in an Uncertain World* (RUSI, 2025), 11, https://static.rusi.org/european-digital-defence-priorities-march-2025.pdf; Martin and Liversain, 'A Winding Road Before Scaling-Up?', 248.

76 Sylvia, *European Digital Defence Priorities in an Uncertain World*, 6, 8.

77 Sylvia, *European Digital Defence Priorities in an Uncertain World*, 8.

link sensors and platforms across domains and support better decision-making, which will also be part of the FCAS program.[78]

In short, European countries are trying to build their cyber and information warfare capabilities but remain hampered by dependencies in the physical (components, data centres) and digital (software, cloud) domain.

2.3 Command & Control Infrastructure (C2)

Command and control (C2) infrastructure in its most basic form is the system through which combatants communicate on what actions should be taken. Crucial elements of C2 are people, information, and the overarching support infrastructure. People take decisions and implement them; information is the basis upon which people build awareness of the situation and the support infrastructure links people and information so that appropriate decisions can be made.

Due to the importance of information as the basis for decision making, C2 needs appropriate technical systems to handle streams of information.[79] While these technical and procedural aspects form important aspects of C2, it also encompasses more concrete military actions such as creating decisive manoeuvres or the tactic of a small platoon of soldiers.[80]

Compared to cloud infrastructure, Europe has greater strengths when it comes to the (C2) software that link users across domains and provide access to the computing capacity and data. For example, *SitaWare Headquarters*, developed by the Danish company Systematic, is widely used for systems in NATO higher level command.[81] Again, a persistent challenge for Europe is its reliance on the US for important subsystems that are critical for C2 networks to function, such as systems that provide for the communication between C2 elements. One example here is Link 16, vital for information sharing between military aircraft.[82]

78 'Multi-Domain Combat Cloud | Airbus', 16 July 2024, https://www.airbus.com/en/products-services/defence/multi-domain-combat-cloud; *Closing the Software Gap*.

79 https://irp.fas.org/doddir/usmc/mcdp6/ch1.htm https://researchcentre.army.gov.au/sites/default/files/command_control_b5.pdf

80 https://irp.fas.org/doddir/usmc/mcdp6/ch1.htm

81 *Closing the Software Gap*, 6.

82 *Closing the Software Gap*, 7.

European nations show a large diversity in the degree and maturity to which they have succeeded in deploying digitalized combat networks or use digital systems for tasks such as control, communication, surveillance or targeting. The UK and France are arguably to most advanced countries in this domain. The UK is currently in the process of replacing thousands of legacy IT systems and integrate new systems across various domains.

2.4 Electronic warfare

Electronic warfare (EW) uses electromagnetic signals to disrupt adversary systems and defend friendly ones by combining offensive tools, such as jamming and spoofing, with defensive software and platforms to protect against interference. Electromagnetic attack uses electronic energy to degrade enemy systems. It includes simple noise jamming, which floods a frequency band, and more advanced Digital Radio Frequency Memory (DRFM) techniques that feed altered radar signals back to the enemy to distort range or position. Both approaches aim to saturate the target's receiver so it cannot process intended signals. High-power EA can also damage systems by overloading their electronics.[83] Electronic attack is challenging because jamming distant radars requires a high jamming power output, and radars can rapidly change frequencies to resist jamming. A low-power alternative is called spoofing. Spoofing is the practice of emitting deceptive signals to mislead navigation systems such as satellites.[84]

Electronic countermeasures use electromagnetic energy to protect a platform under attack and rely on similar mechanisms as electromagnetic attack. They can interfere with enemy fire-control radars or missile seekers to prevent accurate targeting. Defence methods include chaff, which releases metal-coated strips to confuse radar, along with frequency hopping and signal-emitting decoys.[85] Some antennas can also filter out hostile signals and focus only on the intended source.

83 Jack Watling and Noah Sylvia, *Competitive Electronic Warfare in Modern Land Operations* (RUSI, 2025), 11, https://static.rusi.org/competitive-electronic-warfare-in-land-operations_1.pdf.

84 Jack Watling and Noah Sylvia, *Competitive Electronic Warfare in Modern Land Operations*, 12.

85 Stephanie Halwa en Lydia Harriss, *Electromagnetic (electronic) warfare* (UK Parliament, 2025), 4, https://researchbriefings.files.parliament.uk/documents/POST-PN-0749/POST-PNpdf.

In general terms, most experts believe that European EW capabilities are not as mature and fully developed to those of Russia.[86] Additionally, most of the EW capabilities that Europe could theoretically field are provided by the US, especially airborne EW platforms. Europe therefore has few sovereign capabilities in this field.[87]

In terms of the EDTIB required for electronic warfare, Sweden, France, Germany and Italy are able to produce electronic countermeasure (ECM) devices for protecting their respective fighter aircraft, with Sweden and France also able to produce dedicated aircraft for electromagnetic intelligence (ELINT).[88] Sweden's Saab is winning major contracts for the Arexis system, which can deliver localized jamming capabilities.[89] However, a major capability gap remains in airborne electronic attack (EA). The US Navy's EA18G Growler remains the primary stand-off jamming asset for NATO.[90] While Saab has developed a pod that offers similar jamming capabilities as those used on the EA-18 Growler, the pod has not yet been purchased yet by either the German or Swedish air force, who are currently focusing on better self-protection measures against aerial threats of their fighters than to turn them into specialised airborne EA platforms.[91] European programs such as the REACT II initiative under the European Defence Fund are still in development to increase EA capabilities.[92]

On land, European states have greater operational capacity, though many existing systems are legacies of the Cold War. Germany's TPz Fuchs system, built by Rheinmetall, was developed in 1979 and is still in service in Germany, the

86 Clara Le Gargasson and James Black, *Electromagnetic Warfare: NATO's Blind Spot Could Decide the Next Conflict* (2025), https://www.rand.org/pubs/commentary/2025/11/electromagnetic-warfare-natos-blind-spot-could-decide.html.

87 Justin Bronk, *Airborne Electromagnetic Warfare in NATO: A Critical European Capability Gap* (The Royal United Services Institute (RUSI), 2025), 31, https://static.rusi.org/airborne-electronic-warfare-in-nato_0.pdf.

88 Justin Bronk, *Airborne Electromagnetic Warfare in NATO: A Critical European Capability Gap*, 11-12.

89 *Saab's Arexis: Advanced Electronic Warfare System for Fighter Aircraft*, Air, 15 May 2025, https://defence-industry.eu/saabs-arexis-advanced-electronic-warfare-system-for-fighter-aircraft/.

90 Justin Bronk, *Airborne Electromagnetic Warfare in NATO: A Critical European Capability Gap*, 19.

91 Justin Bronk, *Airborne Electromagnetic Warfare in NATO: A Critical European Capability Gap*, 23.

92 'EU Seeks to Boost Airborne Electronic Attack with REACT II Programme', Default, 28 June 2023, https://www.janes.com/osint-insights/defence-news/air/eu-seeks-to-boost-airborne-electronic-attack-with-react-ii-programme. Justin Bronk, *Airborne Electromagnetic Warfare in NATO: A Critical European Capability Gap*, 23.

Netherlands, the UK; even in the US a variant of the system is still in use. France is set to increase its capacity over the coming decade with the development of the VBMR-L Serval armoured personnel carrier, which will include an EW configuration. Over 2,000 Servals are set to be delivered by 2035, though it is not clear how many will specifically be EW systems.[93] In general, capacity in this realm can be quite fungible, given that most land EW systems are reconfigured personnel carriers or IFVs. The challenge therefore is not the platform, but the actual system on board the vehicle, which must be continuously updated and tested under realistic conditions. In the case of the most ambitious EW development programmes underway, a new contract was awarded in 2021 to Thales and Airbus to create a multi-service EW capability, a project that is still underway.[94]

Despite some ongoing developments, Europe still lags behind the US and, more importantly, Russia. The latter is due to the emphasis EW has received in the Russian defence budget over the years, but also its integration into actual combat operations from Syria to Ukraine. EW is built into manoeuvre units across the Russian Ground Forces, and Russian forces are now experienced in fighting in a degraded electronic environment.[95] Beyond any desire for autonomy, this is reason enough for greater investment and integration of EW in European forces.

2.5 Space support

Space- based systems provide critical supporting capabilities for military operations through intelligence, communication, navigation and early warning capabilities. The war in Ukraine has further highlighted the importance of space for conventional military operations, exemplified by Russia's cyber attack on the KA-SAT communication satellite, and the provision of space-based connectivity to Ukraine's army by SpaceX and of high-resolution images by Maxar.[96] The war has also highlighted Europe's large strategic dependencies in this domain.

93 https://www.forcesoperations.com/le-ministere-des-armees-receptionne-les-quatre-premiers-serval/

94 https://www.airbus.com/en/newsroom/press-releases/2021-02-thales-and-airbus-selected-by-dga-to-upgrade-frances-joint

95 https://irregularwarfare.org/articles/russian-electronic-warfare-from-history-to-modern-battlefield/

96 *ESPI Yearbook 2023* (European Space Policy Institute, 2024), 20, https://www.espi.eu/yearbooks/yearbook-2023/.

Both SpaceX and Maxar are private American companies. Elon Musk, the owner of SpaceX, has personally intervened into the conflict by restricting access to connectivity over certain regions.[97] Furthermore, European dependence on American intelligence has given Trump considerable leverage to restrict access of information to Ukraine in order to advance his goal of securing a peace deal in Ukraine.[98]

Notwithstanding Europe's strategic dependencies, it is important to note that in most areas, Europe has capabilities and technical expertise that is on par with those of other big spacefaring nations. For example, the European Galileo satellite navigation system is considered to be the most accurate and secure positioning system, outperforming big competitors such as Beidou developed by China or GPS from the US.[99] Europe also holds a global market share of 41% in the field of Earth observation through its Copernicus Earth Observing System that provides data for disaster management or climate change monitoring.[100]

However, Europe is considerable lagging behind in a number of key fields that translate into critical strategic dependencies. One of these is Europe's comparatively weak footprint in the satellite launcher market, next to a lack of competitiveness in rocket propulsion, sustaining mega-constellations of satellite receivers, as well as being highly dependent on electronic components such as semiconductors. While much of the future economic growth will be based on the exploitation of data enabled by space applications, the traditional launcher market represents a strategic capability since it is the enabling capability for subsequent exploitations in space.[101] While Europe is able to engineer rockets such as the Ariane-6 series for medium to heavy lift launches and the Vega-C

97 Joey Roulette et al., 'Musk Ordered Shutdown of Starlink Satellite Service as Ukraine Retook Territory from Russia', Investigations, *Reuters*, 25 July 2025, https://www.reuters.com/investigations/musk-ordered-shutdown-starlink-satellite-service-ukraine-retook-territory-russia-2025-07-25/.

98 'Trump Administration Pauses Flow of Intelligence to Ukraine That Helps on Battlefield', AP News, 5 March 2025, https://apnews.com/article/ukraine-russia-putin-trump-cia-zelenskyy-5eb2c8025f6bb4b616c86e1fe89bba0f.

99 Mario Draghi, *The Future of European Competitiveness* (European Commission, n.d.), 178, https://commission.europa.eu/document/download/ec1409c1-d4b4-4882-8bdd-3519f86bbb92_en?filename=The%20future%20of%20European%20competitiveness_%20In-depth%20analysis%20and%20recommendations_0.pdf.

100 Mario Draghi, *The Future of European Competitiveness*, 174.

101 Mario Draghi, *The Future of European Competitiveness*, 173.

for lighter payloads, there were only five launches in 2025, in stark contrast to the more than 200 global launches that were performed globally in 2024.[102] Europe's market share in this sector has significantly declined: in the 1980s, Ariane launchers accounted for half of the demand for space launches for the geostationary orbit.[103] Europe's lack of launch capacity is compounded by the fact that Europe only has one spaceport for heavy lifts, located in French Guyana, adding logistical challenges for any scheduled space launch.[104]

To address Europe's lack of launch capacity and capability gaps such as satellite-based communication and observation, several initiatives and programs have recently been initiated. Several private European companies are developing launchers for small lifts, even though all of them have still have to reach orbit, and a few defence companies working in other sectors have started to enter the market to develop rocket motors. In addition, there is a push in several countries to develop spaceports that support smaller launchers, for example in Norway, Sweden, Portugal and the UK, even though these new ports are still waiting to launch a rocket into orbit.[105]

Furthermore, initiatives such as IRIS 2 aim to provide Europe with a sovereign capability to provide a secure space-based connectivity to European governments, embassies or armed forces but also businesses, comprising 264 satellites in various speres of orbit.[106] While the number of satellites are a far cry from the several thousands that controlled by Starlink, the initiative is important in creating the basis for a more independent and competitive European satellite communication ecosystem, and addresses one of the perennial challenges of the European space industry that is suffering from a lack of coordination to aggregate demand and establish synergies between space and military activities.[107]

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102 James Hacket and Ben Schreer, *Progress and Shortfalls in Europe's Defence* (IISS, n.d.), 13, https://www.iiss.org/globalassets/media-library---content--migration/files/publications---free-files/strategic-dossier/pds-2025/complete-file/iiss_strategic-dossier_progress-and-shortfalls-in-europes-defence-an-assessment_092025.pdf?utm_source=chatgpt.com.

103 'European Space Agency', accessed 4 December 2025, https://www.esa.int/.

104 James Hacket and Ben Schreer, *Progress and Shortfalls in Europe's Defence*, 12.

105 James Hacket and Ben Schreer, *Progress and Shortfalls in Europe's Defence*, 12-13.

106 Lucille Caliman, 'IRIS2: Everything You Need to Know about This New European Constellation', *Polytechnique Insights*, 11 March 2025, https://www.polytechnique-insights.com/en/columns/industry/iris2-everything-you-need-to-know-about-this-new-european-constellation/.

107 Mario Draghi, *The Future of European Competitiveness*, 178, 180.

3 Dual use goods and components

Davis Ellison and Ron Stoop

Europe's defence sector depends heavily on dual-use technologies that support a wide range of military applications. A significant part of these dual use goods are imported from outside the EU. Based on the EU dual goods sanction list, this study groups the dual good categories into five broader categories for a more holistic understanding of the dual use dependencies.

3.1 Semiconductors and electronic circuits

Semiconductors, or chips. and integrated circuits enable electronic systems to receive, store and process data. Semiconductors are integrated in virtually all military systems across land, sea, air, and space. On land, tanks, UAVs or anti-tank missiles use semiconductors for targeting, movement and autonomous operation. Naval platforms use semiconductors to e.g. track underwater threats and to conduct electronic warfare operations. In the air, stealth military aircraft and satellites require special semiconductors that can withstand high temperatures and radiation that protect stored mission data.

Semiconductors generally fall into three groups. Logic devices handle computing tasks, including CPUs and GPUs.[108] Memory devices store information. And finally, discrete, analogue, and opto-electronic devices convert and process signals such as light or temperature.[109] High performance often correlates with small node sizes. Advanced sectors like autonomous driving or industrial automation require semiconductors below 10 nm, with leading designs reaching

108 Stephanie Susnjara and Flinders, 'What Is a GPU? | IBM', 6 January 2025, https://www.ibm.com/think/topics/gpu.

109 Graham Lambert, 'How Analog to Digital Converters Work', Circuit Basics, 25 October 2021, https://www.circuitbasics.com/analog-to-digital-converters/.

5 to 3 nm.[110] Europe has limited capacity in this range and cannot produce semiconductors smaller than 7 nm. Its moderate production capability above 20 nm comes from firms like STMicroelectronics and GlobalFoundries.[111]

Europe is stronger in early stages of the value chain. It hosts leading design software providers such as Siemens. It also leads in manufacturing equipment through companies like ASML and ASMI, and supplies key materials through firms such as BASF.[112]

3.2 Various optical components like sensors and lenses

Optical technologies are used to generate, detect, collect and carry information. This category includes optics and optoelectronics (both part of the broader photonics subfield). Optical components are used in a wide variety of different civilian and defence systems. Both defence and space are important market segments for optical components.[113] In the defence sector, infrared and night vision cameras, as well as cameras for aerial reconnaissance and surveillance, drive sales in this market.[114] Optical components are used within various applications ranging from basic telescopes used by soldiers up to cameras in missiles, drones, and satellites to identify hostile targets.[115]

The European photonics industry is the second largest player in the global market (without counting photovoltaics and displays) and had a market share of 15% in

110 Sujai Shivakumar and Charles Wessner, *Semiconductors and National Defense: What Are the Stakes?*, 6 August 2022, https://www.csis.org/analysis/semiconductors-and-national-defense-what-are-stakes.

111 Jan-Peter Kleinhans, *The Lack of Semiconductor Manufacturing in Europe* (Stiftung Neue Verantwortung, 2021), 8-9, https://www.interface-eu.org/storage/archive/files/eu-semiconductor-manufacturing.april_.2021.pdf.

112 Jamie Whitney, 'The Role of Image and Video Processing', Military Aerospace, 22 March 2023, https://www.militaryaerospace.com/computers/article/14289480/video-processing-image-processing-artificial-intelligence-machine-learning.

113 'Market Research Study Photonics 2024', Flipsnack, 14, accessed 22 September 2025, https://www.flipsnack.com/photonics21/market-reserach-study-photonics-2024/full-view.html.

114 *Photonics – an Essential Technology for Defence* (Photonics 21, 2024), 14, https://www.photonics21.org/download/ppp-services/photonics-downloads/Photonics_for_Defence_FINAL_C3.pdf.

115 Jamie Whitney, 'The Role of Image and Video Processing', Military Aerospace, 22 March 2023, https://www.militaryaerospace.com/computers/article/14289480/video-processing-image-processing-artificial-intelligence-machine-learning.

