



POLICY PAPER

# DEFENDING EUROPE'S SKIES

CHALLENGES AND PROSPECTS

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## INTRODUCTION

Russia's war in Ukraine has underscored the importance of effective air and missile defence for the protection of both units on the battlefield, and energy and other critical military and civilian infrastructure behind the front lines. A supporting coalition of states has stepped up to supply Ukraine with a variety of air and missile defence systems, from anti-aircraft guns, through short-, medium-, and long-range ground-based missile systems, to fighter aircraft. Even so, President Zelenskyy's calls for more air defence systems and ammunition have been frequent throughout the war. The supporting states have been unable or unwilling to fully meet Ukraine's needs.

Even before Russia's full-scale invasion of Ukraine, air and missile defence had long been recognised as a critical capability shortfall throughout Europe, but NATO Allies and EU Member States had not acted to rectify this situation. As a result, Allied air defence capabilities today fall far short of the requirements set out in NATO's new regional defence plans.<sup>1</sup> This is clearly unsatisfactory and substantially damaging to the Alliance's credibility as it refocuses its attention on deterring and, if needed, defending against the threat posed by an aggressive Russia.

Initiatives intended to address the problem have progressed slowly, often with uncertain funding. To the particular frustration of states on NATO's eastern flank who feel the shortage of air defence especially keenly, stop gap proposals such as the conversion of Baltic Air Policing to an air defence mission, or the rotational deployment of ground-based air defence assets have either not found favour or, if agreed, been only partially implemented.

<sup>1</sup> Henry Foy and John Paul Rathbone, "[Nato has just 5% of air defences needed to protect eastern flank](#)," *The Financial Times*, 29 May 2024.

To discuss these and other related issues, the ICDS, in cooperation with the Embassy of the Netherlands in Tallinn, convened a seminar in March 2025. Around 40 participants, including officials from the Netherlands and Estonia, air and missile defence experts, and representatives of the Tallinn-based diplomatic corps met at Ämari airbase in Estonia and took part in two discussion sessions, one focused on the policy and operational aspects of air and missile defence, and a second on defence industrial issues. This policy paper records some of their deliberations and makes recommendations for defence decision makers.

## 1. POLICY AND OPERATIONS

Russia's hesitant and ineffective air operations in Ukraine meant that it did not, as might have been expected, establish air superiority in the first days following its full-scale invasion of 24 February 2022.<sup>2</sup> The airspace over Ukraine has remained contested throughout the war, and the prevalence of missile and drone attacks, including against civilian targets, has underlined to both military planners and to publics the importance of effective air and missile defence. Already a priority capability area for NATO's European Allies and EU Member States, air and missile defence has received renewed attention in defence policy and planning.

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NATO's regional defence plans, agreed at the Summit in Vilnius in July 2023, are a key mechanism for Europe's rearmament and have exposed the disparity between the large number of assets to be defended by the Alliance from air attacks and the limited resources available to do so. In accordance with the NATO Defence Planning Process, new capability targets based on the regional defence plans have been allocated to Allies,

<sup>2</sup> Robert Dalsjö, Michael Jonsson and Johan Norberg, "[A Brutal Examination: Russian Military Capability in Light of the Ukraine War](#)," *Survival*, 64:3, 10.

but NATO planners acknowledge that Allies are already behind in delivering existing targets and that implementation of the new targets will require considerable effort and resources.<sup>3</sup>

At present, then, there is a mismatch between the demand for air and missile defence and what the Allies can supply. This is exacerbated by a tendency for requirements for air and missile defence to be inflated by unrealistic expectations and political considerations.<sup>4</sup>

*At least as a short-term measure, there is a requirement for more realistic planning and prioritisation of defence resources*

At least as a short-term measure, there is a requirement for more realistic planning and prioritisation of defence resources. This should include an acceptance among decision makers that it is not realistic to attempt to defend every inch of European territory from attacks from the air. Furthermore, this must also be communicated to publics, not least in support of efforts to build resilience among European populations.

Russia's war, meanwhile, has provided many detailed tactical- and operational-level lessons related to air and missile defence that will need to be studied and eventually reflected in the doctrines of Europe's armed forces. There are also higher-level lessons from the war relevant to the continuing development of an air and missile defence architecture for Europe.

First, Russia's war has underlined the importance of mass broadly, including in the context of air and missile defence. According to data from the Kiel Institute for the World Economy, western donors have provided Ukraine with longer-range ground-based air defence systems worth more than USD 9 billion since the beginning of the full-scale war, approximately 7.5% of the total provision

of military assistance.<sup>5</sup> This figure, however, paints a far from complete picture of air and missile defence requirements in large-scale warfare. It excludes, for example, the anti-aircraft guns, short-range missile systems, and supplementary ammunition that donors have also provided.

Second, the war has underlined the importance of including a mix of systems in air and missile defence, both to ensure that all layers are adequately defended, and that systems are available appropriate to the threat (for example, it would be extremely wasteful to use expensive air defence missiles against cheap drones).

Third, it has underlined the importance of mobility for air and missile defence systems. Detection of their radar transmissions makes them vulnerable to counterattack very soon after they start operating in one location, and they must be ready to rapidly deploy to new operating positions.

Fourth, it has highlighted the importance of integration between systems to ensure the efficient allocation of resources to

*Interoperability is insufficient. The aim should instead be integration, which has a force multiplying effect*

targets. Interoperability – when systems can communicate with each other – is insufficient. The aim should instead be integration, which has a force multiplying effect. Ukraine has demonstrated this well with the development of its 'Delta' Situational Awareness and Battlefield Management System, a tool for multi-source data fusion that provides comprehensive situational awareness and allows for real-time battlefield coordination.<sup>6</sup> Integration is, however, not only obstructed by technical issues such as closed system architectures and proprietary software (Ukraine has also demonstrated that multiple systems from a variety of donor sources can be successfully integrated into a working whole),

<sup>3</sup> Rudy Ruitenberg, "[NATO to ask allies for 30% capability boost, top commander says](#)," *DefenseNews*, 14 March 2025.

<sup>4</sup> For example: "[Israel's Iron Dome air defence system is not realistic for Europe, expert says](#)," *bfbs Forces News*, 23 May 2024.

<sup>5</sup> Kiel Institute for the World Economy, "[Ukraine Support Tracker](#)," 14 February 2025.