2022.[116] Europe has strong production capabilities for photonics across various segments such as components, smart manufacturing or healthcare. However, it only leads globally in smart manufacturing.[117] Other market segments are either dominated by China or, in the case of healthcare and defence, by the US.[118] Despite these differences, European producers still hold a global market share of 24% in the defence sector, with leading manufacturers such as Thales, Safran and Hensold.[119]

3.3 Various electronical devices and components

Electronical devices and components include devices such as permanent magnets used in cruise missiles, submarines and stealth fighters.[120] Regarding the production of permanent magnets derived from rare earths, a continuous challenge is Chinese dominance in mining of rare earths. For the manufacturing of magnets, the ability to refine and process the light rare earth Neodymium is especially important.[121] Europe currently only has two facilities that can refine all 17 rare earths.[122] One factory is operated by Solvay in La Rochelle, France, and the other by Neo Performance Materials in Narva, Estonia.[123] Besides Estonia, magnet production exists only in Germany and Slovenia and remains limited.[124] With EU capacity around 1,000 tons in 2021 versus 16,000 tons imported from China, a large dependency remains.[125]

116 'Photonics Market Bucks Global Trends – Compound Semiconductor News', Compound Semiconductor, accessed 13 November 2025, https://compoundsemiconductor.net/article/119352/Photonics market bucks global trends – Compound Semiconductor News.

117 Flipsnack, 'Market Research Study Photonics 2024', Flipsnack, accessed 13 November 2025, https://www.flipsnack.com/photonics21/market-reserach-study-photonics-2024/full-view.html.

118 Flipsnack, 'Market Research Study Photonics 2024', 23-24.

119 Flipsnack, 'Market Research Study Photonics 2024'.

120 Todd Lopez, 'DOD Looks to Establish "Mine-to-Magnet" Supply Chain for Rare Earth Materials', U.S. Department of Defense, accessed 20 August 2025, https://www.defense.gov/News/News-Stories/Article/Article/3700059/dod-looks-to-establish-mine-to-magnet-supply-chain-for-rare-earth-materials/.

121 Vasileios Rizos et al., *DEVELOPING A SUPPLY CHAIN FOR RECYCLED RARE EARTH PERMANENT MAGNETS IN THE EU* (CEPS, 2022), 11.

122 'How Europe Is Vying for Rare Earth Independence from China'.

123 'How Europe Is Vying for Rare Earth Independence from China'.

124 Vasileios Rizos et al., *DEVELOPING A SUPPLY CHAIN FOR RECYCLED RARE EARTH PERMANENT MAGNETS IN THE EU*, 13.

125 Roland Gauß et al., *Rare Earth Magnets and Motors: A European Call for Action* (European Raw Materials Alliance, 2021), 9.

3.4 Machines and tools necessary for additive manufacturing

Machine tools, especially modern CNC systems, support many military-industrial functions, including producing firearm and artillery parts and processing tough materials like titanium for hulls or armour.[126] This category also covers equipment for processing rubber and cement used in vehicles and fortifications;[127] and additive manufacturing (or 3D-printing), which has grown in importance in recent years. The additive manufacturing process builds objects layer by layer from materials such as plastics or metal powders, making both raw materials and processed alloys key parts of the 3D-printing value chain.

The EU lacks locally sourced critical raw materials for 3D-printing, with less than 1% of relevant inputs – such as cobalt or tungsten used in printing high-performance alloys – coming from Europe, with the vast majority supplied by China.[128] However, Europe is strong in metallurgical powders: it holds over 50% of global supply in stainless steel and specialised alloys, though this market is highly concentrated.[129] Europe also performs well in final 3D-printer production, ranking third in polymer printers with 20% global share and leading metal-based printers with 32%.[130]

3.5 Chemicals, alloys and metals

This category covers metals, alloys and chemicals resistant to heat and wear, such as tungsten (used in armour-piercing ammunition) and steel, essential for many military and civilian products.[131] China dominates tungsten supply with 86% of global production, and provides 32% of EU imports. The EU produces only

126 'The Vital Role of CNC Tools in Defense and Military Manufacturing', BAUCOR® USA, accessed 28 August 2025, https://www.baucor.com/pages/cnc-tools-defense-and-military.

127 John Spencer, 'The Most Effective Weapon on the Modern Battlefield Is Concrete – Modern War Institute', 15 November 2016, https://mwi.westpoint.edu/effective-weapon-modern-battlefield-concrete/, https://mwi.westpoint.edu/effective-weapon-modern-battlefield-concrete/.

128 Darina Blagoeva et al., *Materials Dependencies for Dual-Use Technologies Relevant to Europe's Defence Sector* (European Commission, 2019), 68, https://doi.org/10.2760/570491.

129 Blagoeva et al., *Materials Dependencies for Dual-Use Technologies Relevant to Europe's Defence Sector*, 64.

130 Blagoeva et al., *Materials Dependencies for Dual-Use Technologies Relevant to Europe's Defence Sector*, 65.

131 Chin Trento, 'Applications of Tungsten Penetrators in New Armor and Optical Protection', 2025, https://www.samaterials.com/blog/applications-of-tungsten-penetrators-in-new-armor-and-optical-protection.html.

about 2%, mainly in Austria, which also handles most refining. The EU imports little raw tungsten ore and mostly brings in processed tungsten products.[132]

For steel, the EU produced 6.8% of global crude output in 2024, far behind China's 55%, with Germany contributing 28% of EU production.[133] The Union is also heavily dependent on imported iron ore, covering about 77% of demand from Brazil, Ukraine and Canada.[134] Reliance on imported coking coal has also grown, with Poland providing 26% of demand and Australia and the US most of the rest.[135] Despite these raw-material dependencies, the EU can still meet 60% to 87% of domestic demand for its key finished steel products.[136]

3.6 Importance for the land domain

A common dual use item used in military land vehicles such as main battle tanks and armoured fighting vehicles are infrared and thermal imaging systems. These systems can detect heat emissions from various objects and show contrasting heat signatures and anomalies, even in conditions with low visibility.[137] Thermal imaging is used to identify hidden threats or objects.[138]

Hybrid propulsion is another technology with increasing crossover between commercial and military applications. Hybrid propulsion systems like diesel electric motors are often used in personal vehicles or buses and are hold advantages for military vehicles in terms of fuel savings at low speeds.[139]

132 'RMIS – Raw Materials' Profiles', RMIS – Raw Materials Information System, accessed 23 September 2025, https://rmis.jrc.ec.europa.eu/rmp/Tungsten.

133 *European Steel in Figures* (The European Steel Association, 2024), 14-15, https://www.eurofer.eu/assets/publications/brochures-booklets-and-factsheets/european-steel-in-figures-2024/EUROFER-2024-Version-June14.pdf.

134 *SCRREEN Iron Ore* (Solutions for CRitical Raw materials – a European Expert Network, 2020), 25-26, https://scrreen.eu/wp-content/uploads/2023/08/SCRREEN2-factsheets_IRON-ORE.pdf.

135 *SCRREEN Coking Coal* (Solutions for CRitical Raw materials – a European Expert Network, 2020), 3, https://scrreen.eu/wp-content/uploads/2023/12/SCRREEN2_factsheets_COKING_COAL_update.pdf.

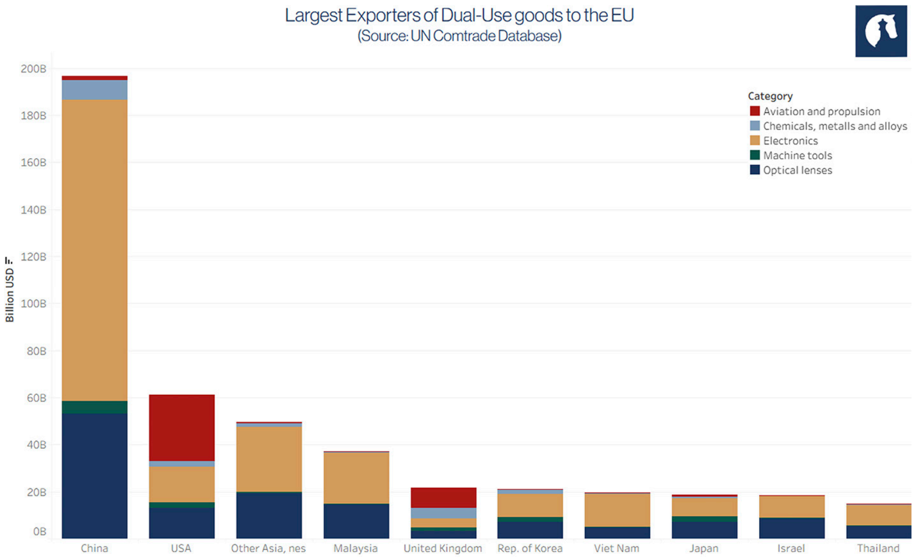
136 *Analysis of the EU Steel Supply Chain: Current Trends and Circularity Opportunities* (European Commission, 2025), 4-5, file:///C:/Users/LennartCramer/Downloads/JRC142660_01%20(1).pdf.

137 'What Is Thermal Imaging? Thermal Cameras and How They Work', accessed 12 September 2025, https://www.fluke.com/en-us/learn/blog/thermal-imaging/how-infrared-cameras-work.

138 'What Is Thermal Imaging?'

139 'What Is Hybrid Propulsion?', BAE Systems, 1 January 2000, https://www.baesystems.com.

Figure 1 EU Imports of Dual Use goods (2025.)



Additionally, hybrid propulsion systems produce less noise and have lower heat signature, thereby making it easier for military vehicles to evade enemy detection. Consequently, militaries around the world are starting to integrate hybrid propulsion systems into their future tank fleets, for example in the American Abrams, or the European Main Ground Combat System (MGCS).[140]

3.7 Importance for the maritime domain

A crucial element for the operation of especially submarines is their availability to remain undetected, necessitating low noise levels and thermal signatures from onboard propulsion systems.[141] Compared to nuclear or diesel-powered

140 Joseph Trevithick, 'Next Generation AbramsX Tank Will Have Hybrid Power Plant', The War Zone, 5 October 2022, https://www.twz.com/next-generation-abramsx-tank-will-have-hybrid-powerplant; Samuel Cranny-Evans, 'Hybrid Theory: The Development of Armoured Alternative Propulsion', Global Defense Technology, https://defence.nridigital.com/global_defence_technology_feb24/hybrid_propulsion_engines_armoured_vehicles#nav-area.

141 Simon O'Hehir, 'The Importance of Stealth in Combatting a Submarine Threat | Sea Power Centre', 4 January 2021, https://seapower.navy.gov.au/analysis/importance-stealth-combatting-submarine-threat.

submarines, fuel cells offer advantages both in terms of noise emission and thermal heat signature.[142] The main reason for this is that fuel cells do not contain as many mechanical and vibrating parts inside their engine or cooling compartments.[143]

Conversely, detecting submarines necessitates acoustic sensors and sonar. Whereas an active sonar emits acoustic signals and subsequently analyses the time for the return of the "echo" to determine the distance, passive sonar merely analyses detected acoustic emissions and is on its own unable to measure range.[144] Such dual use systems are relevant for both submarines as well as surface vessels such as destroyers and frigates to track them.

3.8 Importance for the air domain

Aircraft engines are a common and obvious dual use item. Despite clear differences – especially advanced 5th generation fighters need highly specialised engines – there are clear crossovers between civilian and military applications. There is generally a high overlap in the supply chain between civilian and military engines, with some producers in the US having no separate production lines, for example.[145]

Apart from the direct crossovers between military and civilian supply chains, it is important to note that aircraft parts such as engines are frequently used to manufacture uninhabited aerial vehicles and cruise missiles, especially to achieve cost savings. The Iranian Shahed 136 drone, which Russia employs extensively to saturate Ukrainian air defences, is powered by a reverse engineered German-designed Limbach L 550 motor, originally designed to power planes.[146] Likewise, Ukrainians new Flamingo cruise missile is built around an

142 J. Narayana Das, 'Fuel Cell Technologies for Defence Applications', in *Energy Engineering* (Springer, Singapore, 2017), 9, https://doi.org/10.1007/978-981-10-3102-1_2.

143 William Earl Fannin, 'Non-Nuclear Submarines? Choose Fuel Cells', U.S. Naval Institute, 1 June 2019, https://www.usni.org/magazines/proceedings/2019/june/non-nuclear-submarines-choose-fuel-cells.

144 'What Is Sonar?', National Oceanic and Atmospheric Administration US Department of Commerce, accessed 12 September 2025, https://oceanservice.noaa.gov/facts/sonar.html.

145 'The Future of Military Engines', accessed 15 January 2026, https://www.csis.org/analysis/future-military-engines.

146 'Russia's Iranian-Made UAVs: A Technical Profile', 7 November 2025, https://www.rusi.org.

AI-25TL turbofan engine. This engine was originally designed to power a Soviet regional airliner, and is used today in jet trainer aircraft such as the Aero L-39, and therefore readily available around the word.[147]

Probably one of the most marked features in the Ukraine war is the widespread use and importance of drones on the battlefield.[148] Fiber-optic cable guided drones have been especially revolutionary, due to their resistance to jamming and other electronic interference. Ukraine is able to produce 200.000 drones a month, reportedly accounting for 60-70 % of all destroyed Russian military equipment, even though between 60-80 % of Ukrainian first-person view drones (FPVs) fail to hit their target.[149] These figures clearly underline the crucial importance of drones for Ukraine's defence, especially in light of continuing manpower challenges.[150]

Already in 2019 the EU identified UAVs as being one of five dual-use technologies that are relevant for the European defence sector and where Europe faces strategic dependencies.[151] Whilst Europe is fully dependent on the supply for most of the raw materials at the base of drone production, the report of 2019 highlights further dependencies in terms of various drone components. Dependencies differ depending on the product category, notable bottle necks exist for components such as magnets, gears, GPUs, microprocessors and batteries. Lithium-ion batteries are one of the most frequently used batteries to

147 Fabian Hoffmann, 'The FP-5 Flamingo Has Arrived: What Ukraine's 3,000-Kilometer Cruise Missile Means for the War and the Future of Europe', Substack newsletter, *Missile Matters – with Fabian Hoffmann*, 23 August 2025, https://missilematters.substack.com/p/the-flamingos-have-arrived-what-ukraines.

148 Jan Joel Andersson and Sascha Simon, *Minding the Drone Gap: Drone Warfare and the EU | European Union Institute for Security Studies* (2024), https://www.iss.europa.eu/publications/briefs/minding-drone-gap-drone-warfare-and-eu.

149 Mariam Halstian, 'A First Point View: Examining Ukraine's Drone Industry', *Georgetown Security Studies Review*, 15 May 2025, https://georgetownsecuritystudiesreview.org/2025/05/15/a-first-point-view-examining-ukraines-drone-industry/; Jack Watling and Nick Reynolds, *Tactical Developments During the Third Year of the Russo–Ukrainian War* (n.d.), 10.

150 Leo Chiu, 'Ukraine Compensates Manpower Shortages With Drones', Kyiv Post, 7 February 2025, https://www.kyivpost.com/post/46756.

151 Blagoeva et al., *Materials Dependencies for Dual-Use Technologies Relevant to Europe's Defence Sector.*

power drones given their favourable power-weight ratio.[152] However, virtually all phases in the production process from raw materials up to the manufacturing of lithium-on cells are dominated by China. Europe plays a comparatively negligible role across the entire supply chain and has an almost inexistent role in final manufacturing.[153]

In addition, it is important to note that whilst most drone components could be sourced from politically aligned states such as the US, Japan or Korea, the supply of assembled civilian drones rests firmly in the hand of Chinese companies. Chinese manufacturer DJI controls 70% of the global commercial market and Autel another 7%, with French company Parrot and US Skydio coming third with 3% each.[154] This has real material impacts. In October 2024, China started to restrict Ukrainian access to Chinese drones, starting with restring the sale of drone components such as frames, cameras and engines to Ukraine. Subsequently, China cut the supply of batteries to the largest American manufacturer of commercial drones and reportedly even halted drone sales to the West and Ukraine completely.[155] Whilst it has been rightly suggested that these supply restrictions could have negative impact on Ukraine's ability to defend itself, it is not entirely clear to what extent these restrictions are currently impacting Ukraine's drone production in practice.[156]

Ukraine has reportedly been able to manufacture at least some drone parts like frames, motors, optical lenses, thermal imaging cameras and, probably most importantly, lithium-ion batteries whose cell components were sourced

152 Hashim A. Hashim, 'Advances in UAV Avionics Systems Architecture, Classification and Integration: A Comprehensive Review and Future Perspectives', *Results in Engineering* 25 (March 2025): 7, https://doi.org/10.1016/j.rineng.2024.103786.

153 Blagoeva et al., *Materials Dependencies for Dual-Use Technologies Relevant to Europe's Defence Sector*, 19.

154 Matthew Kroening and Bayoumi, 'A Global Strategy to Secure UAS Supply Chains', *Atlantic Council*, 25 June 2024, https://www.atlanticcouncil.org/in-depth-research-reports/issue-brief/a-global-strategy-to-secure-uas-supply-chains/.

155 Aosheng Pusztaszeri, 'Why China's UAV Supply Chain Restrictions Weaken Ukraine's Negotiating Power', 16 December 2024, https://www.csis.org/analysis/why-chinas-uav-supply-chain-restrictions-weaken-ukraines-negotiating-power; Fratsyvir, 'China Cuts Drone Sales to Ukraine, West but Continues Supplying Russia, Bloomberg Reports', The Kyiv Independent, 29 May 2025, https://kyivindependent.com/china-suts-drone-sales-to-ukraine-west-but-continues-supplying-russia-bloomberg-reports/.

156 Pusztaszeri, 'Why China's UAV Supply Chain Restrictions Weaken Ukraine's Negotiating Power'.

from Korean Samsung.[157] This indicates that Ukraine is at least able to source some of its parts domestically and even produce the first drone batches build entirely from locally sourced parts, lessening the negative impact of Chinese export restrictions to a certain degree.[158] Ukraine is, however, still dependent on some Chinese machine tools for drone production as well as magnets from rare earths.[159]

3.9 Dual-use missile components

Missiles contain a host of dual-use systems, such as electronic systems and sensors to receive signals, process information and to manage propulsion and navigation.[160] Due to the large range at which rocket propelled artillery systems are used, a reliable guidance system is necessary for the rocket to precisely hit its intended target. A GPS guiding system helps determining the location of the rocket.[161]

An effective and low-cost type of guidance system to augment the Global Positioning System (GPS), is the Inertial Guidance System (INS). INS-systems work with several motion sensors that calculate the position, orientation and velocity of the relevant object relative to its original starting point that is used as a reference.[162] The advantage of INS is that it does not depend on external signals and thus functions even in environments with weak or no GPS signals. For this

157 Post, '"Little by Little Away from China" – Inside Ukraine's New Mass-Production of Drone Parts', The Kyiv Independent, 15 August 2025, https://kyivindependent.com/little-by-little-away-from-china-ukraines-new-mass-production-of-drone-parts/; David Hambling, 'Ukraine Is Making FPV Drones Without Chinese Parts And At Lower Cost', Forbes, accessed 29 August 2025, https://www.forbes.com/sites/davidhambling/2025/04/08/ukraine-is-making-fpv-drones-without-chinese-parts-and-at-lower-cost/; David Hambling, 'Ukraine Shows U.S. How To Beat China In Drone Battery Wars', Forbes, accessed 29 August 2025, https://www.forbes.com/sites/davidhambling/2024/11/14/ukraine-shows-us-how-to-beat-china-in-drone-battery-wars/.

158 Halstian, 'A First Point View'.

159 Post, '"Little by Little Away from China" – Inside Ukraine's New Mass-Production of Drone Parts'.

160 '2025 Update of the EU Control List of Dual-Use Items – Trade and Economic Security', accessed 16 January 2026, https://policy.trade.ec.europa.eu/news/2025-update-eu-control-list-dual-use-items-2025-09-08_en.

161 Ove Dullum, *The Rocket Artillery Reference Book* (2010), 21, https://www.ffi.no/en/publications-archive/the-rocket-artillery-reference-book.

162 Ove Dullum, *The Rocket Artillery Reference Book*, 20.

reason, navigation through INS is used whenever there is no external signal available such as in tunnels where it helps guiding trains, apart from its military applications where GPS might not be available or interfered.[163]

GPS and INS guiding systems are also integrated into some conventional 155 mm artillery shells. One example is the American Excalibur extended range artillery shells. Its shell contains a host of microelectronic systems such as onboard computers, circuits and navigates with a dual GPS/INS guiding system.

Conclusion: dual use capability shortfalls

Semiconductors and electronic circuits are essential for receiving, storing and processing data across defence systems. Europe is weak in advanced chip production, focusing mainly on larger-nanometre nodes while remaining stronger in earlier parts of the value chain such as design software and manufacturing equipment. Optical components and sensors are similarly critical for infrared vision, night vision and reconnaissance. Europe's photonics industry is well developed, ranking as the second-largest market in 2022 and leading in smart manufacturing, though imports from the US in this domain are substantial.

Electronic devices and components, including permanent magnets for missiles and stealth fighters as well as switches and sockets, reveal major dependencies. Europe has only a few magnet producers and remains highly reliant on imports. Machine tools and CNC systems are important for processing armour, while additive manufacturing offers new production options. The EU holds a reasonable position in 3D printing but still sources many key input materials from other continents. For alloys and metals such as tungsten and steel, Europe imports mainly processed materials and depends heavily on suppliers in China, Brazil, Canada and Ukraine. Overall, Europe has some industrial strengths across the dual-use supply chain, but significant gaps need to be addressed if Europe wants to have a robust EDTIB.

163 'Achieving high-accuracy geo-localization inside a 57-kilometre tunnel without GPS', Thales Aerospace Blog, 7 June 2016, https://onboard.thalesgroup.com/achieving-high-accuracy-geo-localization-inside-57-kilometre-tunnel-without-gps/.

4 Critical Raw Materials

Davis Ellison and Ron Stoop

The interest in Critical Raw Materials (CRM) in the defence sector and beyond has risen in recent years.[164] CRM play a central role in most modern civilian and military applications, and have become increasingly important as the world moves deeper into the energy transition and the digital infrastructure expands.[165] The growth of the EDTIB adds additional demand for these materials.

CRM have become a subject of geopolitical manoeuvring: global competitors are pursuing control of CRM supply chains, creating strategic leverage over countries that lack such control.[166] Europe, and by extension its defence industry, remain highly dependent on a narrow group of suppliers for CRM.[167] Despite recent research on the importance of CRM for defence, dependence remains high, and is not expected to lessen in the upcoming years, or at least without decisive policy actions.

This chapter examines CRM's relevance for European defence by assessing the prevalence of key materials across military systems. Such an assessment is essential for strengthening strategic autonomy. This assessment builds upon an existing risk taxonomy for each CRM created by HCSS. This risk taxonomy takes into account relevant supply vulnerability indicators such as supplier diversity, geopolitical relations with the supplier country and the usage of the CRM the military system. The vulnerabilities will be discussed by domain (land, air, maritime, and multi-domain systems such as missiles).

164 'Critical Raw Materials and European Defence', IISS, accessed 16 November 2025, https://www.iiss.org/research-paper/2025/03/critical-raw-materials-and-european-defence/.

165 'Critical Raw Materials Act – Internal Market, Industry, Entrepreneurship and SMEs', accessed 16 November 2025, https://single-market-economy.ec.europa.eu/sectors/raw-materials/areas-specific-interest/critical-raw-materials/critical-raw-materials-act_en.

166 Policy Position, 'Mining for Tomorrow: The Strategic Importance of Critical Raw Materials for Europe's Industry', Jacques Delors Centre, accessed 16 November 2025, https://www.delorscentre.eu/en/publications/detail/publication/mining-for-tomorrow.

167 Statistics Netherlands, 'Dutch Dependency on Critical Raw Materials', webpagina, Statistics Netherlands, 29 September 2025, https://www.cbs.nl/en-gb/longread/rapportages/2025/dutch-dependency-on-critical-raw-materials.

Table 2 CRM use by military system. Source Girardi et al. (2023), Patrahau & Girardi (2024) and Patrahau et al. (2025).

	Domain	Air		Land		Sea		
	Military Application	Fighter	Drone	155mm	MBT	Submarine	Frigate	Missile
Very High Risk	Aluminium							
	Graphite							
High Risk	Beryllium							
	Chromium							
	Cobalt							
	Copper							
	Dysprosium							
	Germanium							
	Iron/Steel							
	Lanthanum							
	Nickel							
	Neodymium							
	Platinum							
	Praesodymium							
	Samarium							
	Tantalum							
	Titanium							
	Tellurium							
	Terbium							
	Tungsten							
	Vanadium							
	Yttrium							
Medium Risk	Barium							
	Borates							
	Cadmium							
	Gallium							
	Indium							
	Lead							
	Lithium							
	Manganese							
	Molybdenum							
	Niobium							
	Silver							
	Tin							
	Thorium							
	Zinc							
	Zirconium							
	Silicon							
Low Risk	Gold							
	Hafnium							
	Selenium							

4.1 Importance for the land domain

The land domain uses a wide array of CRM, mainly due to the specialised and high-intensity nature of land warfare. This means that system supply chains are exceptionally fragile, with many points of failure along the broad set of materials used in low volume.

Several materials both carry a very high supply-risk and are used in many systems such as main battle tanks, artillery and ammunition. For example, aluminium and graphite are integral to land-based defence platforms.[168] Graphite is used for navigation systems, combat identification systems and in components of machine guns. Aluminium is used for the hull structure of the tank, for example in lightweight armour panels, and in communication equipment. Iron and steel (structure of systems) and copper (wiring, sensors) remain fundamental for most combat systems, as well as chromium, which is used for hardening steel.

Other examples of materials with a high supply risk that are used in land-based systems are beryllium, germanium and neodymium. Beryllium is used in defence for high-precision sensors and targeting systems. Beryllium's specific properties (lightweight, stiff, heat-resistant) make it valuable in missile structures, guidance units and advanced electronics.[169] Beryllium alloys also appear in specialised components such as actuators, connectors and high-fatigue mechanical parts.[170] Germanium is used for navigation and combat identification systems, such as infrared optic systems, semiconductors and imaging components for target detection.[171] Germanium which has become geopolitically important (for example via export controls). Neodymium is also used for navigation and combat identification equipment though its use in permanent magnets, which underpin several capabilities in a range of combat systems.[172] Together, these materials form critical enablers of the tank's mobility, protection and situational awareness.

Beyond these high-profile examples, land-based military systems rely on several other CRMs. The complete overview can be found in table 2.

168 'Strategic Raw Materials for Defence | Mapping European Industry Needs', *HCSS*, n.d., accessed 16 November 2025, https://hcss.nl/report/strategic-raw-materials-for-defence/.

169 'Beryllium Statistics and Information | U.S. Geological Survey', accessed 16 November 2025, https://www.usgs.gov/centers/national-minerals-information-center/beryllium-statistics-and-information.

170 M. A. Boland, 'Beryllium--Important for National Defense', in *Fact Sheet*, nos 2012-3056 (U.S. Geological Survey, 2012), https://doi.org/10.3133/fs20123056.

171 Claudiu Pavel and Evangelos Tzimas, 'Raw Materials in the European Defence Industry', JRC Publications Repository, 2016, https://doi.org/10.2790/509931.

172 Pavel and Tzimas, 'Raw Materials in the European Defence Industry'.

4.2 Air

In the air domain, reliance on CRM is substantial. Fighter jets use a large variety CRM, in varying quantities.[173] These CRM play a role in airframes, propulsion systems, communications and sensors.[174] Thus, fighter aircraft emerge as among the most material-intensive defence platforms, demanding a wide spectrum of CRMs for their advanced capabilities.

Materials such as aluminium and graphite are identified as having a high-risk profile, which applies across all military domains. Other CRM with a high-risk profile include dysprosium, yttrium and praseodymium. All these are part of the Rare Earth Element (REE) group and perform key functions in fighter jets. Dysprosium is used in propulsion of the aircraft, as well as in control systems for the aircraft.[175] Praseodymium supports propulsion and electronic systems. Fighter jet propulsion also relies heavily on yttrium, which is used in turbine components, maintaining engine performance under extreme operating conditions, and in electro-optical systems.[176]

Drones rely heavily on critical raw materials (CRM) for their structure, propulsion, navigation and sensor systems. Their lightweight airframes often use aluminium, titanium and magnesium to achieve strength and low mass.[177] Electric motors and actuators (devices that convert energy into motion) in drones typically incorporate rare earths such as neodymium and dysprosium.[178] Components like sensors, communication modules and navigation units use gallium, germanium and indium.[179] These material dependencies create strategic vulnerabilities, as

173 Pavel and Tzimas, 'Raw Materials in the European Defence Industry'.

174 IISS, 'Critical Raw Materials and European Defence'.

175 Benedetta Girardi et al., 'Strategic Raw Materials for Defence Needs: Mapping European Industry Needs', January 2023, https://hcss.nl/wp-content/uploads/2023/01/Strategic-Raw-Materials-for-Defence-HCSS-2023-V2.pdf.

176 Girardi et al., 'Strategic Raw Materials for Defence Needs: Mapping European Industry Needs'.

177 'UAVs, Drones and Critical Minerals', SFA (Oxford), accessed 16 November 2025, https://www.sfa-oxford.com/knowledge-and-insights/critical-minerals-in-low-carbon-and-future-technologies/uavs-drones-and-critical-minerals/.

178 *6 Military Uses of Rare Earth Elements in Defense Technology*, Applications of Rare Earth Elements, 4 October 2025, https://rareearthexchanges.com/rare-earth-elements-in-defense-technology/.

179 'Critical Raw Materials for Strategic Technologies and Sectors in the EU – Publications Office of the EU', accessed 16 November 2025, https://op.europa.eu/en/publication-detail/-/publication/8e167f11-077c-11eb-a511-01aa75ed71a1/language-en.

many CRM have vulnerable supply chains due to a lack of supplier diversification and/or geopolitical tensions, which could lead to export restrictions or other disruptions.

4.3 Maritime

The maritime domain is dependent on CRM through two main channels. The first channel consists of the materials used for the hull and pertains structural materials such as steel, aluminium and other CRM that enhance the structure of a hull. The second channel through which CRM are used is based on the (digital) systems that are present on ships. These systems of perception, analysis, communication, propulsion and missile delivery can share similarities with land-based and air-based systems, creating overlap between CRM needed in the maritime domain and in other domains.

Frigates consist of a wide range of subsystems that each rely on specific raw materials to perform at sea. The hull is built from high-strength alloys that combine CRM such as steel, nickel, chromium, copper and titanium, combining corrosion resistance, structural durability and water pressure resistance.[180] Propulsion systems contain titanium, nickel, copper and molybdenum in turbine components.[181] Weapons and missile systems on frigates utilise magnesium, aluminium, manganese and chromium.[182] Radar and communication systems depend on gallium, germanium, silicon and indium, which are used in semiconductors, radar modules and sensors.[183]

Military submarines rely on a wide range of critical raw materials across their hull, propulsion, sensors and weapons. The hull uses strong, corrosion-resistant alloys containing nickel, chromium, copper, molybdenum, titanium, manganese,

180 Girardi et al., 'Strategic Raw Materials for Defence Needs: Mapping European Industry Needs'; IISS, 'Critical Raw Materials and European Defence'.
181 Heanjia, 'Aero and Marine Engine Turbine Components', *Heanjia Super Metals Co. Ltd.*, 24 October 2015, https://super-metals.com/aero-and-marine-engine-turbine-components/.
182 Pavel and Tzimas, 'Raw Materials in the European Defence Industry'.
183 'Critical Minerals in Defence and National Security', SFA (Oxford), accessed 16 November 2025, https://www.sfa-oxford.com/knowledge-and-insights/critical-minerals-in-low-carbon-and-future-technologies/critical-minerals-in-defence-and-national-security/.

silicon, vanadium and niobium to withstand seawater and extreme pressure.[184] Propulsion systems contain, lithium, cobalt, samarium, titanium, nickel, aluminium, copper and molybdenum.[185] Torpedoes depend on lightweight and durable materials such as aluminium, magnesium, manganese, zirconium and chromium.[186] Sensors and the periscope use carbon composites (made from carbon fibre) and specialised ceramics[187] to detect, navigate and communicate underwater.[188]

Steel and titanium are central elements for various military and civilian down-stream products in sectors such as construction, automotive, aerospace and shipbuilding.[189] Whilst there are numerous steel alloys with different properties that are used in shipbuilding, particularly high-strength low alloy steel (HSLA) is a common type of steel for naval system due to its high toughness, weldability and high strength to weight ratio Due its high weightbearing properties and ability to sustain high pressures, it is amongst others used as parts for the chassis of heavy-duty trucks or trailers in civilian applications.[190] Titanium, on the other hand, is known for its heat resistance, strength and resistance to corrosion.[191] With these properties, civilian and military aerospace is the primary user of Titanium, but it is also used in naval applications such as in hulls or heat exchangers.[192]

4.4 Missiles

Missile systems contain an extensive array of critical raw materials (CRM) in its components. These materials support precision and reliability of the missiles. The exact CRM composition of each missile differs, but the below CRM have been

184 Paul Anciaux, *Raw Materials for Europe's Defence Industry*, 5th Annual High Level Conference of the EIP on Raw Materials Brussels – 8 November 2017 (2017).

185 Anciaux, *Raw Materials for Europe's Defence Industry.*

186 Anciaux, *Raw Materials for Europe's Defence Industry.*

187 Piezoelectric ceramics, which contain CRM

188 Anciaux, *Raw Materials for Europe's Defence Industry.*

189 'About us | Wirtschaftsvereinigung Stahl – Stahlindustrie Deutschland', *Wirtschaftsvereinigung Stahl – Stahlindustrie Deutschland |*, 30 October 2024, https://www.wvstahl.de/about-us/.

190 'What Makes S700MC Perfect for Defense Applications?', *Masteel*, n.d., accessed 24 November 2025, https://masteel.co.uk/news/what-makes-s700mc-perfect-for-defense-applications/.

191 OLAVARRIETA Alejandro Buesa et al., 'Titanium Metal in the EU: Strategic Relevance and Circularity Potential', JRC Publications Repository, 2025, https://doi.org/10.2760/5871804.

192 Buesa et al., 'Titanium Metal in the EU'.

associated with the components of a missile system.[193] Guidance components use niobium and lithium niobate. The warhead (and its casing) contains copper, molybdenum and tantalum, nickel, chromium and molybdenum. Hangars (the support frame) rely on nickel, chromium, molybdenum, aluminium and titanium. Wings and structural parts use copper, nickel, chromium, molybdenum, niobium and tungsten. The fuselage (outer shell of the missile) includes aluminium, copper, magnesium, chromium, silicon, zinc, zirconium and titanium. Propulsion systems, actuators and their casings contain lithium, cobalt, boron, neodymium, praseodymium, dysprosium, chromium, nickel, molybdenum, titanium, aluminium and samarium. Finally, the tail uses nickel, chromium, molybdenum, manganese, cobalt and titanium.

193 Pavel and Tzimas, 'Raw Materials in the European Defence Industry'.

5 Requirements for a stronger European Defence Industry

Floor Stoelinga

For decades, Europe's defence industry has struggled with underinvestment, shifting political priorities, and a fragmented market. Declining budgets, high unit costs and slow procurement cycles have steadily undermined its development.[194] Because defence expenditure is a member state competence under EU treaties, national industries also developed in isolation, leading to a high level of redundancy and duplication.[195] The 10 different howitzers in Ukraine provided by EU members, and the 12 different operated tanks, are a symptom of this disease.[196] The return of major war to Europe exposed the challenges illustrated by the difficulty of meeting its ammunition pledges to Ukraine[197] and replacing depleting stocks.[198] This chapter discusses the possibility now generated by the new momentum and challenges to achieve new ambition levels.