<sup>6</sup> Mykhailo Samus, "[Drone-Centric Warfare](#)," *ICDS*, 15 January 2025.

but may also be hindered by procedural obstacles, for example, overly strict national security requirements that prevent systems from being connected with each other.

Fifth, the war has highlighted that threats may evolve and that systems must be ready for, or able to be adapted to deal with, new threats. The extensive use of drones by the two sides – both tactical and longer-range strike drones – has been a conspicuous feature of the conflict in the air domain. So too have been electronic warfare and the cyber dimension of air operations. These weapon systems have evolved rapidly as the two sides have attempted to leapfrog each other's innovation and countermeasure cycles. In the NATO/EU context, there is a risk that responding to rapidly evolving air threats will be challenged by traditional defence procurement cycles that are often slow and unresponsive.

*Above all, European states will need to invest at high levels to provide the substantial uplift in systems that will be required*

There are several implications of these lessons if effective air and missile defence is to be built for Europe. Above all, European states will need to invest at high levels to provide the substantial uplift in systems that will be required. They will need not only more shooters, but also air and missile defence sensors (mostly radar systems and acoustic sensors, which at present are both insufficient and inadequately integrated into the air and missile defence architecture) and the command and control systems whose importance is often underestimated. More broadly, European states lack the intelligence, surveillance and reconnaissance systems that, inter alia, provide the backbone that assists air defence units in detecting, identifying, and responding to air threats. Procurement processes for all these systems will need to include at least some capacity for innovation and the speedy delivery of countermeasures to rapidly evolving threats.

This requirement for investment in air and missile defence mass may be magnified by the possible strategic reorientation of the US away from Europe. For example, NATO's Ballistic Missile Defence mission relies heavily

on deployed American sea- and land-based assets. As an aside, the origins of NATO's Ballistic Missile Defence mission in the period of the 'global war on terror' means that it is focused on threats from potentially hostile states to NATO's south-east and not on Russia. This is clearly a poor fit for today's geostrategic circumstances and some reorientation of the mission is required.<sup>7</sup>

While delivering sufficient mass will be challenging, there may be some low-hanging fruit that can be picked to deliver benefits rapidly and at relatively low cost. One example might be efforts to remove procedural barriers to the integration of national air and missile defence systems. European states should, as a priority, take steps to identify such opportunities.

Even so, political leaders will need to make the effort to communicate the importance of higher defence spending and international cooperation, even if this means that national defence and technological interests are threatened. The overall aim of these efforts is to deter adversaries. A capable air and missile defence architecture will certainly raise the costs of aggression against European states, but strong political and public will are also key components of Europe's deterrence posture.

A second implication is that there is a level of urgency associated with the requirement to invest more in air and missile defence. While many systems are available off-the-shelf, procurement processes may be lengthy owing to a lack of production capacity in Europe and elsewhere. Furthermore, timescales to full operational capability are likely to be lengthened by the need to recruit and train personnel to operate air and missile defence systems, especially the more complex systems that tend to correspond with longer-range capability (fighter aircraft, sea-based air and missile defence, long-range ground-based air defence).

A third implication is that European states will need to cooperate more and better to build an

<sup>7</sup> NATO, "[Ballistic missile defence](#)," 1 August 2024; Ian Brzezinski and Ryan Arick, "[Issue brief: A NATO strategy for countering Russia](#)," *Atlantic Council*, February 2025.

effective air and missile defence architecture. Integrated air and missile defence is simply too expensive for any state to act alone in this area. Furthermore, Europe's airspace is already conceived, through the NATO Integrated Air and Missile Defence System, as an operational whole. Ensuring the implementation of this concept will be better served by multinational cooperation from the outset, than by the later integration of individual systems.

### *European states will need to cooperate more and better to build an effective air and missile defence architecture*

Multinational cooperation in implementation will thus support the necessary shift from an interoperability paradigm towards a full integration paradigm under which weapons, sensors and command and control elements operate within a shared network.

In any event, the need for operational cooperation across the whole of NATO airspace drives a requirement for more, and more realistic, military exercises and operational air and missile defence deployments. These enhance both integration and readiness. As air and missile defence capability is unevenly (and, at present, thinly) distributed across European states, deployment of air defence units is inevitable in times of crisis. In these circumstances it is also essential that the host nation support provided by receiving states is also properly exercised.

A related, immediate issue is that NATO's rotational model for air defence announced at the Vilnius Summit in 2023 (see Annex) has been operationalised through bilateral agreements between deploying and host nation states. Ideally, this coordination should take place at the NATO level where there are better prospects for efficiently matching needs to available capabilities Alliance-wide.

The requirement to enhance multinational cooperation has further consequences. One is that decisions will be needed at the political and strategic level not to pursue competing or duplicating schemes for air and missile defence for Europe. An obvious example is the apparently similar aims of the German-led European Sky Shield Initiative and the (as

yet, thin on details) Greek-Polish proposal for a European air and missile defence system. Efforts will be needed to streamline such initiatives if resources are not to be wasted and if Europe's air and missile defence is to operate as an integrated whole. One option might be for NATO or – more likely – the EU to take a lead in investing in centrally procured capabilities.

Another consequence is the need for better institutional cooperation between NATO and the EU in pursuit of the common goal of effective air and missile defence for Europe. Indeed, this requirement has been emphasised in the Commission's March 2025 defence white paper, which also recognises an "integrated, multi-layered, air and missile defence that protects against a full spectrum of air threats (cruise missiles, ballistic and hypersonic missiles, aircraft and UAS)" as a priority capability area for development.<sup>8</sup> As the European memberships of the two organisations largely overlap – more so with Finland and Sweden's accession to the Alliance – it is perhaps unnecessary for both NATO High Visibility Projects and EU PESCO projects (see Annex) to be pursuing broadly similar objectives. Again, these initiatives should be reviewed with a view to more efficient delivery against requirements.

Meanwhile, the broadening of the air domain, particularly through the use of uncrewed systems, electronic warfare and cyber-warfare, means that European states should pay more attention to the concept of multi-domain operations (the orchestration of military activities across all operating domains and environments).<sup>9</sup> At the procedural level, more work is needed to ensure that the roles of the various assets across all domains are properly standardised and understood. This will require the development, promulgation and exercising of a better set of tactics, techniques, and procedures, and standard operating procedures. At the technical level, NATO's dated air and missile defence command and

<sup>8</sup> European Union, European Commission, High Representative of the Union for Foreign Affairs and Security Policy, "[Joint White Paper for European Defence Readiness 2030](#)," JOIN(2025) 120 final, 19 March 2025, 6, 7, 19.