5.1 A new momentum for European Defence Investment

The current surge in defence investments (see box 2) marks a new era of strategic planning and defence-industrial development across the EU. The 2025 Defence Readiness Roadmap[199], aligns financial tools with capability gaps identified in the Defence White Paper. The European Defence Industrial Strategy (EDIS) also sets

194 Dick Zandee, *European defence industry: urgent action is needed!* , The Clingendael Institute, January 2024.
Stefan Hefter, *Europe's defence industry facing a new start*, KPMG, May 30, 2025.
195 Cavendish, Georgiana, David Chinn, Nadine Grießmann, Hugues Lavandier, and Tobias Otto *Invasion of Ukraine: Implications for European defense spending*, McKinsey and Company, 2020.
196 EU Comission, *The Draghi report on EU competitiveness*, 2025.
Nicolás, Elena Sánchez and Sergi Pijuan, *How many divisions does Europe have? A look at the state of Europe's defence* April 8, 2025.
197 Maria Psara, *EU countries failing to meet ammunition production demands for Ukraine*, Euronews, November 14, 2023.
198 Le Monde, *French defense industry faces challenge of ramping up production,* July 212025.
199 European Commission, *Readiness Roadmap 2030*, 16 October 2025

ambitious targets: at least half of defence procurement is to be European made by 2030. Notably this strategy is supported by a €1.5 billion European Defence Industrial Programme (EDIP) – a first for Europe.[200] The challenge at present is to bridge the legacy divide between Europe's strategic ambitions and its industrial reality.[201]

Box 2. The EU Defence Investment Momentum

- The ReArm Europe / Readiness 2030 roadmap aims to mobilise €800 billion in defence spending through loans, fiscal flexibility, the Stability and Growth Pact escape clause, and an expanded role for the European Investment Bank.
- Key funding instruments include SAFE loans (€150 billion) and the European Defence Industry Programme (EDIP, €1.5 billion). An EU-budget proposal of €131 billion for defence, security and space, also marks a major shift from the previous MFF.
- Ad-hoc measures such as the EU Defence Industry Reinforcement Through Common Procurement Act (EDIRPA) and the Act in Support of Ammunition Production (ASAP), were introduced to address urgent capability gaps and supporting Ukraine through joint procurement.
- Long-term programmes, including the European Defence Fund (EDF), the Defence Industrial Strategy (EDIS), and its dedicated Defence Industrial Programme (EDIP), aim to strengthen sector integration.
- EDTIB investments are also supported through the Digital Europe Programme, Connecting Europe Facility, Strategic Technologies for Europe Platform (STEP), and Horizon Europe.

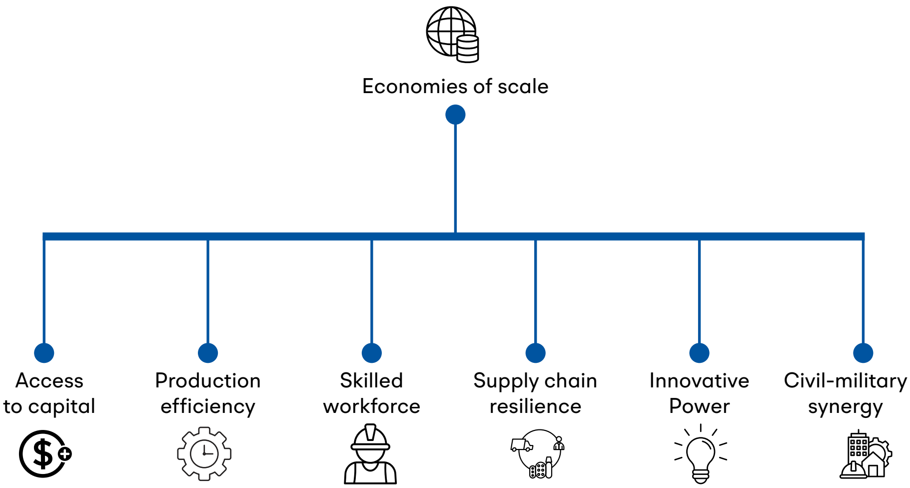
5.2 Pillars and challenges for a stronger European defence industry

Several challenges can be identified that currently hamper the development of a strong European defence industry. These are pooled in figure 2 and discussed below.

200 European Commission, *A new European Defence Industrial Strategy: Achieving EU readiness through a responsive and resilient European Defence Industry*, 5 March 2024

201 Alexandr Burilkov, Katelyn Bushnell, Juan Mejino-López, Thomas Morgan, and Guntram B. Wolff *Fit for war by 2030? European rearmament vis-a-vis Russia lagging in numbers and technologies*, Bruegel, June 20, 2025.

Figure 2 Pillars of a stronger European defence industry



(Source: author's compilation. For similar model, see Keller et al., "Cutting-edge, affordable, ready. A vision for Europe's defense industrial future.", Strategy&, 2025)

5.2.1 Access to capital and production efficiency

A clear driver for a stronger European defence industry is increased spending – both from European funds, but even more so from the member states themselves. The new 5% of NATO GDP pledges and reforms in national defence approaches[202] are already resulting in more spending and procurement to fill capability gaps. In 2024, defence expenditure of EU member states reached €343 billion, a staggering 19% increase from the previous years.[203] Europe's economic power – its GDP over 5 times that of Russia[204] – has clear potential for defence-industrial performance. A success story is ammunition: in February 2023, Europe made about 300,000 155mm shells (the most used type in Europe) annually; as of this writing, it is closer to one million.[205]

202 Most notably in Germany, where the Bundestag voted to lift the constitutional restrictions on defence spending. Deutsche Welle, *Germany's Bundestag votes in favor of reforming 'debt brake'*, March 18, 2025.

203 European Defence Agency (EDA), *EU defence spending hits €343 bln in 2024, EDA data shows*, September 2, 2025.

204 World Economics, *Europe's Combined GDP is far Larger than Russia's*, 2025.

205 The Economist, *Europe's armsmakers have ramped up capacity*, March 20, 2025.

However, bottlenecks persists when it comes to demand volume. This is especially evident in complex systems such as long-range air defence[206], strike capabilities, and armoured vehicles, where Europe struggles with insufficient orders.[207] The production of Leopard 2 tanks, for example, is slow due to a lack of major orders, despite Franco-German manufacturer KNDS taking over additional production plants. Expanding production of complex systems is possible but requires massive, long-term funding and an extended strategic horizon. Current overreliance on ad hoc or extra-budgetary spending undermines producer confidence.[208] Frankly put, although Original Equipment Manufacturers (OEMs) are willing and able to invest, they require certainty of long-term contracts and government uptake."[209]

Another funding issue is the lack of funding "for the critical stage, from the start-up to the scale-up".[210] Despite investments in defence startups increasing substantially,[211] bureaucracy and lack of growth-potential causes Small and Medium Enterprises (SMEs) to leave Europe. These companies hold significant potential for innovation, particularly those drawing on lessons from Ukraine, but they require support to scale up and meet national and NATO-level standards.[212]

The *Savings and Investment Union* (proposed March 2025) presents a critical opportunity to direct capital towards growth-enhancing sectors, if the EU can avoid the pitfalls of the Capital Markets Union. Achieving this will depend on pragmatic, targeted measures rather than institutional overhauls that were

206 Since July 2024, however, a coalition comprising EU member states (France, Germany, Italy, and Poland, subsequently joined by Sweden) and the United Kingdom has been working jointly on ELSA, European Long-Range Strike Approach, a programme focused on developing long-range, ground-launched airstrike capabilities. Saif Ul Haq, *European Long Range Strike Approach (ELSA): future developmental trajectories*, Modern Diplomacy, May 22, 2025.

207 As identified in part 1 of this report.

208 Dr. Bastian Giegerich, James Hackett, Dr. Ben Schreer, Douglas Barrie et al., *Building Defence Capacity in Europe: An Assessment*, International Institute for Strategic Studies (IISS), February 2022.

209 As recognised in the updated NATO Defence Production Action Plan. Updated Defence Production Action Plan, February 13, 2025.

210 European Commission, *Speech by the President: opening session of the NATO Summit Defence Industry Forum*, June 24, 2025.

211 An increase of 500% since the start of the war in Ukraine. European Commission, *Speech by the President: opening session of the NATO Summit Defence Industry Forum*, June 24, 2025.

212 Martin Greenacre, *Von der Leyen reaffirms dual use R&D plans ahead of EU budget proposal*, Science Business, June 26, 2025.

previously stifled by bureaucracy and protectionism.[213] The current issue is that Europe's vast capital sources, such as household and pension savings, remain largely untapped and lack cross-border mobility. Mobilising these assets urgently requires reducing regulatory barriers to create a more integrated capital market. For example, establishing a euro-wide listing platform could bridge the scale-up gap, enabling innovative firms to access scale-stage funding within Europe rather than relocating to deeper US markets.[214] In the defence sector, scaling up faces an additional barrier: navigating stringent security and quality standards requires stronger institutional guidance or specialised venture builders to support growth.

5.2.2 A skilled workforce

The defence sector employs around one million people and is projected to grow to 1.46 million by 2030, but a shortage of skilled workers could slow expansion, with the EU potentially facing a 3.9 million-strong talent gap by 2027.[215] Critical needs include advanced manufacturing experts, for example in AI for autonomous systems, but also skilled trades like welders and technicians.[216]

The EU seeks to address this issue through the Union of Skills strategy, aiming to upskill or reskill at least 600,000 workers by 2030.[217] The defence sector, however, competes for the same limited talent pool as other industries, and wage increases offer only a partial solution while potentially undermining competitiveness.[218] Thus, as the demand and industry expands, the EU, member states, and industry alike, face a race against a widening skills gap. The shortage of skilled labour – a legacy of persistent underinvestment in the industry – is already forming a bottleneck for companies to meet the bloc's rearmament needs.

213 Ignazio Angeloni, The EU's capital market strategy must support innovation, January 27, 2026. Confirmed by interview insight.

214 Ignazio Angeloni and Andrea Cavallini, Feasible steps to finance innovation in Europe: six proposals to strengthen EU capital markets, Bocconi University, 2025.

215 By Michael Kahn, Christoph Steitz and Dominique Patton, *Help wanted: Europe's defence companies scramble for workers as business booms*, Reuters, May 27, 2025. Anna Wiesinger, Henning Soller, Nadja Stark, and Thao Dürschlag, *Tech talent gap: Addressing an ongoing challenge*, McKinsey and Company, March 17, 2025.

216 ASD and Randstad, *Europe's Defense Sector at a Glance – A Historic Transformation with Urgent Workforce Challenges*, 2024.

217 European Commission, *Union of skills* , 2025. Alice Tidey, "EU Aims to Reskill 600,000 Workers for Booming Defence Sector by 2030," November 19, 2025

218 Michael Kahn, Christoph Steitz and Dominique Patton, *Help wanted: Europe's defence companies scramble for workers as business booms*, Reuters, May 27, 2025.

5.2.3 Resilient supply chains

While the sector is competitive overall, Europe lacks strength in key areas – from components and munitions to raw materials, as described in chapters 3 and 4.[219] High-grade steel and versatile alloy (essential for armour, rifles, ships, aerospace, vehicles) are a particular weakness.[220] After years of competition with cheap imports, notably from China, the European steel industry has contracted substantially, prompting some countries to reassess and rebuild domestic capacity for national defence.[221] Similar dependencies exist on and China for defence-critical raw materials identified by NATO and the EU, as well as chemicals and dual use technologies.[222] Echoing the findings of first part of this report, beyond dependence on US imports and maintenance, Europe also faces supply-chain dependencies as it seeks to develop its own materiel and systems.

5.2.4 Innovative power

At present, the EU is heavily dependent on external suppliers in the digital sphere, quantum, and AI.[223] Despite the EU's 3% Research & Development (R&D) target,[224] it continues to lag significantly behind the US, which benefits from a more advanced and integrated R&D ecosystem spanning public, private, and foreign investment (see figure 3).[225] Yet figure 3 itself presents a distorted picture of European R&D strength: because investments largely occur in national silos, innovation translates into *national* rather than *European* competitiveness on the international stage.

219 See part 1 and James Hackett, Ester Sabatino, Matthew Bint, et al., *Critical Raw Materials and European Defence*, International Institute for Strategic Studies (IISS), March 2025.

220 Elisabeth Braw, *How cheap steel endangers Europe's defence build-up*, Financial Times, May 29, 2025.

221 George Allison, MoD to review defence steel supply chains, UK Defence Journal, June 19, 2025.

222 European Commission, *Proposal for a Regulation of the European Parliament and of the Council establishing a framework for ensuring a secure and sustainable supply of critical raw materials and amending Regulations (EU) 168/2013, (EU) 2018/858, 2018/1724 and (EU) 2019/1020*, March 16, 2023. NATO, *NATO releases list of 12 defence-critical raw materials*, December 11, 2024.

223 By contrast, the United States benefits from a more robust civilian–military ecosystem in these fields. Aerospace, Security and Defence Industries (ASD), *ASD Input on the Cloud and AI Development Act*, July 2025.

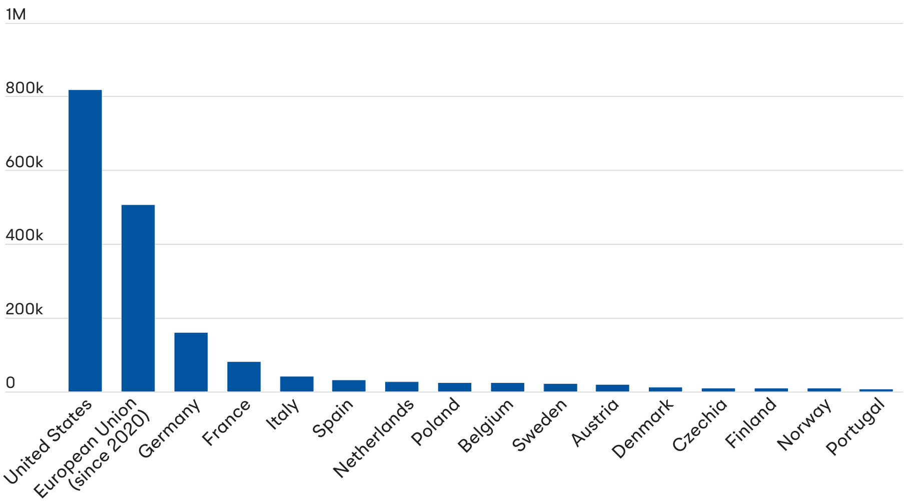
224 Note that the Netherlands' R&D spending approximates 2,3% of GDP. Lotte de Groen, *Netherlands loses economic ground due to lagging R&D investment*, TNO Vector, January 22, 2024.

225 The graph includes all EU member state data, but some are left out for visual clarity.

Defence innovation, particularly in disruptive technologies, is not only a driver of competitiveness but also a cornerstone of strategic autonomy.[226] Protecting European technological sovereignty, requires rapidly scaling up Europe-wide R&T and R&D investments to develop currently missing critical technologies. Bridging the civilian–military gap is also essential, as many 21st-century technologies, including semiconductors, AI, satellites, cloud, and software, are inherently dual-use.[227]

At the same time, innovation in advanced manufacturing can help address Europe's widening skills gap by increasing production efficiency. Automation, AI-enabled processes, and digital production systems reduce reliance on scarce labour, optimise output, and enhance productivity.[228]

Figure 3 Differences in Gross Domestic Spending on R&D between the US and the EU (source: OECD, Gross domestic spending on R&D)



226 European Defence Agency (EDA), *Beyond 2040 - EDA analysis warns on future warfare trends and technology imperatives for European defence*, October 23, 2023.

227 European Commission, *Speech by the President: opening session of the NATO Summit Defence Industry Forum*, June 24, 2025.

228 IISS, Progress and Shortfalls in Europe's Defence: An Assessment, Chapter 4: Transforming European Defence Procurement and Industry, September 2025.

5.2.5 Economies of scale

The challenges above stem from a fundamental issue: fragmentation in the European defence sector prevents it from achieving necessary economies of scale. Simply put, the EU cannot sustain a large, efficient industry if every country buys and builds separately. Three elements are required to move from participation to scale:

1. **Clear and credible demand signals**, indicating which capabilities are expected to be procured in significant quantities and over what time horizon.
2. **Early procurement commitments** by a critical mass of member states, reducing uncertainty and anchoring industrial investment decisions.
3. **Sustained and predictable funding**, extending beyond initial development or ramp-up phases to cover serial production and lifecycle support.

The necessity for consolidation is thus two-dimensional: aggregating national orders into larger contracts drives production efficiency and reduces redundancy, while unifying capital and R&D spending provides the financial scale required to develop critical technologies and spur innovation.[229] Notably, the EU has deployed numerous investment tools (see textbox 1) toward this goal, yet their scale remains modest. For instance, EDIP's €1.5 billion through 2027 is a mere fraction of the €381 billion projected in national spending for 2025 alone.[230]

Through this lens, centralised governance of the industrial environment is also an essential tool to rationalise upscaling. By providing a unified framework, the EU is best positioned to strengthen supply chains and diversify partnerships, reform capital and labour markets, and extend the strategic horizon for defence-industrial cooperation. Cross-border vulnerabilities could be managed more efficiently at the European level. Effectively, friendshoring critical raw materials is possible only through the EU, which holds the competence in trade.[231] As the Draghi report notes, this coordination is the only path to a "unified European production scale."[232] The question remains if these instruments can generate

229 As acknowledged by the Dutch Minister of Defence at the Defence Experts Industry Dinner. Government of the Netherlands, *Speech by Dutch Minister Brekelmans of Defence at Defence Experts of Industry Dinner | Speech* , June 23, 2025.

230 European Commission, EDIP in detail. 2025. European Council, EU defence in numbers, 2025. See also: Jacopo Barigazzi, *EU ambassadors reach preliminary deal on €1.5B defense spending plan*, Politico, June 18, 2025.

231 Ditte Brasso Sørensen, *The EU's Critical Raw Materials Strategy: Engaging with the World to Achieve Self-Sufficiency*, Think Europa, February 9, 2024.

232 European Commission, *The Draghi report on EU competitiveness*, 2025.

the necessary consolidating “pull” or whether a genuine coordination effort by shifting competences from national to European level is required with shared governance and funding institutions.

6 Consolidation – Dilemmas and Implications

Floor Stoelinga and Dick Zandee

In an ideal scenario, the European defence industry would operate as a 'level playing field'. If joint capability planning were the starting point, interoperability and efficiency would naturally follow, as buyers would select the best products regardless of borders.[233] In practice, however, the industrial market is trapped in a classic 'prisoner's dilemma'. While governments recognise the benefits of pooled demand and market consolidation for Europe's industrial growth, they also face intense pressure to prioritise domestic industries to protect jobs or defence companies in which they hold stakes.[234]

The concern then is that *a true market* consolidation (from the demand side) may come only after a major crisis, potentially war on EU territory, by which time it would be too late.[235] Under the current treaties, escaping this deadlock inevitably requires the support of member states, industry and some governance flexibility. This chapter reflects on implications and dilemma's that shape the consolidation debate.

6.1 Consolidation of Supply

Consolidation is frequently contested because member states seek an equal share of the defence-industrial 'pie'. However, the pie is already highly unequal – only a handful of countries (Austria, the Czech Republic, France, Germany, Italy, Poland, Spain, Sweden, and the United Kingdom) dominate, hosting both the largest producers and most SMEs.[236]

233 Interview insight.

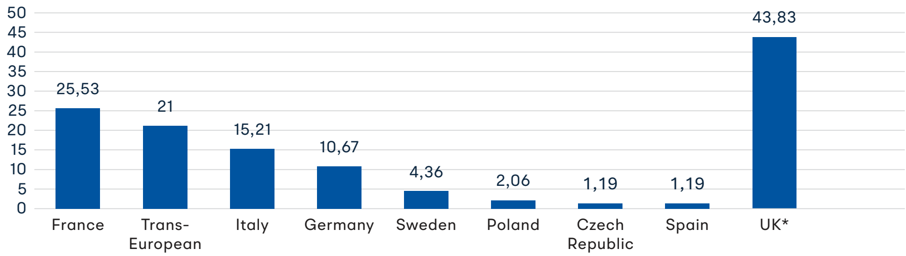
234 Notably the biggest defence producing countries such as France (Naval Group, Thales), Italy (Leonardo S.p.A), Poland (Polish Armaments Group)

235 Expert insight.

236 Christian, *THE EUROPEAN DEFENSE INDUSTRY*, Association of Accredited Public Policy Advocates to the European Union, April 9, 2025.

Figure 4 illustrates the strength of Europe's leading defence companies. The combined revenues of France's largest defence firms are nearly three times greater than the total turnover of the Dutch defence industry (€9.01 billion). The UK stands out as a defence-industrial heavyweight. The relative power of trans-European mergers such as Airbus, MBDA, and KNDS is also notable, demonstrating the competitive edge of scale.

Figure 4 Revenue of defence leaders across Europe
(Source: The SIPRI top100 arms producing and military services companies)



* The United Kingdom is included as a non-EU European country to illustrate the defence-industrial weight of third countries. **Selected firms and holdings:** Czech Republic: Czechoslovak Group, France: Thales, Naval Group, Safran, Dassault Aviation Group, CEA, Germany: Rheinmetall, Thyssenkrupp, Hensoldt, Diehl, Italy: Leonardo, Fincantieri, Poland: PGZ, Spain: Navantia, Sweden: Saab, United Kingdom: BAE Systems, Rolls-Royce, Babcock International Group, Serco Group, Atomic Weapons Establishment Trans-European: Airbus, MBDA, KNDS

The strength of larger companies raises the question of whether the EU should prioritise so-called European 'best athletes' in arms production. The logic is to boost output and improve interoperability by reducing the number of weapon systems in use across Europe. Joint structures between Europe's strongest firms may indeed be better suited to meet the current surge in demand, thanks to their capacity and faster production and innovation cycles.[237] Moreover, consolidated companies are more likely to capture export market share abroad – an important competitiveness objective.[238] Notably, in the maritime sector, a few consolidated

237 Alice Tidey, *Defence: France and Germany looking at 'best athlete' model to boost European military production*, Euronews, August 28, 2025.

238 French Navy Chief of Staff Adm. Nicolas Vaujour argued in favour of such a model before French parliament in May. Rudy Ruitenberg, *Europe is plagued by too many naval yards, French Navy chief says*, Defense News, May 26, 2025.

shipyards could be more efficient than the 14 European shipyards that currently compete against each other on every bid.[239]

In practice, this will be very difficult. The joint FCAS (Combat Air System) and MGCS (Battle tank) projects are already fraught with friction. The FCAS, for example, has become stuck on multiple occasions, following disputes over workshare, decision making and intellectual property.[240] Similarly, the Naviris joint venture between Italy's Fincantieri and France's Naval Group also "failed to spur vendor consolidation."[241] From a governance perspective, a key problem beyond national protectionism is the wide divergence in national strategies and standards, leading to vastly different industrial practice. In cross-border projects, companies face significant practical burdens due to these differences. Navigating between many different export controls, operational systems, and cloud-based platforms, has led to substantial delays and even project breakdown.[242]

Moreover, concentrated production does not automatically eliminate duplication. Even if 'European champions' emerge, they must contend with national variants, which are deeply entrenched in specific requirements, operational practices, dedicated infrastructure and maintenance – a challenge not easily overcome. Moreover, limiting competition in Europe may slow innovation, and thus competitiveness and quality in the long-term.[243] In the US, for example, the number of prime defence contractors for the Department of Defense has declined by more than 80%.[244] Such overconcentration gives individual companies enormous leverage over the government, but also isolates the

239 Rudy Ruitenberg, *Europe is plagued by too many naval yards, French Navy chief says*, Defense News, May 26, 2025.

240 Aaron Spray, *Dassault, Airbus spar over FCAS fighter jet control*, Aerospace Global News, August 22, 2025. Sabine Siebold, Tim Hephner, and Michel Rose, "France's Macron and Germany's Merz to discuss troubled fighter project, sources say", Reuters, March 18, 2026.

241 Rudy Ruitenberg, *Europe is plagued by too many naval yards, French Navy chief says*, Defense News, May 26, 2025.

242 Expert insight.

243 Interview insight. See also: Alice Tidey, *Defence: France and Germany looking at 'best athlete' model to boost European military production*, Euronews, August 28, 2025.

244 Expert insight. See also: Gregory C. Allen and Doug Berenson, *Why Is the USDefense Industrial Base So Isolated from the USEconomy?*, Centre for Strategic International Studies (CSIS), August 20, 2024.

defence sector from other industries, limiting spill-over benefits and dual-use opportunities, and ultimately reducing efficiency and capital flow.[245]

The situation serves as a warning to both member states and the Commission. Governments can become vulnerable to 'national champions' that often exhibit chronic underperformance, inflate cost, or exploit preferential treatment – risks the Commission may likewise face when promoting 'European champions'.

6.2 Governance considerations

The debate over defence champions has already been overtaken by industrial reality. Firms are rapidly responding to a shifting investment landscape, recalibrated defence strategies and budgets, and a surge in orders and expected demand. To expand capacity and capture growth opportunities, companies are driving consolidation up the supply chain, giving rise to both national and European champions. This shift is best reflected in a wave of strategic mergers and integrated holdings.[246] Some structures are even evolving towards industrial specialisation, clarifying "who should produce what, for all". This includes major players such as Airbus Defence and MBDA.[247]

The trend towards industrial powerhouses raises important governance questions. For example, how to connect SMEs to the platform-producing companies, which are mostly located in larger EU member states[248] and how to integrate specialised capabilities from member states with more isolated industries, like in Eastern Europe.[249] While the EU has some provisions for these issues,[250] in practice sector consolidation often takes place with little or no EU involvement at all.

245 Gregory C. Allen and Doug Berenson, *Why Is the USDefense Industrial Base So Isolated from the USEconomy?*, Centre for Strategic International Studies (CSIS), August 20, 2024.

246 Manfred Hader, Stephan Baur, Andreas Grille and Dieter Atzwanger, On the offensive: The rise of M&A in European defense, December 4, 2025.

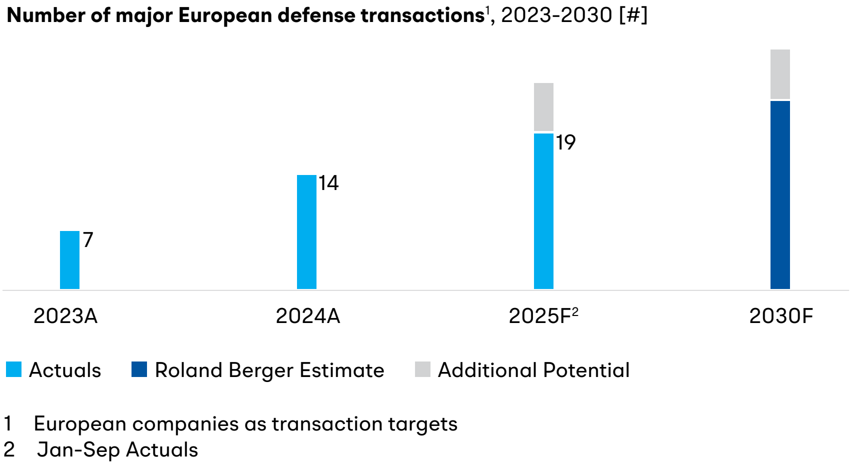
247 Dick Zandee, *European defence industry: urgent action is needed!*, Clingendael Institute (page 7), January 17, 2024.

248 *idem*.

249 Lucie Béraud-Sudreau, and Lorenzo Scarazzato, *Beyond Fragmentation? Mapping the European defence industry in an Era of Strategic Flux*, Brussels School of Governance, July 7, 2023.

250 For example, increasing access to finance for SMEs. Defence Industry Europe, *EIB triples funding to €3billion for defence industry SMEs, signs first deal with Deutsche Bank*, June 11, 2025.

Figure 5 Mergers and Acquisition targeting European defence companies are on the rise. (Source: Manfred Hader, Stephan Baur, Andreas Grille and Dieter Atzwanger, "On the offensive: The rise of M&A in European defense," Roland Berger, December 4, 2025)



Nonetheless, the EU can have an essential role in managing industrial consolidation: market regulation can be leveraged to support consolidation where scale is necessary, while safeguarding competition where it is not. With the Defence Readiness Omnibus, it has already taken an important step forward in balancing efficiency, competition, and security objectives.[251]

Crucially, the ongoing review of EU merger guidelines represents a fundamental opportunity to reduce supply-side fragmentation. By prioritising mergers that deliver efficiency gains or address strategic security needs, the EU could pave a legal pathway for 'European champions' where they are most needed. A significant tool for fostering balanced consolidation lies in Article 107(3)(c) TFEU. Historically, this article has functioned as a guardrail to prevent market distortion by restricting national subsidies. However, as the Union moves towards a 'defence-ready' economy, there is a compelling case for repurposing this mechanism as a strategic filter.

251 European Commission, *Defence Readiness Omnibus*, 2025.

The logic of this shift is grounded in conditionality. Rather than merely policing competition, the Commission could refine its approval process to favour projects that actively reduce fragmentation. For instance, by conditioning the approval of state aid on cross-border cooperation, system interoperability, or European supply chain security. This evolution would allow for vital industrial support while ensuring that national fiscal power is harnessed to meet collective European priorities, rather than subsidising redundant national champions.[252]

6.3 Demand Consolidation

As long as defence spending remains a national competence, market consolidation will thus remain contested, as seen in persistent frictions between the European Commission and EU member states.[253] Paradoxically, concerns about supply chain security are also leading countries to regain control over national industries, such as steel, which further breaks up the European 'unified production scale'.[254] The 1.5% share earmarked to 'civil preparedness' as part of the NATO pledge risks fuelling national opportunism even more, as it is open to broad interpretation.[255]

In the absence of binding mechanisms for European demand aggregation, defence ministries retain authority over requirement setting and acquisition decisions, while bearing full political, financial, and operational responsibility for outcomes. These accountability structures create incentives that systematically favour national control in procurement choices, even where cooperation is formally encouraged. From both an economic and political perspective, persistent market fragmentation therefore constitutes a *rational* outcome of decision-making under existing institutional and incentive structures.

252 Andreas von Bonin, Thomas Janssens, Katharina Kunert, Edward Dean, and Conor Leavy *Roadmap for EU Defence Consolidation: Guidance on M&A and State aid in the EU Commission's Defence Readiness Omnibus*, Freshfields, June 24, 2025.

253 See chapter 2.

254 IISS, Progress and Shortfalls in Europe's Defence: An Assessment, Chapter 4: Transforming European Defence Procurement and Industry, September 2025.

255 Alessio Dell' Anna, Alice Tidey, María Muñoz Morillo, *NATO's 1.5%: Is this the devil in the detail that could derail the new spending deal?*, Euronews, June 25, 2025.

6.3.1 Why fragmentation persists

National procurement decisions are shaped by risk management and accountability. Major defence acquisitions involve long time horizons, high political visibility and significant budgetary exposure. Governments therefore prioritise demand control over requirements, delivery schedules and life-cycle costs. This favours nationally controlled or trusted bilateral arrangements over multilateral programmes with shared authority and higher outcome uncertainty.

Demand-side incentives are reinforced by platform-centric procurement. Prime contractors combine design authority, systems integration and long-term sustainment. Once a platform choice is made, downstream supply chains are locked in for decades. This makes early demand decisions decisive and discourages late convergence on shared European platforms.

Time pressure further strengthens these dynamics. In response to urgent capability shortfalls, governments prioritise speed of delivery over harmonisation, opting for national or off-the-shelf solutions. The proliferation of nationally defined drone programmes illustrates how urgency fragments demand even where operational needs are broadly shared. Divergent specifications, certification standards, and operating systems further push member states toward the U.S., for simplicity and interoperability.[256]

The result of this dynamic is directly visible in the domestic procurement deadlock today. Although EU leaders have repeatedly urged member states to spend "more and better together" is proves difficult to realise this ambition. Collaborative defence spending has increased in absolute terms but remains concentrated in a limited number of programmes and has not reversed the broader trend toward diversified national procurement portfolios. Participation in EU-funded initiatives has therefore expanded cooperation at the project level without fundamentally altering acquisition behaviour. The EDA set a benchmark of 35 percent collaborative procurement in 2007, yet by 2022 only around 18 percent met this threshold.[257] After 2022, member states stopped reporting comparable data, further reducing transparency.

256 European Commission, *The Draghi report on EU competitiveness*, 2025.
257 European Defence Agency, *Defence Data Portal*, 2025.

At the same time, 'buying European' is on the rise – more than half of spending occurs within Europe.[258] However, most defence tenders (70-80%)[259] go directly to national projects. National priorities, legislation, requirements and industrial policies continue to obstruct joint purchasing[260] – even when it comes to products developed through collaborative R&D. Most of Germany's recent procurement has gone to domestic primes.[261]

Such figures reflect the location of prime contractors rather than underlying supply chains, which often involve extensive cross-border subcontracting and provide smaller defence economies with access and value creation that remain invisible in aggregate statistics. This distinction matters for interpreting both dependency and integration. Procurement data capture demand decisions at prime level, while obscuring subcontracting and supply-chain interdependence. European integration is therefore deeper than procurement statistics suggest, yet weaker than strategic autonomy ambitions require.

6.3.2 When Cooperation Works

Where European defence cooperation has produced durable results, it has done so under demand-side discipline. Successful programmes combine early convergence on requirements, clearly defined governance and credible, long-term demand commitments across the full capability lifecycle. Multinational platform programmes such as the Airbus A330 MRTT and the Airbus A400M Atlas, for example, illustrate the conditions under which European defence cooperation can translate into scale and interoperability. In both cases, participating states agreed early on core operational requirements and governance arrangements, which provided industry with sufficient predictability to invest in production capacity and long-term supply chains. While neither programme was free from delays or cost overruns, they nevertheless delivered

258 Juan Mejino-López, Guntram B. Wolff, *What role do imports play in European Defence?*, Bruegel, July 4, 2024.

259 Lucian Cernat, Oscar Guinea, Hannah Preuss, Openness and Fragmentation in EU Defence Procurement, European Centre for International Political Economy, Policy Brief no.20, 2025. Confirmed as Interview insight.

260 IISS, Progress and Shortfalls in Europe's Defence: An Assessment, Chapter 4 Transforming European Defence Procurement and Industry, September 2025.

261 Ibid.

pooled fleets and common platforms that fragmented national approaches would have struggled to achieve.[262]

6.3.3 Governance Considerations

Efforts to align capability demand and industrial supply across Europe have produced mixed results. However, these programmes demonstrate that cooperation is feasible when requirements are defined upfront and governance is sufficiently robust to sustain demand over time. Recent developments in tactical drones illustrate the same dynamic. Despite coordination efforts and joint initiatives to support Ukraine, multiple nationally anchored programmes are emerging in parallel, limiting scale, standardisation and interoperability.[263] A predominantly national approach raises costs and weakens the prospects for consolidation.

Where cooperation is initiated only after national requirements have diverged, it remains limited to coordination or partial industrial collaboration. Without early convergence, EU-level incentives rarely reshape outcomes. This disparity underscores a central conclusion: fragmentation is a rational outcome of a system that rewards early national control but penalises delayed alignment. For years, this dynamic was manageable, resting on the assumption of sufficient supplier capacity and the viability of small, nationally tailored fleets. The high-intensity phase of the war in Ukraine further reinforced this through an "emergency logic" that prioritised fragmented, off-the-shelf purchases to meet immediate time pressures.

As this emergency phase eventually must reach a halt or a pause, the justification for such fragmented procurement loses its force. This creates a strategic window for a fundamental recalculation of these assumptions. To avoid a return to sub-scale "boutique" capabilities, there is an opportunity to aggregate demand where it is most critical, particularly in strategic enablers and the air domain. Breaking these national procurement reflexes, however, requires more than political commitment; it may demand a re-engineered institutional framework. The following chapter examines the interplay between NATO's NDPP and EU

262 For a more detailed overview of the various models of multinational procurement models, see: Jan Joel Andersson, *Buying Weapons Together (or not) – Joint defence acquisition and parallel arms procurement*, Brief 7, EU Institute for Security Studies, April 2023.

263 See: *Verslag Raad Buitenlandse Zaken Defensie 20 mei 2025*, Kamerbrief van de minister van Defensie Ruben Brekelmans, 3 juni 2025.

instruments, such as the EDA and DEFIS, and how their alignment can and cannot turn aggregated demand into lasting industrial and capability outcomes.

Considerations for Dutch policy

- The Netherlands remains heavily reliant on US imports to meet urgent readiness needs and to support Ukraine.[264] Without large-scale Original Equipment Manufacturers (OEMs) in its base[265], the Dutch contribution to European defence-industrial strategic autonomy will remain limited unless it rapidly accelerates the uptake of European systems and rethinks its role in international production lines, as the landscapes shifts towards more powerful players.

- The Dutch Defence Industrial Strategy (DSII) is well focused on five key niches – Quantum, Smart Materials, Space, Intelligent Systems, and Sensors – where it can secure leadership. The relatively competitive Dutch industrial base, however, is highly dispersed. Firms in these highly innovative domains cannot compete on expertise alone; they require early access to capital and long-term demand.[266]

- This necessitates more immediate integration into major European platforms – specifically those projects overlapping with EDIP's projects of common interest. Moreover, participation in larger European projects would require commitments to the uptake of non-Dutch defence products, helping to break its 'off-the-shelf' procurement deadlock and move toward the 40% European procurement target.[267] Early commitment is crucial: Requirements, standards and workshare are determined at the design phase, not after contracts are awarded.