<sup>9</sup> NATO, "[Multi-Domain Operations in NATO – Explained](#)," 5 October 2023.

control systems are insufficiently robust to support a multi-domain approach and will need to be upgraded.

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A further consequence of emphasising the multi-domain approach is that with more systems contributing to air and missile defence across a range of domains, capability gaps that are not directly related to air and missile defence may still negatively impact its effectiveness. It will thus be important to air and missile defence that other capability shortfalls are addressed according to the requirements set out in NATO's new regional defence plans – Allies will need, as they have agreed, to make these defence plans “the main driver for the organisation of our forces and the specific military requirements NATO asks of them.”<sup>10</sup>

A final implication is the requirement for a shift in mindset towards more offensive operations to deal with threats from the air. Current NATO doctrine may be too reactive, and should, for example, put greater emphasis on the use of long-range ground fires or fighter aircraft to eliminate an adversary's air attack capabilities. The rationale is that it is more efficient to destroy a missile launcher (the ‘archer’) than it is to focus on the individual missiles once launched (the ‘arrows’).

*An evolution in NATO's air and missile defence architecture and doctrine may be insufficient. Rather, a radical redesign is required*

Taken together, the need to substantially grow Europe's air and missile defence capability, technological developments in the realm of air power, the evolution of the assessment of the ballistic missile threat to now encompass Russia, the possible strategic reorientation

of the US suggest, and the limited progress achieved by existing European air and missile defence initiatives suggest that an evolution in NATO's air and missile defence architecture and doctrine may be insufficient. Rather, a radical redesign is required.<sup>11</sup>

## 2. THE DEFENCE INDUSTRIAL DIMENSION

Russia's aggression against Ukraine and the urgent need for Europe to boost its defence capabilities has also led to the rediscovery of the importance of defence industries. After a long period of decline following the end of the Cold War, the strengthening of the defence technological and industrial base has now become an issue at the top of the political agenda of the EU and NATO. Both organisations and their Member States/Allies have taken a wide range of initiatives to ramp up industrial production of military equipment and munitions, driven by two needs: first, to continue their delivery to Ukraine, supporting the country in its war effort against the invader; second, to replace delivered equipment and ammunition, and to enhance and to modernise their own capabilities. Air and missile defence is part of this wider effort and, therefore, its defence industrial dimension should be analysed in the broader context of strengthening defence industry.

NATO underscores the importance of defence industries to supply and maintain military equipment and has various bodies to discuss the matter, but the organisation has little money to spend on procuring defence equipment. While the Alliance defines ‘what is needed’ for deterrence and defence, the EU has a treaty-based responsibility to strengthen Europe's industry, including the European Defence Technological and Industrial Base (EDTIB). In short, the EU's

<sup>10</sup> NATO, “[Vilnius Summit Communiqué. Issued by NATO Heads of State and Government participating in the meeting of the North Atlantic Council in Vilnius 11 July 2023](#),” Press Release (2023) 001, 11 July 2023, para. 34.

<sup>11</sup> While this may seem extreme, this possibility is at least on the radar of some decision makers. See, for example, the remarks of French Minister for the Armed Forces, Sébastien Lecornu: “[E5 Defence Ministers Press Conference](#),” posted 14 March 2025, by Ministère des Armées, YouTube, 1:15:36.

role is “translating NATO capability goals into industrial capacity”.<sup>12</sup> To implement its role, the European Commission launched

*The EU has a treaty-based responsibility to strengthen Europe’s industry, including the European Defence Technological and Industrial Base*

several programmes after the release of the EU Global Strategy in 2016, starting with the European Defence Fund (EDF). Nine years later, the plethora of EU programmes and acronyms is almost confusing: EDIRPA, ASAP and EDIP – just to mention three.<sup>13</sup> Although the purpose and timelines of these programmes vary, they are all driven by the same needs: to support financially Member States and defence industries to compensate for military equipment deliveries to Ukraine, to support procurement by Member States to backfill their own stocks of weapon systems and ammunition, and to support the Ukrainian defence industry.

Recent events, such as the shock resulting from the Munich Security Conference-2025 and US announcements and decisions taken since then, have resulted in a quickly growing awareness in Europe that efforts should be stepped up to spend more on defence for ensuring European security. The ReArm initiative of Commission President Von der Leyen to spend €800 billion on procuring defence equipment in the years to come has been welcomed by the European Council.<sup>14</sup> However, €650 billion of this has to be generated by the Member States through increasing their defence budgets by 1.5% GDP. The EU funding would amount to €150 billion (SAFE: Security and Action for Europe). Also, nothing has been decided. To speed up defence industrial production, including

the air and missile defence sector, three key conditions will have to be met.

First, more money must be spent, and it must be spent over the longer term. The NATO 2% defence spending target is already history – literally as 2024 was the deadline for achievement, but more importantly in political terms due to US pressure and the European aim of becoming more self-reliant in defence. It will be up to the Alliance in the run-up to the NATO Summit in The Hague (June 2025) to discuss and to decide on setting a higher percentage target. Implementation measures will also be a national responsibility

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and nothing should be excluded. For example, having taxes for security purposes could be considered.<sup>15</sup>

Next to raising national defence spending, there is the issue of allocating more money to defence by the EU. Bold action will be required to follow-up the European Council conclusions of 6 March. Pressure is increasing to use all available means:

- The EU budget itself, by raising the financial volume of the next Multi-annual Financial Framework 2028-2034, for which the Commission will make proposals in the coming summer. Alternatively, reallocating money from other budget lines to defence could be an option.
- Exempting defence expenditure from the EU Stability and Growth Pact criteria as proposed by President Von der Leyen in her ReArm Europe initiative is another option; it has received a positive reaction from the European Council.<sup>16</sup>
- By borrowing money, which has also been welcomed by European political leaders in

<sup>12</sup> According to Secretary-General of the European External Action Service Charles Fries. See: Olivier Jehin, “[No European army, but 27 armies capable of defending Europe. This is the wish of Kaja Kallas](#),” *Bruxelles 2*, 23 January 2025.

<sup>13</sup> EDIRPA – European Defence Industry Reinforcement through common Procurement Act; ASAP – Act in Support of Ammunition Production; EDIP – European Defence Industry Programme.