264 Farah Bahgat, *Netherlands to buy US arms for Ukraine under new NATO scheme*, Deutsche Welle, May 8, 2025.

265 Luddo Oh, Nick Hageraats, Hans Schotel, *Nederlandse defensie- en veiligheid gerelateerde technologische industriële basis*, Berenschot, April 2024.

266 Dutch Ministry of Defence, *Defence Strategy for Industry and Innovation 2025-2029*, 2025.

267 This is in line with the 2030 targets: the goal is for 50% of defence procurement budgets and at least 40% of defence equipment procurement to be conducted through collaborative European initiatives.

- A practical pathway for the Netherlands is to link its industrial vision with trusted partners with complementary strengths (such as Belgium, Germany, and the Nordics)[268]. Such cross-border division of labour allows for the emergence of mid-sized suppliers alongside best athletes, streamlining barriers to interoperability and industrial cooperation (such as diverging platforms, export controls, requirements, industrial practice etc.). It also allows for the emergence of an 'economy of scale' at a smaller, more manageable level.[269]

268 Interview insight. For example, building on other cooperative structures with Belgium, Germany, the UK, and the Nordics.

269 Interview insight.

7 EU Governance and Institutional Coordination

Karen van Loon, Dick Zandee, and Floor Stoelinga

Europe's ambition to strengthen strategic autonomy in defence depends on how well its institutions align military demand with industrial supply and on whether that alignment is sustained over time. The governance question is therefore practical: who does what, on which mandate, with what money, and how do overlapping roles add up to capability delivered? This chapter maps the institutional landscape, clarifies the role of the new Commissioner for Defence and Space, and examines how EU and non-EU mechanisms can better translate shared priorities into predictable programmes and production.

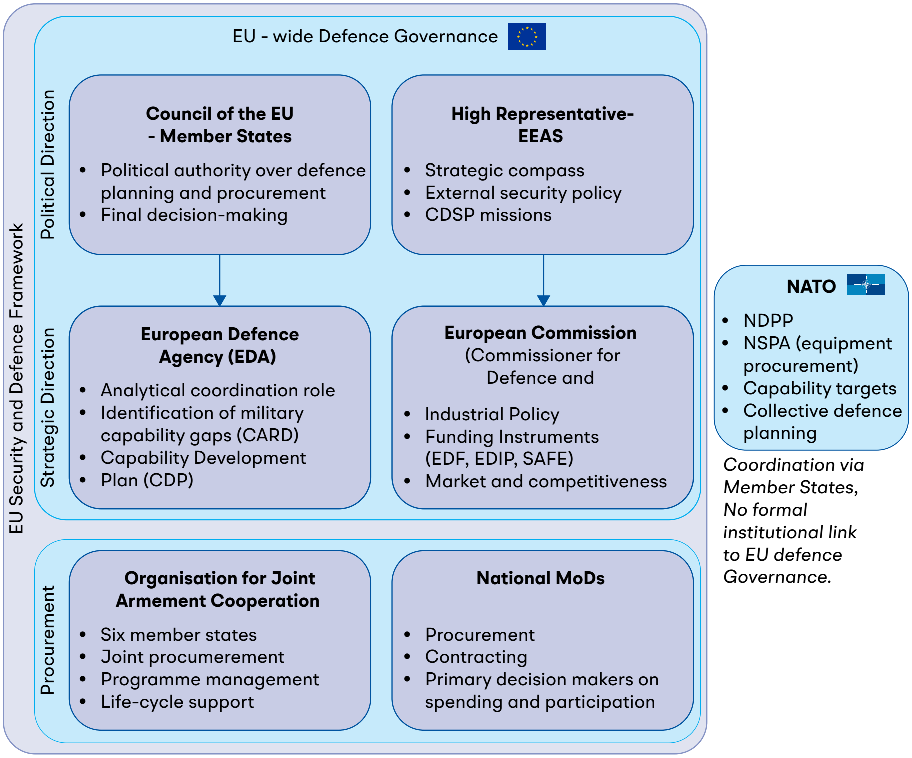
7.1 Mapping the Institutional Landscape

European defence-industrial governance is characterised by a fragmented distribution of authority across national governments, EU institutions and non-EU frameworks. No single actor controls the full capability development cycle from threat assessment and requirement-setting to procurement and industrial scaling. This institutional configuration reflects longstanding choices to preserve national sovereignty in defence while enabling selective forms of European coordination. The result is not a lack of initiatives, but a structural gap between where defence demand is defined and where EU-level instruments can intervene.

At the core of this landscape (see figure 6), member states retain decisive authority over defence planning and procurement. Governments remain directly accountable for military readiness and therefore determine which capabilities are acquired, on what timelines and from which suppliers. European cooperation can shape incentives, frameworks and coordination mechanisms, but it does not override national decision-making. In practice, this allows member states to prioritise speed, bilateral arrangements or domestic industrial considerations over collective European solutions, particularly in periods of heightened security pressure.

Within the EU framework, the European Defence Agency performs an analytical coordination role rather than an executive one. Through instruments such as the Capability Development Plan (CDP)[270] and the Coordinated Annual Review on Defence (CARD)[271], the Agency supports the identification of capability gaps and potential areas for cooperation. These processes enhance transparency and alignment among member states, but they do not create binding commitments. The EDA has no programme-scale spending authority, no procurement mandate and no capacity to enforce prioritisation. Its intergovernmental design has remained focused on coordination rather than decision-making authority, and its role has not evolved into one of central steering.

Figure 6 Mapping the EU's institutional landscape in defence governance



270 European Defence Agency, *Capability Development Plan*, 2025.

271 European Defence Agency, *Coordinated Annual Review on Defence*, 2025.

At the same time, a stronger steering role for the EDA would overlap with the European Commission's expanding set of defence-industrial instruments. Over the past decade, the Commission has consolidated its position as the main driver of EU-level defence-industrial policy through funding programmes, regulatory initiatives and financial facilitation mechanisms. These instruments concentrate leverage on the industrial and market side of defence cooperation, rather than on the definition of military requirements. This also makes it less realistic for the EDA to become the central authority directing European defence-industrial outcomes.

The creation of a Commissioner for Defence and Space formalises the Commission's role in this domain and signals a stronger political commitment to treating defence industry as a strategic policy area at EU level. The Commissioner's mandate, however, remains explicitly connected to industry. It does not extend to defining military capability requirements, selecting platforms or directing national procurement decisions. Influence is exercised primarily through conditional incentives linked to funding and regulation, rather than through authority over demand.

The High Representative and the European External Action Service contribute to strategic framing and policy coherence, particularly at the intersection of defence, foreign policy and external partnerships. Their role is important for articulating shared priorities and linking internal industrial efforts to broader security objectives. However, they lack direct leverage over procurement or production decisions.

Taken together, the institutional landscape reveals a core structural constraint: authority over defence-industrial outcomes is horizontally distributed rather than hierarchically organised. Analytical coordination, industrial incentives and procurement power reside in different institutions with distinct mandates and accountability structures. This configuration enables flexibility and national control, but it also limits the EU's capacity to translate shared priorities into predictable programmes and production at scale.

Box 3. How EU defence governance evolved (select milestones)

- Around 2000, the European Security and Defence Policy[272] prioritised civilian and military crisis-management missions. Decision-making sat largely with the Council and its committees, reflecting a predominantly intergovernmental model with limited supranational involvement.

- In 2004, the European Defence Agency[273] was established to coordinate capability development and armaments cooperation. It remains an intergovernmental body, governed by defence ministers and chaired by the High Representative, underscoring member states' continued control over procurement and force planning.

- The Treaty of Lisbon[274] (in force 2009) renamed ESDP as the Common Security and Defence Policy, established the EEAS as the EU's diplomatic arm, and provided the treaty basis for deeper defence cooperation, while leaving primary authority with national governments.

- The European Union Global Strategy[275] (2016) shifted the focus from crisis management to strategic autonomy and stronger European capability development, setting the political direction for deeper defence cooperation.

- From 2016, the European Commission expanded its role through the European Defence Action Plan[276] and the European Defence Fund[277], embedding defence within EU industrial and research policy and financing multinational capability projects from the EU budget.

- Following Russia's invasion of Ukraine in 2022, additional short-term instruments supported joint procurement, ammunition production

272 European Council, *Presidency Conclusions, Cologne European Council*, June 3 and 4, 1999.
273 European Union, *European Defence Agency (EDA)*, 2025.
274 European Union, *Treaty of Lisbon*, December 13, 2007.
275 European External Action Service, *A Global Strategy for the European Union's Foreign and Security Policy*, July 2016.
276 European Parliament, *European Defence Action Plan*, 2025.
277 European Commission, *The European Defence Fund in detail*, 2025.

and stock replenishment. The ReArm Europe / Readiness 2030[278] plan proposed up to €800 billion in investments, including €150 billion in Security Action for Europe (SAFE)[279] loans, with incentives such as VAT exemptions for common procurement.

- Overall, EU defence governance has evolved through incremental layering: the Commission increasingly steers funding and industrial competitiveness (notably under Article 173 TFEU[280]), while operational control and force decisions remain fragmented across EU institutions, NATO, and member states.

7.2 NATO and Non-EU Demand-Setting: Where Requirements Are Defined

If authority over the capability cycle is horizontally distributed, the decisive question becomes where military requirements are defined and prioritised. While the European Union has expanded its role in defence-industrial policy, authoritative demand-setting in Europe remains largely located outside the EU framework. For most member states, military requirements continue to be defined primarily through NATO, via the NATO Defence Planning Process (NDPP).[281] This has important implications for how, and to what extent, EU instruments can translate shared priorities into predictable programmes and production.

7.2.1 Defence Planning and Production

The NDPP is the central mechanism through which NATO translates threat assessments into concrete capability targets for individual Allies. These targets inform national defence planning, force structure decisions and procurement priorities. For the majority of EU member states, the NDPP therefore constitutes the most binding reference point for military requirements. This means that NDPP targets shape procurement decisions in high-cost capability areas such

278 European External Action Service, *White Paper for European Defence – Readiness 2030*, March 21, 2025.

279 European Commission, *SAFE – Security Action for Europe*, 2025.

280 "Consolidated version of the treaty on the functioning of the European Union", *Official Journal of the European Union*, October 26, 2012.

281 NATO, *NATO Defence Planning Process*, April 16, 2025.

as air defence, ammunition stockpiles or strategic mobility. National ministries consequently translate these targets into budgetary and procurement choices, often on different timelines and with varying technical preferences. EU-level instruments may support these efforts financially or industrially, but they do not replace this national translation step.

EU-level capability processes such as the CDP and CARD operate alongside this framework but do not supersede it. Instead, they remain complementary, drawing on national inputs that are themselves shaped by NATO commitments. Institutional links between NATO and the EU in capability planning remain limited, with coordination relying on informal staff contacts and parallel planning cycles. This reliance on informal coordination reinforces NATO’s position as the primary locus of demand authority and limits the EU’s ability to directly steer capability priorities. Formal EU–NATO capability coordination, however, remains constrained by enduring political obstacles, most notably the unresolved Cyprus–Türkiye dispute, which restricts the structured exchange of classified defence planning information.

In recent years, NATO has also strengthened its focus on industrial capacity and production. Initiatives such as the NATO Defence Production Action Plan seek to accelerate output, improve supply-chain resilience and provide clearer demand signals to industry. These efforts respond to similar pressures as EU initiatives but remain embedded in NATO’s alliance-based governance and do not address EU-level industrial consolidation or autonomy.

7.2.2 Procurement and Programme Management

Other long-standing non-EU frameworks such as the NATO Support and Procurement Agency (NSPA)[282] and the Organisation for Joint Armament Cooperation (OCCAR)[283] continue to play a role in multinational procurement and programme management. These bodies offer speed, expertise and cost efficiencies, but function as substitutes for EU-level aggregation rather than extensions of it. These organisations partially compensate for the absence of EU-level demand aggregation, but they operate outside EU budgetary and regulatory frameworks, limiting their ability to anchor a coherent European industrial strategy.

282 NATO, *NATO Support and Procurement Agency (NSPA)*, April 22, 2022.
283 Organisation for Joint Armament Cooperation, *OCCAR – Home*, 2025.

Non-EU procurement and programme management bodies

- The NATO Support and Procurement Agency (NSPA) aggregates demand among Allies, conducts joint procurement and manages systems across their life cycle, generating efficiencies and often benefiting from VAT exemptions. Examples include multinational arrangements for the Airbus A330 MRTT and MIM-104 Patriot.

- The Organisation for Joint Armament Cooperation (OCCAR) manages cooperative armament programmes from development through joint procurement. Projects have included the Airbus A400M Atlas, the Boxer and the FREMM, with current programmes such as the Eurodrone. Since 2012, OCCAR has a cooperation agreement[284] with the EDA, which defines requirements upstream while OCCAR manages downstream implementation.

Beyond NATO, many bilateral or minilateral procurement programmes also rely on ad hoc coordination structures, particularly in early design phases when participating states define and adjust operational and technical requirements. Examples include the Franco-German-Spanish Future Combat Air System (FCAS) and the Franco-German Main Ground Combat System (MGCS), with major national defence firms often involved from the outset.

Taken together, these non-EU mechanisms shape the conditions under which EU defence-industrial instruments operate. They define demand, manage procurement or facilitate production without being embedded in EU governance. As a result, the EU's ability to translate shared priorities into predictable programmes depends not only on its own instruments, but also on alignment with demand signals generated elsewhere.

7.3 EU Defence Instruments: Enabling Participation, Not Prioritisation

EU-level defence instruments have expanded rapidly since 2022 and play a growing role in shaping the industrial and financial conditions for defence

284 See: European Defence Agency, *EDA & OCCAR build links, seeking efficiencies through cooperation*, July 27, 2012.

production. Collectively, these tools reduce barriers to cooperation, lower financial risk and stimulate cross-border participation. However, they do not resolve the underlying problem identified in the previous section: the absence of a single authority capable of translating military requirements into binding, large-scale procurement decision.

7.3.1 What EU Instruments Do Well ☑

First, EU defence instruments are effective at lowering financial and regulatory friction. By providing grants, loans, guarantees and regulatory flexibility, they reduce upfront investment risk for both member states and industry. This has been particularly relevant in capital-intensive areas such as ammunition production, defence manufacturing capacity and supply-chain resilience.

Second, these instruments encourage cross-border industrial participation. Requirements for multinational consortia and incentives for SME involvement have increased collaboration across national lines, broadened supplier networks and strengthened parts of the European defence industrial base that were previously fragmented or undercapitalised.

Third, EU instruments signal political commitment and continuity. Multiannual programmes such as the European Defence Fund (EDF) and successor initiatives provide industry with greater predictability than purely national, short-term procurement cycles, supporting incremental capacity expansion and technological development.

7.3.2 What EU Instruments Do Not Do ☒

At the same time, EU defence instruments do not select or prioritise military capabilities. Decisions on what to buy, in what quantities and on which timelines remain firmly in the hands of member states, typically shaped by NATO defence planning targets and national threat assessments.

Nor do EU instruments impose convergence of requirements or procurement choices. While they can incentivise cooperation, they cannot oblige member states to align technical specifications, acquisition schedules or long-term sustainment models. As a result, participation in EU-funded projects does not necessarily translate into common platforms or interoperable production at scale.

Finally, EU instruments do not guarantee demand certainty for industry. Funding often supports development, coordination or capacity expansion, but without binding follow-on procurement commitments. This limits industry's willingness to invest in sustained production lines and reinforces a cautious, incremental investment posture.

7.3.3 Instrument-specific limits

Within this broader pattern, the main EU defence instruments exhibit distinct but structurally similar limitations.

SAFE and related financial instruments primarily address affordability and liquidity constraints, enabling faster procurement and capacity expansion. They do not, however, harmonise requirements or synchronise national acquisition timelines.

EDF supports collaborative research and development and helps de-risk early-stage cooperation. Yet EDF projects frequently stop short of guaranteed procurement, limiting their impact on production scale and long-term industrial planning.

Emerging instruments under EDIP and the post-2027 framework aim to strengthen supply chains and incentivise joint procurement. Their effectiveness will depend less on their legal design than on whether they are coupled to credible, shared demand commitments by member states.

Taken together, these instruments expand what is possible at EU level, but they do not alter the basic governance reality: defence demand remains nationally defined, while EU action operates primarily on the supply and enabling side. In the absence of these conditions, national procurement behaviour becomes the decisive driver of outcomes, not EU-level programme design.

8 External Partnerships and Strategic Balance

Karen van Loon

The EU's pursuit of strategic autonomy in the defence-industrial domain unfolds within a dense network of external partnerships. Despite the expansion of EU-level defence initiatives, Europe's defence industry remains deeply interconnected with non-EU partners through alliances, procurement, supply chains and industrial cooperation. These partnerships shape capability development and production capacity and directly affect Europe's freedom of action in security and foreign policy.

Strategic autonomy does not imply self-sufficiency or disengagement. It refers to the EU's ability to act independently where necessary, supported by a resilient defence-industrial base. The core challenge is therefore not whether to cooperate externally, but how to govern interdependence to preserve political choice and long-term security interests. This requires the systematic use of concrete governance levers, most notably exportability, intellectual property arrangements and security of supply, to manage dependencies over the life cycle of defence capabilities.

8.1 Overview of EU external partnership frameworks

The EU's external defence-industrial relationships are organised through several partially overlapping partnership frameworks that differ in legal basis, institutional depth and industrial relevance. Together, they form a layered governance landscape rather than a single hierarchy, shaping how strategic autonomy is pursued under varying political and institutional conditions.

NATO remains the central framework for collective defence in Europe, and the primary reference point for operational planning and capability targets through the NATO Defence Planning Process. For most EU member states, NATO structures define defence requirements, while EU instruments increasingly support the industrial, regulatory and financial conditions needed to meet those requirements. Key partners in this framework include the United States, the United Kingdom, Canada, Norway and Türkiye. Political constraints, notably the long-standing Türkiye–Cyprus dispute, limit formal NATO–EU coordination, resulting in reliance on informal mechanisms and parallel planning processes.

Several NATO allies are also embedded in EU defence cooperation through additional frameworks, creating overlap between NATO-based cooperation and EU-centred governance. The United Kingdom, Canada Norway, and Iceland combine NATO membership with formal EU Security and Defence Partnerships[285], while Albania and North Macedonia participate as NATO allies with more limited industrial weight. This dual positioning enables closer political dialogue and, in some cases, participation in EU defence initiatives, but also introduces governance complexity, as cooperation must be managed across both NATO and EU instruments.

Unlike other NATO allies, the United States is not embedded in EU defence-industrial governance instruments and does not participate in EU frameworks such as Security and Defence Partnerships or the European Defence Fund. U.S. involvement in EU initiatives is limited to narrowly defined cases, most notably participation as a third country in the PESCO Military Mobility project[286], resulting in operationally deep but institutionally asymmetrical cooperation from an EU governance perspective.

EU Security and Defence Partnerships (S&DPs) form a second layer of structured external engagement; as of early 2026, they have been concluded with the

285 European Council, *Security and defence partnerships*, September 2, 2025.

286 European Council, *PESCO: Canada, Norway and the United States will be invited to participate in the project Military Mobility*, May 6, 2021.

United Kingdom[287], Canada[288], Norway[289], Iceland[290], Japan[291], South Korea[292], India[293], Albania[294], North Macedonia[295] and Moldova[296].

Beyond NATO and S&DPs, the EU also cooperates with a broader set of partners through bilateral and ad hoc arrangements. This category includes countries with significant industrial, technological or regional relevance, such as Israel, Australia and Brazil. Cooperation with these partners may involve industrial collaboration, technology development, procurement or operational engagement, but remains less institutionalised and therefore more sensitive to political alignment, export-control regimes and governance constraints.

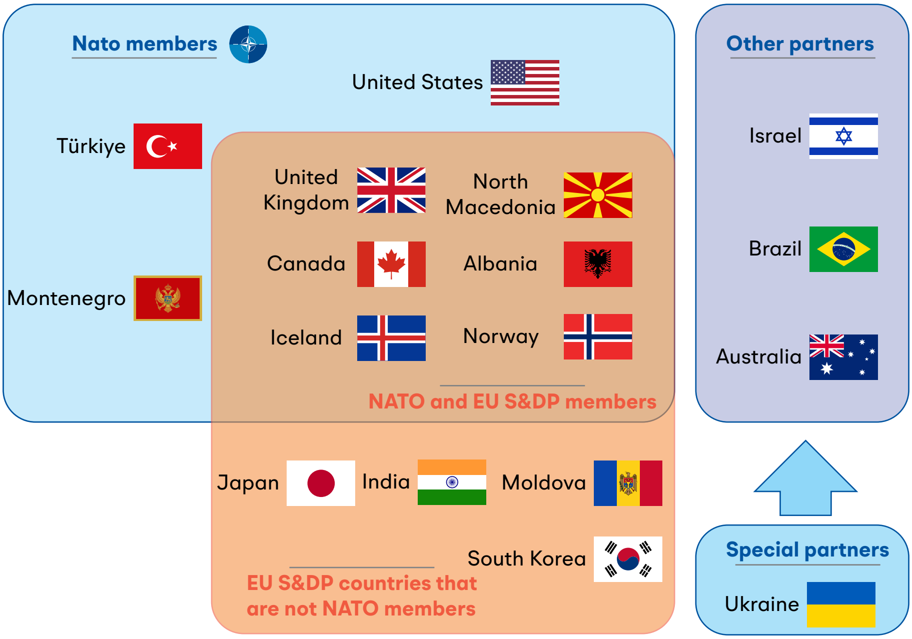
Ukraine occupies a distinct position within this landscape. Since Russia's full-scale invasion, cooperation with Ukraine has intensified rapidly across operational, industrial and innovation domains. Ukraine is neither a NATO ally nor an S&DP partner, yet its defence industry, combat experience and production surge are increasingly shaping European defence-industrial practices. As such, Ukraine does not fit neatly into existing partnership frameworks and requires a differentiated analytical approach.

Taken together, these overlapping frameworks illustrate that EU external partnerships operate across intersecting governance layers, with varying degrees of political alignment, institutional access and industrial integration.

287 European External Action Service, *Security and Defence: EU and UK conclude a Security and Defence Partnership*, May 19, 2025.
288 Council of the European Union, *Security and defence partnership between the European Union and Canada*, June 18, 2025.
289 Council of the European Union, EU-Norway Security & Defence Partnership, May 28, 2024.
290 Government of Iceland, EU - Iceland Security and Defence Partnership. March 18, 2026.
291 European External Action Service, *Security and Defence Partnership between the European Union and Japan*, November 1, 2024.
292 European External Action Service, *Security and Defence Partnership between the European Union and the Republic of Korea*, November 4, 2024.
293 European External Action Service, EU and India sign security & defence partnership January 27, 2026.
294 European External Action Service, Albania: New Security and Defence Partnership with the EU to strengthen capabilities and cooperation, November 19, 2024.
295 European External Action Service, North Macedonia: New Security and Defence Partnership with the EU to strengthen capabilities and cooperation November 19 2024.
296 European External Action Service, EU-Moldova Security & Defence Partnership, May 21, 2024.

Strategic autonomy consequently requires differentiated governance that balances operational imperatives, political relationships, and industrial control.

Figure 7 Overview of EU external defence partnerships and partner groupings



8.2 Typology of EU external defence-industrial partnerships

External defence-industrial partnerships affect European strategic autonomy in different ways. Rather than classifying partners by geography or political alignment, this chapter differentiates them according to their functional contribution to European defence, their level of access to EU defence frameworks, and the depth of industrial cooperation involved.

The typology highlights how these dimensions shape EU control over critical technologies, supply chains, exportability, and decision-making across capability life cycles. The categories are not mutually exclusive; partners may operate across multiple frameworks or evolve over time. The aim is not rigid classification, but to clarify differences in access, contribution, and control that matter for EU defence-industrial governance.

Table 3 EU External Defence-Industrial Partnerships: Types and Autonomy Effects

Partnership type	Partners	Core characteristics	Typical autonomy implication
Primary transatlantic security partner	United States	Deep operational and industrial integration; access to advanced platforms and systems	Strong short-term readiness; high long-term dependency risk
Close European non-EU allies	United Kingdom, Norway	High political alignment; shared standards; deep industrial cooperation	Structural contribution to European resilience
Secondary or constrained NATO partners	Canada, Türkiye, Albania, North Macedonia, Iceland	Selective industrial relevance; political or governance constraints	Conditional and limited autonomy gains
Indo-Pacific and global partners	Japan, South Korea, India, Australia, Brazil	Selective cooperation; technology access, surge capacity, market diversification	Bridging or long-term diversification effects
Neighbourhood and conflict-driven partners	Ukraine, Moldova	Security-driven cooperation; rapid innovation and operational feedback	Transformational but exceptional

This typology shows that external partnerships contribute to European defence in structurally different ways. Core transatlantic partnerships, most notably with the United States, primarily address short term readiness and deterrence. Close European non-EU partnerships, such as with the United Kingdom and Norway, support long term industrial resilience, interoperability and sustainment. Indo Pacific and other global partnerships contribute to diversification, technology access and surge capacity, while neighbourhood and conflict driven partnerships, particularly with Ukraine, generate stabilisation effects and accelerated innovation under exceptional conditions.

These differences inform the governance choices examined in the following sections, which assess partners' access to EU defence frameworks and their concrete industrial and capability contributions.

8.3 Institutional access and governance asymmetry

External defence industrial partnerships differ not only in strategic function, but also in their degree of institutional access to EU defence frameworks. This access determines where cooperation can take place, how far the EU can shape industrial outcomes, and how dependency risks are governed.

EU defence cooperation relies on a limited set of instruments, notably NATO EU coordination, S&DPs, PESCO and the EDF. Access to these instruments is uneven and conditional. Some partners are embedded across multiple frameworks, while others remain operationally close but institutionally external.

This uneven access creates a persistent governance asymmetry. Partners with high operational or industrial relevance may have limited formal access to EU defence industrial instruments, while trusted partners with lower political risk can be more deeply embedded. Overlapping memberships further complicate governance, particularly where NATO allies also participate in EU frameworks.

For strategic autonomy, these asymmetries matter because they shape the EU's ability to steer cooperation, aggregate demand, and enforce common rules on exportability, intellectual property and security of supply. Table 4 maps institutional access across key partners and provides the governance baseline for the analysis that follows.

Table 4 Differentiated Institutional Access in EU Defence-Industrial Partnerships

Partner		NATO	EU Security & Defence Partnership (S&DP)	PESCO access	EDF access	Key governance constraints
United States		✓	✗	✓ (Selected projects)	✗	Export controls, licensing, ITAR[297]
United Kingdom		✓	✓	✓(Selected projects)	✗	Third-country status
Norway		✓	✓	✓(Selected projects)	✓ (associated)	Low
Canada		✓	✓	✓(Selected projects)	✗	Regulatory spillover from US
Türkiye		✓	✗	✗	✗	Political vetoes, Cyprus issue

297 ITAR (International Traffic in Arms Regulations) is the United States export control regime for defence-related goods and data, constraining partners by requiring U.S. approval for transfers or re-exports and thereby limiting industrial and operational autonomy.. USDepartment of State – Directorate of Defense Trade Controls, *ITAR & Export Controls*, 2025.

Partner		NATO	EU Security & Defence Partnership (S&DP)	PESCO access	EDF access	Key governance constraints
Iceland		✓	✓	◐ (negotiating)	✗	Low
Albania		✓	✓	✗	✗	Limited industrial capacity
North Macedonia		✓	✓	✗	✗	Limited industrial capacity
Japan		✗	✓	✗	✗	Technology protection regimes
South Korea		✗	✓	✗	✗	Licensing, localisation
India		✗	✓	✗	✗	Local content requirements
Australia		✗	◐ (negotiating)	✗	✗	Ad hoc cooperation
Brazil		✗	✗	✗	✗	Limited defence alignment
Israel		✗	✗	✗	✗	Export controls, political sensitivity
Moldova		✗	✓	✗	✗	Minimal industrial base
Ukraine		✗	✗	✗	✗	Wartime conditions

✓ indicates formal participation or structured access
✗ indicates no formal access, though ad hoc cooperation may exist
◐ indicates a Security and Defence Partnership under negotiation

EDF "associated" refers to formal association without EU membership

PESCO participation by third countries is project-specific and subject to Council approval; "✓ (selected projects)" indicates participation limited to individual PESCO projects (e.g. Military Mobility).

Table 4 covers NATO, S&DPs, PESCO and the European Defence Fund; other EU instruments (e.g. SAFE or ad hoc procurement mechanisms) fall outside its scope.

A central governance paradox emerges. Partners with the greatest industrial relevance often have the most limited formal access to EU instruments, while highly trusted partners such as Norway are deeply embedded despite non membership. Strategic autonomy therefore depends less on alliance labels and more on institutional design.

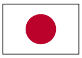
8.4 What external partnerships deliver in practice

Beyond institutional access and political alignment, external partnerships differ fundamentally in what they deliver in practical defence industrial and capability terms. These contributions range from advanced platforms and systems to surge production capacity, logistics support, technology access and operational innovation. Assessing partnerships through this lens helps distinguish structural gains for strategic autonomy from temporary or conditional benefits.

The relevance of a partnership for strategic autonomy depends not only on the type of capability involved, but also on the time horizon. Some partnerships primarily support short term readiness and deterrence, while others contribute to longer term industrial resilience, diversification or innovation. In several cases, a single partnership can generate different effects simultaneously, depending on governance design and industrial embedding.

Table 5 maps the primary practical contribution of key external partners to European defence and defence industrial objectives. It does not assess political desirability but clarifies how partnerships function in operational and industrial terms.

Table 5 What EU External Defence-Industrial Partnerships Deliver in Practice

Partner		Primary contribution	Typical capability or industrial role	Autonomy effect
US		Advanced systems and deterrence	Airpower, ISR, missile defence, command and control, plus limited participation in Military Mobility	Short term readiness support with long term dependency and export control exposure
UK		Top tier industrial capacity and interoperability	Air, naval and strike systems, research and development collaboration	Medium to long term industrial resilience and interoperability
Norway		Integration into European supply chains	Maritime systems, missiles and sustainment	Structural autonomy gain when embedded under EU governance rules
Canada		Enabling and sustainment support	Logistics, transport, maintenance and operational support	Enabling effect, limited and governance dependent
Türkiye		Relevant mid tier capabilities and production potential	Drones and land systems, primarily via bilateral or NATO channels	Conditional and politically sensitive, requires intensive governance
Japan		High technology cooperation	Sensors, space, electronics and advanced components	Long term diversification and technology access
South Korea		Surge production capacity	Artillery, armour and ammunition	Bridging short term capacity gaps with potential for longer term integration
India		Selective industrial cooperation and market scale	Co production pathways and industrial collaboration where governance permits	Selective effect, dependent on governance and implementation
Australia		Political and operational alignment with selective industrial scope	Interoperability and niche technology cooperation	Limited at present, potentially supportive for diversification
Brazil		Industrial niche cooperation	Aerospace components and selected defence manufacturing	Limited direct autonomy effect
Israel		Advanced subsystems	Sensors, electronics and unmanned systems components	Technologically valuable but politically sensitive
Albania		Political and operational alignment	Training and limited industrial involvement	Limited direct industrial effect
North Macedonia		Political alignment	Limited industrial involvement	Limited direct industrial effect
Moldova		Stabilisation and security support	Institutional capacity building and resilience measures	Indirect and non industrial
Ukraine		Combat driven innovation under wartime conditions	Drones, electronic warfare and rapid adaptation	Transformational under exceptional conditions

Methodological note

The autonomy effects in Table 3 reflect the interaction between three variables: the functional contribution of each partner to European defence, the time horizon over which this contribution materialises, and the degree of institutional embedding within EU defence governance frameworks as mapped in Table 4.

The table does not assess political desirability or alliance value. Instead, it evaluates how different forms of cooperation affect the EU's capacity to retain control over critical technologies, supply chains, exportability and decision making. Where institutional access is limited, even substantial operational or industrial contributions are treated as conditional or dependency sensitive. Conversely, deeper embedding under EU rules is treated as a potential structural autonomy gain.

Ukraine: from recipient to shaper

Russia's war has turned urgent support for Ukraine into a structural driver of Europe's defence-industrial policy. The EU–Ukraine Joint Security Commitments[298] have placed defence-industrial cooperation on a more formal footing, including provisions on intellectual property, technology protection and mutually reinforcing production, while EU level initiatives such as the EU–Ukraine defence-industrial task force aim to deepen integration.

Ukrainian battlefield demand has reshaped European production priorities, particularly in high-consumption and rapidly evolving capability areas such as 155mm ammunition, counter-UAS and electronic warfare. Proposals for initiatives such as a Drone Alliance, supported by dedicated EU funding, illustrate how urgent demand can translate into co-development opportunities alongside Europe's own industrial scaling efforts[299]

298 European Council, *Joint security commitments between the European Union and Ukraine*, June 27, 2024.

299 Ursala von der Leyen, *2025 State of the Union Address by President von der Leyen*, September 10, 2025.

The opening of EU accession talks in June 2024[300] creates a framework for the gradual alignment of its armed forces and defence-industrial base with European Union standards, supply chains, and investment mechanisms

From an autonomy and governance perspective, Ukraine increasingly shapes EU production priorities without constituting a source of critical dependency. This points to a dual-track logic, in which EU-centred funding, planning and decision-making anchor core capability development, while clearly scoped EU–Ukraine co-production arrangements translate urgent wartime demand into durable European industrial scale. The governance challenge lies in ensuring that such cooperation remains anchored in EU programme rules, including safeguards on exportability, intellectual property, use rights and SME participation, so that cooperation reinforces rather than dilutes European strategic autonomy.

8.5 Governing external partnerships

The comparative analysis of partnership types, institutional access and practical contributions shows that external cooperation is neither inherently beneficial nor detrimental to European strategic autonomy. Its impact depends on how partnerships are governed, regarding dependency risks, time horizons and the degree of industrial embedding.

Three governance principles follow from this analysis.

1. **Unavoidable dependencies are accepted but bounded institutionally.**

While partnerships that provide immediate readiness and deterrence remain central in the short term, reliance on external suppliers for critical systems, software, sustainment, or upgrades can restrict long-term freedom of action. Governance therefore prioritises modular design, diversified suppliers, protected data and use rights, and the development of European alternatives where feasible.

300 European Council, *EU opens accession negotiations with Ukraine*, June 25, 2024.

2. **Partnerships that reinforce European industrial resilience are deepened and stabilised.** Cooperation with closely aligned non-EU European partners enhances scale, interoperability, and supply-chain robustness while carrying relatively low political risk. These relationships increasingly operate as functional extensions of the European defence technological and industrial base and are embedded in predictable governance frameworks, including reciprocal market access, clear intellectual-property rules, and alignment with EU capability and industrial priorities.

3. **Selective partnerships serve to bridge specific gaps rather than create new structural dependencies.** Arrangements that provide surge capacity, niche technologies, or market access can mitigate capability shortfalls, but their contribution to strategic autonomy depends on the depth of integration. Cooperation embedded in co-production, localisation, and reciprocal supply chains strengthens resilience, whereas transactional procurement risks substituting one dependency for another.

Across all partnership categories, a persistent governance challenge concerns the mismatch between operational relevance and institutional access. Partners with high practical value often have limited access to EU defence instruments, constraining the Union's ability to shape industrial and capability outcomes. Addressing this requires not uniform inclusion but differentiated governance calibrated to the risks and benefits of each relationship.

The overarching principle is straightforward: higher dependency risks correspond to stronger governance requirements. Strategic autonomy derives not from reducing external cooperation but from aligning the depth of partnerships with appropriate political, legal, and industrial safeguards.