<sup>14</sup> European Union, European Council, “[European Council conclusions on European defence](#),” 6 March 2025.

<sup>15</sup> Estonia has already introduced a ‘security tax’. “[Ministry: Estonian state to raise nearly €2.5 billion with tax changes](#),” *ERR*, 17 September 2024.

<sup>16</sup> European Union, European Council, “[European Council conclusions on European defence](#).”

the context of the proposed €150 billion defence investment fund.

- By mobilising private capital.<sup>17</sup>

Whatever option or, most likely, combination of options is selected, it will be a crucial test of the Member States' seriousness in investing together in defence industrial production. An important aspect is to keep the door as wide open as possible for participation of non-EU countries and defence industries located on their territory. The United Kingdom and other non-EU European countries should be connected to strengthening the EDTIB to the maximum extent.

*An important aspect is to keep the door as wide open as possible for participation of non-EU countries and defence industries located on their territory*

Second, for the defence industry itself to succeed in realising a 'big bang' in defence production, three conditions will have to be met:

- First, long-term contracts will be required, ensuring that defence companies can accept investment risk in new production facilities, advanced machinery and tools, and personnel, but also count on resilient supply chains. This requires a long-term strategic approach with multi-year procurement plans, clear budget commitments and coordinated efforts among member states (and non-member states) to streamline and harmonise demand.

*Defence industries need to get priority access to scarce raw materials, steel, chips and semi-conductors to speed up production*

- Second, defence industries need to get priority access to scarce raw materials, steel, chips and semi-conductors to speed up production. As the CEO of Rheinmetall said already two years ago, it can take eight to twelve months before steel is delivered;

for electronic equipment it may take two years.<sup>18</sup> Extraordinary circumstances beg for extraordinary measures. This requires a partial and time-limited derogation of the liberal free-market competition rules and regulations. It is pressing, as modern defence systems rely heavily on advanced technologies that require a steady and reliable supply of critical resources. This also requires a change of mindset to overcome political hurdles, bureaucratic obstacles and legal objections. Furthermore, defence industries also need more energy and other resources, to be delivered by civil and privately-owned actors to be able to increase production. In short, a whole-of-society approach is required.

- Third, measures should be taken to make defence industries more attractive to highly educated youngsters. The defence companies are losing skilled personnel as a large part of the existing labour force is reaching pension age. Commercial companies are often more attractive – in terms of earnings and career perspective – than defence industries. So, salaries need to go up, and bonuses or profit-sharing schemes should be considered. A long-term career perspective can also be offered when defence industries are entrusted with capital projects of long duration. Because skilled labour in the defence industrial section is expensive, realising cost reduction per system by ramping up production is questionable.

The third key condition is the matter of procuring European vs procuring non-European (read American) weapon systems. This debate is as old as Europe's recovery from the ashes of the Second World War, with discussions on the trans-Atlantic arms trade imbalance. In the early sixties, President Kennedy argued for a more equal US-European burden-sharing, accompanied by the US defence industry connecting that call to Europe to buy American defence equipment. Today, it has a more acute political meaning

<sup>17</sup> European Union, European Commission, High Representative of the Union for Foreign Affairs and Security Policy, "Joint White Paper," 18.

<sup>18</sup> European Union, European Defence Agency, "[How Germany Is Learning to Overcome Neglect to Project Strength and Resolve](#)," *European Defence Matters*, Issue 24 (2022), 16.

with President Donald Trump in the White House as he, very likely, will connect more European defence spending and an agreement on a new NATO defence spending target in a transactional way to a European preference to buy from American defence companies.<sup>19</sup>

*Europe will have to perform a balancing act by combining ‘more European procurement’ with ‘continue to buy American’*

Thus, Europe will have to perform a balancing act by combining ‘more European procurement’ with ‘continue to buy American’. The easiest category is military equipment not produced in Europe, such as heavy lift helicopters and certain types of deep strike weapons. What you need, but you don’t produce – you will be obliged to buy elsewhere. In other categories, Europe has been self-sufficient for decades, in the naval sector (frigates, corvettes, minehunters and submarines) and in the land sector (tanks and other armoured vehicles).

The air sector is more contentious as it is largely dominated by American production, from the F-35 fighter aircraft to unmanned systems such as the Reaper for medium-altitude long-endurance (MALE-HALE) reconnaissance. But the landscape of what Europe can produce itself is also changing. The Eurodrone – developed as a European collaborative project by Germany, France, Italy and Spain – is set to become a European MALE-HALE unmanned aerial system, with envisaged initial operational status as of 2027. The Franco-German Future Combat Air System (FCAS) programme foresees the development of a next generation fighter aircraft as well as unmanned aircraft operating in an integrated network.<sup>20</sup>

Applied to the defence-industrial landscape in production of air and missile defence systems, the following picture emerges. European defence industries have the technology and production lines to deliver air and missile defence weapons in the lower, medium and

high layers: from the short-range Skyranger, to the medium-range IRIS-T and long-range SAMP-T. Therefore, strengthening European production in air and missile defence applies first and foremost to these weapon systems and their successors, as there is no need to start

from scratch. The existing knowledge and industrial production base can be used and enlarged. However, the aspect that should require more attention is standardisation and interoperability. In particular, the fast-growing proliferation of the development and production of short-range air defence assets (battlefield anti-drone capacities) is of concern as further cooperation and integration of land forces of European countries argues for procuring the same kit.

*European defence industries have the technology and production lines to deliver air and missile defence weapons in the lower, medium and high layers*

This is also an area very suitable for close industrial cooperation with Ukraine, as the country has become a leading nation in drone and counter-drone production. The drone action plan of the Netherlands aims to increase industry-to-industry cooperation in this sector. However, such national plans should be integrated in an overall approach in which nations coordinate their efforts to optimise the results instead of solely prioritising national defence industries.

The only layer for which European countries are dependent on American and Israeli missile defence systems is the upper range, for which the US industry produces the Aegis interceptor and Israel, based on US technology, the Arrow. Germany as the only European country procuring Arrow. The question arises if Europe should develop its own industrial capacities for such upper-layer interceptors. It will be time-consuming, and very expensive, raising the question of whether these risks should be taken while systems are available elsewhere. Without giving up the long-term aim of developing Europe’s own defence industrial capacities for upper-layer missile defence, in the near-term enhancing Europe’s production of air and missile defence systems should

<sup>19</sup> Gram Slattery, John Irish and Daphne Psaledakis, “[US officials object to European push to buy weapons locally](#),” *Reuters*, 2 April 2025.

<sup>20</sup> Airbus, ‘[Future Combat Air System \(FCAS\)](#).’

be focussed on the systems for the other layers. For continued dependency on non-European suppliers – first and foremost the US – the condition must be that the delivery of the air and missile defence systems remains ‘guaranteed’. This also applies to systems for all layers, and specifically to the Patriot.<sup>21</sup>

## CONCLUSIONS

The March 2025 Netherlands-Estonia air and missile defence seminar generated many insights which are detailed above. The key points may be summarised as follows:

- In the current security environment, developing an enhanced air and missile defence architecture for Europe is a necessity, not a luxury. This will be a highly challenging endeavour with no quick fixes.
- Many of the components of a new architecture – sensors, shooters, command and control systems – are already in service (albeit in numbers that fall far short of the need) or available from European and US defence manufacturers. But an evolutionary approach will likely not deliver the fully integrated air and missile defence architecture required: a radical redesign will be necessary.
- As a first step, European states should collectively review the current state of the NATO Integrated Air and Missile Defence System, and the range of initiatives intended to enhance air and missile defence, with a view to streamlining overlapping efforts and devising a way forward.
- In any event, European states will need to invest substantial resources to meet their air and missile defence needs. The character of the mission and the need to spend resources efficiently will require significant multinational cooperation.
- As part of this effort, the EU ReArm initiative should be implemented to finance common acquisition of air and missile defence systems and ammunitions.
- Due to the defence industrial connections within and outside the EU, it is essential that programmes (co-)financed by the Union budget are open to participation by defence companies located in ex-EU countries, such as the United Kingdom.
- To speed up defence industrial production at least three conditions will have to be met: long-term contracts; priority rules and regulations for the delivery of key resources and technological products; and financial and other incentives to attract new personnel.
- In the near future, European defence industries should focus their efforts on production of air and missile defence systems for all layers, except the highest upper layer – provided that non-European suppliers (US, Israel) can continue to guarantee the deliveries of the weapons systems and the missiles.
- Air and missile defence doctrine will also need to be fundamentally reshaped, with greater attention paid to multi-domain aspects and to offensive concepts.
- European states should take steps to better manage expectations (political, public, between allies) about what air and missile defence can realistically deliver.

<sup>21</sup> US defence company Raytheon is constructing a plant in southern Germany for the production of Patriot missiles which will help to ‘secure’ the delivery of missiles from the industrial perspective. Matthew M Burke, “[First Patriot missile facility outside US starts up in Germany](#),” *Stars and Stripes*, 2 December 2024.

# ANNEX A. EUROPE’S AIR AND MISSILE DEFENCE CAPABILITY: AN OVERVIEW

## A.1. INTRODUCTION

For more than three years, Ukraine has defended itself against Russia’s full-scale invasion. Russia has used a wide range of delivery systems to attack military targets as well as critical infrastructure and other civilian targets from the air, emphasising the indispensability of effective air and missile defence in modern conflict. While western donors have supplied air defence systems and munitions in substantial quantities, they have struggled to meet Ukraine’s needs. At the same time, the widespread use of long-range and tactical drones in huge numbers by both Russia and Ukraine has added complexity to the air defence picture and compelled states around the globe to re-examine airpower and air defence doctrines.

In recognition of a growing military threat from Russia, European countries have increased their defence budgets, especially since 2022. In 2023, only 10 NATO countries reached the Alliance’s target of spending 2% of GDP on defence. This number has increased to 23 today.<sup>22</sup> The rebalancing of defence budgets has also allowed Allies to spend more on military equipment.<sup>23</sup> Procurement projects, both national and multinational, have included new and modernised air and missile defence systems.

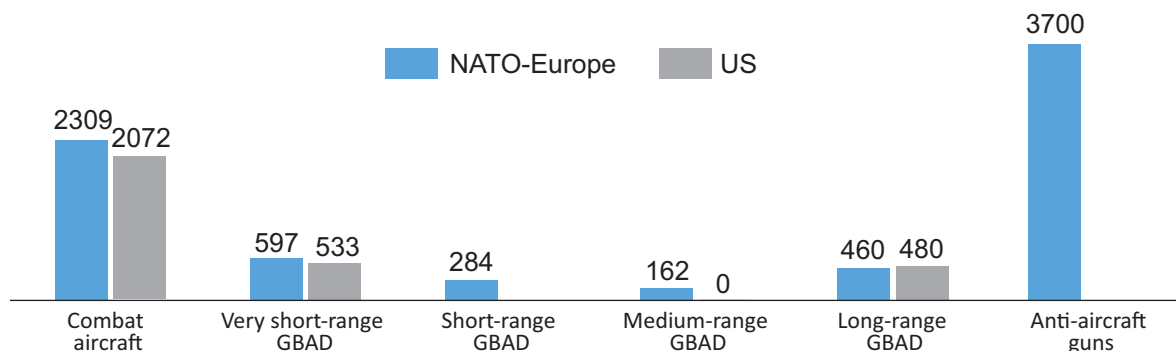
Still, according to NATO sources, Allied air defence capabilities fall far short of the requirements set out in the new regional defence plans (in addition to there being serious military capability shortfalls elsewhere).<sup>24</sup> Furthermore, the new US administration has indicated that it is no longer primarily focused on Europe’s security, raising the prospect that an American strategic realignment will leave Europe with an even greater air and missile defence gap to fill.<sup>25</sup>

This annex provides an overview of Europe’s air and missile defence capabilities, and of various programmes, projects, and initiatives that are underway to address shortfalls.

## A.2. ASSETS

Figure A.1 compares the total air and missile defence holdings of NATO European countries with those of the US, while Table A.1 provides an overview of the main air and missile defence assets available in European inventories (red labels indicate that a country has equipment, but numbers are not available). Of course, these raw numbers say nothing about aspects such as quality, readiness or interoperability.

**Figure A.1. Air and missile defence assets, NATO Europe vs US. The US has short-range Ground-Based Air Defence and anti-aircraft guns, but numbers are not available.** Source: IISS, The Military Balance 2024



<sup>22</sup> NATO, “[Defence Expenditure of NATO Countries \(2014-2024\)](#),” 17 June 2024.