Considerations for Dutch policy

- **European governance is a key multiplier of Dutch influence.**
  With a limited national prime contractor base, Dutch leverage in defence-industrial matters derives primarily from participation in EU frameworks that structure demand aggregation, programme design and industrial standards.
- **European industrial embedding provides greater predictability than ad hoc cooperation.**
  EU-centred cooperation and partnerships with closely aligned European non-EU partners offer clearer governance conditions for exportability, intellectual property and security of supply than bilateral or transactional arrangements.
- **Governance asymmetries have disproportionate effects on smaller defence economies.**
  Where operationally relevant partners remain outside EU defence-industrial instruments, the capacity to steer industrial outcomes is constrained. Collective governance arrangements therefore matter more for the Netherlands than for larger defence economies.
- **The tension between short-term readiness and long-term dependency persists.**
  Procurement choices that prioritise rapid capability delivery tend to reinforce long-term dependency patterns. Managing this tension is closely linked to the availability and credibility of European alternatives.

9 Conclusions and Recommendations

The EDTIB faces significant vulnerabilities. The air domain is the most dependent area, because key future platforms such as fifth generation fighter jets and maritime patrol aircraft come from the US. The land domain presents a mixed picture as Europe produces many systems itself but struggles with ammunition supply chains and relies on military system imports from partners such as South Korea. The maritime industrial base is stronger, with several European companies producing key naval platforms and systems such as frigates, submarines, and naval strike missiles. Nevertheless, production remains fragmented across EU countries.

9.1 The Structure and Capacity of the EU's Defence Technological and Industrial Base

In strategic enabling technologies there are substantial dependencies and capability gaps. Command and control, intelligence, surveillance and reconnaissance, electronic warfare and cyber all show gaps in EU capabilities and/or dependence on foreign powers, which limits Europe's ability to operate independently of the US. Space is a particularly vulnerable area, with strategic early-warning and even secure communications largely being dominated by the US Space Force or American companies. The 2022 situation in which Elon Musk ordered SpaceX not to extend Starlink coverage to support Ukrainian operations near Crimea is highly informative for understanding the risk entailed by this dependency.

Dual use goods add another layer of dependency because chemicals, alloys, electronics and specialised components such as optical systems and avionics often come from abroad. China continues to dominate the dual-use electronics market which is important for military capabilities from small drones to missile components. Other dependencies include a wide array of imports from optical lenses, chemicals, machine tools, and air propulsion systems, though the dependencies are more spread between China, the US, and other sources such as Japan and the ASEAN states.

Critical raw materials form the most structural vulnerability because China dominates mining and refining, which affects advanced platforms and makes systems like fighter jets highly exposed to disruptions in critical raw material supply chains. Beijing's increasing export controls, intensified in the autumn of 2025, have caused real supply issues in that they have explicitly blocked Chinese export licensing for any deliveries to foreign militaries.[301] Alternative sources of raw materials such as Canada and Ukraine have already in large part been tied to the US, though Australia remains a strong source and has an existing MoU with the EU.

Europe essentially finds itself in a double bind. For crucial military platforms it relies on the US, and the supply-chains on which it develops its own systems depend on China. Totally decoupling the Common Market from either is unlikely from both economic and political perspectives. This then puts a continued premium on efforts at de-risking and hedging towards both Washington and Beijing. Hedging in both directions is fraught with risk, as pressure from both on the semiconductor industry in the Netherlands has demonstrated. What requires deliberation is whether the risk of American or Chinese retaliation is greater than the risk of this continued dual dependence.

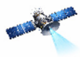
In the medium-term, a deliberate effort by the EDA, DG DEFIS, and the NATO Industrial Advisory Group (NIAG) to rationalise the proliferating number of industrial development initiatives is necessary. The production capacity across domains can only be effectively improved in the coming years if it is efficient, and supply lines and factories across the continent can reduce duplication and ensure stocks of replacement parts can be made widely available.

Separately, the continued increases in defence budgets and a general trend towards de-regulation in the defence industry merits caution. The defence sector has uniquely inflationary tendencies due to its monopsonic nature and the complexity of the systems being developed. It is quite possible that a substantial portion of the new budgets become swept up in inflation, cost over-runs, and supply-chain disruptions. This will require a greater European-level vigilance in ensuring that the new spending is protected from waste and over-runs.

301 Gracelin Baskaran, 'China's New Rare Earth and Magnet Restrictions Threaten U.S. Defense Supply Chains', Center for Strategic and International Studies, 9 October 2025, https://www.csis.org/analysis/chinas-new-rare-earth-and-magnet-restrictions-threaten-us-defense-supply-chains.

Table 6 Key capability gaps across European defence systems and supply chains

Domain	Illustrative European systems/capabilities		Key capability gaps
Air-based systems	Eurofighter Rafale Gripen	  	Lack of more stealth capable aircraft such as F-35. Lack of sufficient tactical and strategic airlift and refueling capabilities
Land-based systems	Leopard 2 CV90 PzH 2000	  	Comparatively few capability gaps. However, different and incompatible systems are produced in low quantities which unnecessarily drives up costs and hampers inoperability. GER, FRA, UK, POL and ITA for example all field different MBTs.
Maritime systems	FREMM frigates Type 212/214 Submarines	 	Comparatively few capability gaps with regular attempts to avoid a duplication of similar yet inoperable systems. European vessels tend to be relatively lightly armed and thus vulnerable to enemy attacks
Long-range missile defense	Interceptor missile: SAMP/T Aster 30/15 Long range strike missile: Taurus NEO (in development)		Beyond SAMP/T, European nations do not have any domestic capabilities to defend against ballistic missile threats. Furthermore, SAMP/T production rates are low and several EU states prefer American patriots as an alternative
Cyber and information warfare	National cyber commands ENISA coordination		Operationally, no European nation is thought to have carried out offensive cyber operations against peer or near-peer adversaries without external help of the US. A limiting factor is insufficient staffing and resources, legal constraints, as well as potentially lacking operational experience
Command and control	Sovereign cloud services		Significant European capability gaps exist in the field of cloud computing and hyperscalers,. Development of national and "sovereign" clouds is done with the cooperation of American cloud providers. Furthermore, integration of digital C2 systems and the exploitation of data remains a considerable challenge for most European armed forces.
Electronic warfare	National EW capabilities, electronic self-defense for high end platforms such as fighter jets		Europe faces capability gaps in the realm of offensive EW capabilities. Exemplary is the air domain, where Europe has no similar capability such as the F-18 Growler that can provide electronic defense to accompanying aircraft. Other gaps are anti-radar missiles to attack electromagnetic installations such as radars.

Domain	Illustrative European systems/capabilities		Key capability gaps
Space	Satellite navigation: Galileo, Copernicus Launch system: Vega-C and Ariane 6 Satellite constellation: Iris 2 (in development) Missile warning system: Odin's Eye II		Recently falling behind in areas such as cost effective launcher development to compete with the US. Europe fields far fewer military satellites used for reconnaissance and communication and is thus highly dependent on assistance from the US in all of these domains.
Dual-use goods	Optronics, Machine tools		Chips of all sorts, electronics, metals, alloys
Raw materials	some niche refined gases (eg. krypton, neon) used to create chips.		High or medium dependency in most critical raw materials necessary for defense.

A useful model would be a well-implemented European equivalent of the US Nunn-McCurdy Amendment, a 1982 law that required defence manufacturers to inform the US Congress if cost overruns breached 25% of the original tender, and authorised Congress to cancel a programme if it exceeded 50%. Any waivers of the amendment required an explanation from the Secretary of Defense that the project is necessary for national security and that the costs are reasonable. This act allowed Congress to cancel the US Army's Future Combat Systems programme in 2006 and the Navy's *Zumwalt*-class destroyers in 2016.[302] Coordinated national legislation and European-level safeguards like Nunn-McCurdy would better allow states to control costs and signal industry that while funds are increasing, oversight is not reduced.

For European governments and industry to realise the ambition set out across the continent, it will be necessary to overcome the dependencies rife within the defence sector and to increase autonomous production capacity. Vulnerable supply chains in dual use enabling technologies and critical minerals should be

302 Alexandra G. Neenan, *Department of Defense Cost Overruns and The Nunn-McCurdy Act*, no. IF13027 (Congressional Research Service, 2025), https://www.congress.gov/crs-product/IF13027?q=%7B%22search%22%3A%22nunn-mccurdy%22%7D&s=1&r=1.

de-risked to the highest degree possible, noting that a total break with global supply chains is not possible without self-defeating difficulty.

9.2 The Governance of Strategic Autonomy

State of Play

The European defence industry has many strengths and a strong willingness and great potential to scale up, notably in the land and maritime domains, but currently operates in a state of structural misalignment. Its abilities are overshadowed by deep dependencies in high-end platforms, digital enablers, and critical inputs. Beyond a legacy of underfunding, the report identifies bottlenecks related to capital access, production efficiency, workforce shortages, and innovation fragmentation. Strengthening the industry's power hinges on sustained efforts to rationalise scaling along these pillars, beyond resolving just its dependence on platforms and materials.

Despite the current surge in defence investments, the delivery of the Defence Readiness Roadmap, and the European Defence Industrial Strategy (EDIS), it remains a challenge for the European Union (EU) to translate ambition into a coherent incentive structure to achieve strategic autonomy. Currently, the EU cannot sustain a large, efficient industry if every country continues to buy and build separately. This fragmentation persists because national procurement and platform ownership remain the lowest-risk options within a complex, non-hierarchical governance landscape, leaving industry without the early procurement commitments and predictable funding needed to anchor long-term investment decisions.

The European Commission, including the Commissioner for Defence and Space, has expanded its role in industrial policy and funding, yet does not define capability requirements or direct national procurement. The European Defence Agency (EDA) supports coordination through instruments such as the Capability Development Plan (CDP) and the Coordinated Annual Review on Defence (CARD), yet it lacks binding authority or programme-scale budgets. Sustaining momentum depends on member state demand alignment. Defence planning, production, and procurement remain predominantly national responsibilities, resulting in persistent coordination challenges across the European Defence Technological and Industrial Base (EDTIB). Military requirements are primarily defined through NATO's Defence Planning Process (NDPP), which translates threat assessments into capability targets. By contrast, EU institutions influence development mainly through funding instruments and regulatory tools. Under current treaties, a primary challenge is reaching the required scale of industrial cooperation while defence remains a national competence.

Persisting challenges

In addressing fragmentation, the question of whether consolidation is feasible and desirable presents a complex dilemma. On the demand side, deeper consolidation is necessary to achieve economies of scale and boost production efficiency, yet it remains difficult due to persistent national interests. While "Buying European" is on the rise, it currently reflects more of a sponsorship of domestic industries rather than an uptake of joint products. On the supply side, consolidation can align urgent capabilities with production capacity but involves risks. While the Commission could refine approval processes to favour "European champions," over-concentration creates the risk of companies gaining enormous leverage over governments. Such isolation can limit spill-over benefits and dual-use opportunities, ultimately reducing the efficiency and capital flow the Union seeks to encourage.

Crucially, strategic autonomy is not synonymous with self-sufficiency; rather, it represents the capacity for sovereign decision-making within a landscape of geopolitical volatility and weaponised supply chains. Consequently, external cooperation is neither inherently detrimental nor beneficial to European strategic autonomy. While partnerships vary in structure, institutional access, and practical contribution, their ultimate impact is determined by how they are governed – specifically regarding dependency risks, time horizons, and the depth of industrial embedding. This approach necessitates that while unavoidable dependencies are accepted, robust institutional measures must be taken to curtail systemic vulnerability.

Moving forward

Taken together, there are multiple fundamental governance challenges that complicate the quest for strategic autonomy in the European defence industry:
- Balancing short-term readiness with long-term industrial development;
- Managing consolidation while accommodating for national interests and without undermining competition; and
- Sustaining partnerships with non-EU allies while limiting critical dependencies.

Many years of disciplined governance are required to achieve a "cohesive and self-sufficient industrial base that is free from critical third-party dependencies, enabling it to function effectively on its own and safeguard long-term security and defence interests". If this is the path ultimately chosen, however, that process begins now. This means national governments need to consider the long-term risks of foreign dependency within new procurement and development programmes. For the Netherlands, this involves revisiting the intended long-term reliance on the F-35 and US missile technologies, perhaps in favour of European projects like FCAS (if it manages to eventually come to completion). Given that dependencies tend to last decades, an earlier stock-taking allows for a timelier resolution.

A central challenge remains the institutional divide: if member states continue to view NATO solely as the interlocutor for defence and the EU only for economic cooperation, strategic autonomy risks falling through the cracks. For EU-level action, early positioning is imperative: strategic autonomy is most effectively reinforced when the EU supports these early member state choices, rather than attempting to correct fragmented outcomes later.

As such, strategic autonomy relies not on isolated initiatives, but on predictable demand, pragmatic de-fragmentation, selective prioritisation, and disciplined governance. This does not necessitate a grand overhaul per se, but rather pragmatic, incremental steps that set the stage for a more rational structural alignment. This policy space evolves over time: Early positioning (2026-2028) establishes the strategic direction. Scaling (2028-2035) occurs through firm procurement commitments. Institutionalisation (2040-2050) anchors autonomy in budgets, markets, and partnerships.

Recommendations

Taken together, the conclusions point to a model of strategic autonomy that is selective, governed, and realistic. Europe's defence-industrial future will not be shaped by a single institutional reform or funding surge alone, but by consistent political choices that align demand, investment, and partnerships over time. Strategic autonomy, in this sense, is less a destination than a discipline of decision-making.

1. Match Industrial Ambition with Predictable Demand and Long-Term Funding

Europe's defence industry is ready to scale, but investment decisions hinge on credible demand signals. Short-term funding surges without long-term procurement commitments will not deliver durable capacity.

At the member state level:

- Embed strategic autonomy objectives in national procurement to avoid lock-ins and signal commitment to European industry.
- Use multi-year procurement commitments (8-10 years where feasible) to underpin industrial scale-up in priority capability areas.

At the EU level

- Recognise that procurement decisions remain national; EU governance should therefore aim to shape incentives early, not correct outcomes late.
- Move from project-based cooperation to programme continuity, linking EU instruments across the full cycle from R&D to procurement.
- In the next Multiannual Financial Framework provide sustained backing for EU defence-industrial instruments, ensure continuity of 'European preference' beyond temporary or crisis-driven funding mechanisms.

2. Strengthen the link between capability development and EU investments.

EU defence-industrial instruments are most effective when they reinforce already converging priorities. Governance should therefore focus on alignment and sequencing, not new layers of authority:

- Systematically test EU-funded projects against agreed capability priorities derived from national and NATO planning. Improve day-to-day coordination between the European Commission (industrial instruments), and the European Defence Agency (capability coherence), without altering formal mandates.

- Prioritise predictability over proliferation: fewer instruments with clearer pathways from assessment to production are preferable to a dense but fragmented toolbox.
- Ensuring that the increased defence funding across Europe can be turned into meaningful outputs requires better coordination at the European level. Improving European production capacity should be the highest priority of these efforts just after ensuring operational effectiveness.

3. Prioritise strategic autonomy where control Is most critical.

Strategic autonomy should be treated as a selective objective, not a blanket ambition. Attempting to localise or Europeanise the full defence-industrial spectrum risks diluting resources and undermining near-term readiness. Focus autonomy efforts on capability areas where loss of control would critically constrain freedom of action, notably:

- Digital and data infrastructure (cloud, software, AI).
- Command-and-control systems.
- Critical enablers such as sensors, electronics, and secure communications.

3. Accept managed dependence in other areas where European alternatives are unrealistic in the medium term.

While mitigating risk through:

- Modular system design.
- Diversified sourcing.
- Contractual safeguards on use-rights, IP, and sustainment.

Align EU funding criteria explicitly with this prioritisation logic, rather than dispersing resources across politically inclusive but strategically marginal projects.

4. Reduce fragmentation through clusters and pragmatic prioritisation.

Full integration of the defence market or production scale across 27 member states is politically unrealistic in the near term. Fragmentation should therefore be reduced through pragmatic clustering, not premature centralisation:

- Promote clusters of frontrunner states with converging threat perceptions, operational concepts, and industrial strengths.
- Use these clusters to:
  - harmonise requirements and practice,
  - reduce duplication,

  - break through the domestic procurement deadlock,
  - create interoperable families of systems with export and scale potential.
- Allow industrial consolidation where it delivers scale and resilience, but: prevent excessive concentration that undermines competition and innovation,
  - preserve access points for SMEs into platform-centric supply chains.
- Use EU competition and state-aid frameworks flexibly to support 'European champions' where production efficiency is urgent or national alternatives non-viable.

5. Position smaller member states strategically within platform-driven dynamics

In a defence-industrial system increasingly shaped by large platforms and major states, smaller member states influence outcomes through early positioning, not downstream participation:

- Prioritise early entry into major European programmes in selected domains rather than maximising participation across many initiatives.
- Align national industrial strategies tightly with emerging European capability trajectories.
- Accept that strategic autonomy gains stem primarily from procurement choices, not SME support or access policies alone.
- Use minilateral industrial partnerships to anchor national specialisations within wider European value chains.

6. Partner More, but on Purpose

Strategic autonomy does not imply disengagement from partners, but it does require disciplined governance of interdependence. External cooperation should expand Europe's options, not constrain them:

- Deepen cooperation with closely aligned partners where dependencies are reciprocal and manageable.
- Calibrate engagement with partners where interests only partially converge, limiting exposure in critical technologies.
- Insist on EU-based value creation, exportability, and supply-security safeguards in all cooperative frameworks.
- Treat external partnerships as complements to European capacity, not substitutes for it.

For the Netherlands

Cooperate with trusted partners. A practical pathway for the Netherlands is to cooperate with trusted partners with (partially) complementary strengths, including Belgium, Germany, and the Nordics). Such cross-border division of labour allows for the emergence of mid-sized suppliers alongside best athletes, streamlining barriers to interoperability and industrial cooperation (such as diverging platforms, export controls, requirements, industrial practice etc.). It also allows for the emergence of an 'economy of scale' at a smaller, more manageable level.

Commit early to selected European platforms. Requirements, standards and workshare are determined at the design phase, not after contracts are awarded.

Early integration into European programmes outweighs platform ownership. The Dutch defence-industrial profile aligns with subsystem, enabling and niche capabilities. Early participation in collaborative European programmes increases the likelihood that such specialisation translates into sustained industrial role

Accept managed interdependence. Reduced national control is the trade-off for sustained industrial access and influence.

Use procurement as the main lever to reduce dependencies. What is bought matters more than SME support or framework participation alone.

Concentrate effort on a limited number of priority domains. Focused bets generate scale and bargaining power; dispersed engagement dilutes impact.