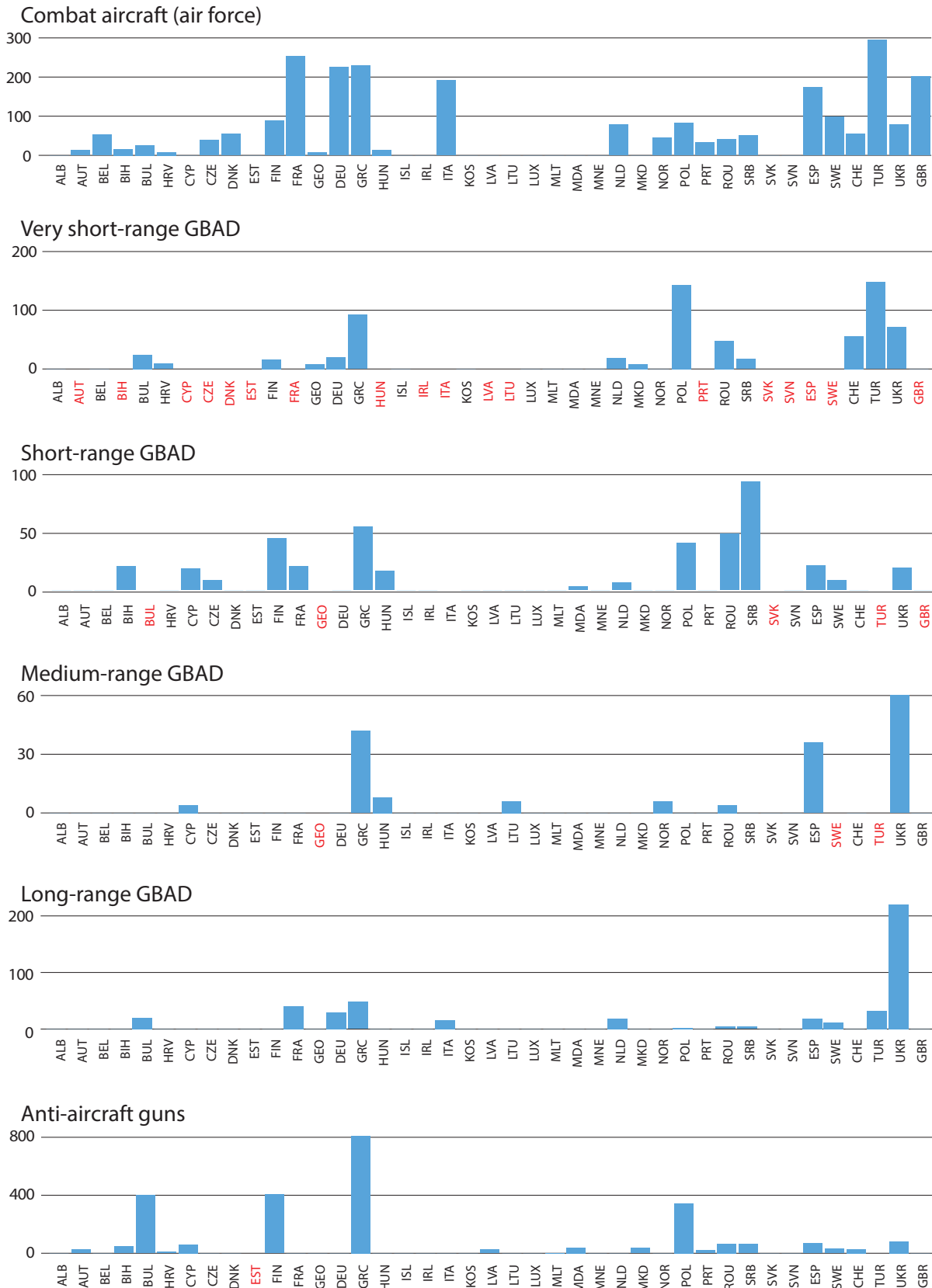
<sup>23</sup> NATO, “[Defence Expenditure of NATO Countries](#).”

<sup>24</sup> Foy and Rathbone, “[Nato has just 5% of air defences needed](#).”

<sup>25</sup> Dan Sabbagh, “[US no longer ‘primarily focused’ on Europe’s security, says Pete Hegseth](#),” *The Guardian*, 12 February 2025.

**Table A.1. Overview of air and missile defence assets of 41 European countries (GBAD – Ground-Based Air Defence). Excludes sea-based systems. Figures are for minimum estimates where ranges are given; red labels indicate that a country has equipment, but numbers are not available.**

Source: IISS, The Military Balance 2024.



## A.3. PROGRAMMES, PROJECTS AND INITIATIVES

### A.3.1. NATO

NATO Integrated Air and Missile Defence (IAMD) operates continuously to safeguard and protect Alliance territory, populations and forces against air or missile threat or attack. Included under the IAMD framework are measures such as NATO Air Policing, NATO Ballistic Missile Defence (BMD), and the IAMD Rotational Model.<sup>26</sup> NATO IAMD is implemented through the NATO Integrated Air and Missile Defence System (NATINAMDS), a network of national and NATO sensors, command and control assets, and weapons systems. It is overseen by the Supreme Allied Commander Europe (SACEUR) and organised, coordinated and implemented by Allied Air Command (AIRCOM), consisting of more than 1,000 employees and based in Ramstein, Germany.<sup>27</sup> AIRCOM is also responsible for standing up a Joint Force Air Component in times of crisis.<sup>28</sup>

- NATO Air Policing is a permanent peacetime mission in which NATO Allies possessing combat aircraft preserve the airspace integrity of Allies without aircraft.<sup>29</sup> Baltic Air Policing has operated since 2004 and in 2014 was supplemented with Enhanced Air Policing, which also saw NATO increase air policing capacity in Bulgaria, Poland and Romania.<sup>30</sup> Allies also provide air policing in Iceland and the Western Balkans, while BENELUX Air Policing is coordinated by Belgium, the Netherlands and Luxemburg.<sup>31</sup> Analysts have argued that Baltic air policing should be converted to an air defence mission, but this idea has not found favour across NATO.<sup>32</sup>
- The NATO BMD command centre is centrally provided and funded by NATO, but otherwise ballistic missile defence relies heavily on US Aegis assets, afloat and ashore, provided under the European Phased Adaptive Approach – a component of the US national ballistic missile defence programme.<sup>33</sup> NATO BMD has, largely in response to Russian concerns, historically focused on defence against ballistic missile threats from the south-east and kept functionally separate from other IAMD measures.<sup>34</sup>
- The non-BMD components of NATO IAMD suffer from shortfalls in capability, interoperability and integration that degrade NATO's abilities to defend against air threats, especially Uncrewed Aerial Vehicles (UAV) and missiles.<sup>35</sup> There are too few modern systems, too many legacy (Soviet) systems, and too many integration and interoperability challenges, to provide the coherent layered air defence necessary for credible defence and deterrence.<sup>36</sup> Furthermore, some analysts have criticised the stovepiping of offence and defence in NATO's operational thinking.<sup>37</sup>
- The IAMD rotational model, announced at NATO's Vilnius Summit, seeks to NATO's enhance air defence by rotating systems throughout NATO's area of responsibility with an initial focus on the eastern flank.<sup>38</sup> Besides occasional deployments for exercises and some short-term

<sup>26</sup> NATO, "[NATO Integrated Air and Missile Defence](#)," 13 February 2025.

<sup>27</sup> NATO, Allied Air Command, "[About Allied Air Command](#)."

<sup>28</sup> NATO, Allied Air Command, "[We Respond To Crisis](#)."

<sup>29</sup> NATO, "[NATO Air Policing](#)," 1 August 2024.

<sup>30</sup> NATO, Allied Air Command, "[Baltic Air Policing](#)."

<sup>31</sup> NATO, Allied Air Command, "[Icelandic Air Policing](#)"; NATO, Allied Air Command, "[Air Policing Over The Western Balkans](#)"; NATO, Allied Air Command, "[Air Policing Over Benelux](#)."

<sup>32</sup> Philip M. Breedlove, "[Toward effective air defense in northern Europe](#)," *Atlantic Council*, 6 March 2018.

<sup>33</sup> Julia Muravska, "[European Integrated Air and Missile Defence in NATO: Progress and Persistent Challenges](#)," *Freeman Air and Space Institute*, October 2023, 5.

<sup>34</sup> Tim Guest, "[NATO BMD and Upper-Tier Developments](#)," *European Security and Defence*, 31 July 2023.

<sup>35</sup> Sean Monaghan, John Christianson, "[Making the Most of the European Sky Shield Initiative](#)," *Center for Strategic and International Studies*, 19 May 2023, 3-9; Utku Cakirozer, "[NATO's Evolving Air and Missile Defence Posture](#)," *NATO Parliamentary Assembly*, 23 November 2024, 11-12.

<sup>36</sup> Julia Muravska, "European Integrated Air and Missile Defence," 5.

<sup>37</sup> Sidharth Kaushal, Archer Macy and Ali Stickings, "[The Future of NATO's Air and Missile Defence](#)," *Royal United Services Institute*, 12 July 2021, 19-23.

<sup>38</sup> NATO, "[Increasing readiness and responsiveness through NATO's Integrated Air Missile Defence Rotational Model](#)," 15 July 2024.

capability surges following Russia's full-scale invasion of Ukraine, progress in implementing the IAMD rotational model appears to be patchy and too reliant on the host nations to secure the commitments of Allies.<sup>39</sup> Estonia, for example, has hosted a Spanish National Advanced Surface-to-Air Missile System (NASAMS) unit, but its presence has been periodic, while the Netherlands has deployed Patriot systems to Lithuania for exercises. Germany has recently announced a deployment of two Patriot batteries to Poland to replace US forces protecting the Rzeszow-Jasionka logistics hub.<sup>40</sup>

NATO's High Visibility Projects are multinational initiatives intended to deliver critical Alliance capabilities and improve interoperability.<sup>41</sup> They also include air and missile defence elements:

- Modular Ground-Based Air Defence, allowing very short- to medium-range Ground-Based Air Defence (GBAD) to be built on a modular basis around a common fire distribution centre, currently at the concept stage.<sup>42</sup>
- Rapidly Deployable Mobile Counter Rockets Artillery and Mortars, a family of mobile systems for defence against rockets, artillery and mortars.<sup>43</sup>
- Command and Control Capability for Surface Based Air and Missile Defence for the Battalion and Brigade Level, providing open architecture air defence management.<sup>44</sup>

NATO also maintains the Integrated Air and Missile Defence Centre of Excellence in Greece, which focuses on supporting the Allies in building IAMD, and research, experimentation, concept development, education and training in the field of air defence.<sup>45</sup>

### A.3.2. EUROPEAN UNION

Air and missile defence is a Capability Development Priority of the EU and one of four capability areas thought to offer the best opportunity for European collaborative investment. Of the 14 Permanent Structured Cooperation (PESCO) projects in the Air Defence and Air Systems area, the five listed in Table A.2 are most relevant to air and missile defence.<sup>46</sup> Member States have committed to common efforts to address air defence shortfalls in response to the most recent Coordinated Annual Review on Defence.<sup>47</sup>

<sup>39</sup> ["Lithuania reaches air defence rotation deals with 3 countries – minister," LRT](#), 24 October 2024.

<sup>40</sup> ["Breaking News: Germany Deploys Patriot Air Defense Missile Systems in Poland to deter Russian aggression," Army Recognition](#), 24 January 2025.

<sup>41</sup> NATO, ["NATO launches five new multinational cooperation initiatives that enhance deterrence and defence,"](#) 17 October 2024.

<sup>42</sup> ["Nato Ground-Based Air Defence \(GBAD\) Project, Europe," Airforce Technology](#), 23 January 2025.

<sup>43</sup> NATO, ["Rapidly Deployable Mobile Counter Rockets Artillery and Mortar \(C-RAM\),"](#) February 2022.

<sup>44</sup> NATO, ["Command and Control Capability for Surface Based Air and Missile Defence for the Battalion and Brigade Level \(GBAD C2 Layer\),"](#) February 2022.

<sup>45</sup> Integrated Air & Missile Defence Centre of Excellence, ["Integrated Air & Missile Defence Centre of Excellence,"](#) 2024.

<sup>46</sup> ["Permanent Structured Cooperation \(PESCO\)."](#)

<sup>47</sup> European Union, European Defence Agency, ["2024 Defence Review paves way for joint military projects,"](#) 19 November 2024.

**Table A.2. PESCO air and missile defence projects. Coordinators highlighted in bold.**

Project	Concept and aim	Participants
Air Power <sup>48</sup>	Define technological components for future air superiority systems, identify sub-systems that will be integrated for the update and conception of platforms dedicated to combat from and in the air. System will elaborate doctrines and key essential elements of air power, develop technical requirements for components applicable to all combat platforms	HRV, <b>FRA</b> , GRC, SWE Obs.: DEU, HUN, NLD, PRT, ESP
Airborne Electronic Attack <sup>49</sup>	Locate, record, replay, and jam hostile communications while tracking across a broad frequency range, covers the design, development and testing of a multi jamming capability + enable a platform for AEA missions that could adapt to the latest in EW requirements	FRA, <b>ESP</b> , SWE, Obs.: ITA
Counter unmanned Aerial System <sup>50</sup>	Development of a modular, scalable and flexible cluster by a combination of active and passive sensors, kinetic and not kinetic effectors and an efficient C2 system to detect and defeat class I drones	CZE, <b>ITA</b> , SWE Obs.: BEL, FIN, FRA, DEU, GRC, HUN, IRL, LTU, NLD, POL, PRT, ESP
Future Short-range Air to Air Missile <sup>51</sup>	Develop concepts and operational requirements of a Short-Range AAM to counter modern 5th and future 6th generation combat aircrafts and airborne threats within a six-pillar approach until 2029	<b>DEU</b> , HUN, ITA, ESP, SWE Obs.: GRC
Integrated Multi-Layer Air and Missile Defence System <sup>52</sup>	Need for complex, fully integrated, multi-layered Ground Based Air and Missile Defence systems. Provide an innovative concept for future IAMD and mature the new features of the Battle Management, Command, Control, Communication, Computer, Intelligence (BMC4I) module	FRA, HUN, <b>ITA</b> , SWE Obs.: DEU, GRC, NLD, PRT

The EU has also supported the joint procurement of GBAD munitions (for Mistral and IRIS-T (infrared imaging system tail/thrust vector-controlled)) through the European Defence Industry Reinforcement through Common Procurement instrument (EDIRPA).<sup>53</sup> These common defence procurements, the first to receive EU financial support, are a test of instruments that may later be components of the European Defence Industrial Programme and European Defence Industrial Strategy.<sup>54</sup>

### 3.3. EUROPEAN SKY SHIELD INITIATIVE

The largest multinational initiative in the field of air defence in recent years is the European Sky Shield Initiative (ESSI), launched by Germany in August 2022 with the aim of building a ground-based European air and missile defence system. The system is intended to be implemented through the common procurement of specified components: Skyranger 30 (short range), IRIS-T SLM (medium range), MIM-104 Patriot (long range) and Arrow 3 (very long range).<sup>55</sup> By January 2025, 22 countries had joined the ESSI, including militarily neutral countries such as Austria and Switzerland. A major criticism of the ESSI is that the member states have not yet been able to convince other major NATO allies such as France, Italy or Spain to join the initiative, due variously to defence industrial concerns related to the selection of non-European components (in particular the preference for Patriot over the French-Italian SAMP/T (Sol-Air Moyenne-Portée/Terrestre) for

<sup>48</sup> Permanent Structured Cooperation (PESCO), "[Air Power](#)."

<sup>49</sup> Permanent Structured Cooperation (PESCO), "[Airborne Electronic Attack](#)."

<sup>50</sup> Permanent Structured Cooperation (PESCO), "[Counter unmanned Aerial System](#)."

<sup>51</sup> Permanent Structured Cooperation (PESCO), "[Future Short-range Air to Air Missile](#)."

<sup>52</sup> Permanent Structured Cooperation (PESCO), "[Integrated Multi-Layer Air and Missile Defence System](#)."

<sup>53</sup> European Union, European Commission, "[EU boosts defence readiness with first ever financial support for common defence procurement](#)," 14 November 2024.

<sup>54</sup> European Union, European Commission, "[European Defence Industrial Development Programme \(EDIDP\)](#)"; European Union, European Commission, "[EDIS | Our common defence industrial strategy](#)."

<sup>55</sup> Anna Desmarais, "[How Sky Shield, Europe's proposed Iron Dome, would work and why it's becoming controversial](#)," *Euronews*, 28 July 2024.

long-range GBAD) and to preferences for bilateral cooperation.<sup>56</sup> Analysts have also indicated that the proposed components – particularly Arrow – may be inappropriate to meet the Russian threat, that there is no concept for integrating the ESSI into the NATO IAMD, and that the ESSI concept draws too heavily on Ukraine’s experience, which may not be applicable in a NATO-Russia war.<sup>57</sup>

In mid-2024, Poland and Greece proposed an EU-funded project to develop a European air and missile defence system.<sup>58</sup> Details are thin, but at first sight this initiative would appear to share many of the objectives of ESSI.

### 3.4. SELECTED PROCUREMENT PROJECTS

Table A.3 lists a selection of recent European air defence procurement projects.

**Table A.3. Recent air defence procurement projects**

Project name	Date	Aim	Participant(s)
Global Combat Air Programme <sup>59</sup>	2022	Design, manufacture, and deliver a next-generation crewed combat aircraft	ITA, JAP, GBR
Land Ground Based Air Defence <sup>60</sup>	Aug. 2022	Procurement, capable of operating across all military domains (air, sea, and land), over the next ten years	GBR
Iris-T <sup>61</sup>	May 2023	Joint procurement to save costs and expedite delivery	EST, LVA
Narew <sup>62</sup>	Nov. 2023	£4 billion air defence deal to continue Poland’s future air defence programme	POL, GBR
PILICA+ <sup>63</sup>	Dec. 2023	Procurement from PGZ-PILICA+ Consortium	POL
Integrated Battle Command System <sup>64</sup>	Mar. 2024	\$2.5 billion deal for an advanced air defence system	POL, USA
PIORUN <sup>65</sup>	Jul. 2024	Joint procurement	LVA, LTU, NOR, POL

<sup>56</sup> Lydia Wachs, “[Russian Missiles and the European Sky Shield Initiative](#),” *SWP Comment* No.45, August 2023, 6.

<sup>57</sup> Sven Arnold and Heloise Fayet, “[Entre ambitions industrielles et contribution à l’OTAN, les défis de la European Sky Shield Initiative](#) [Between industrial ambitions and contribution to NATO, the challenges of the European Sky Shield Initiative],” *Institut français des relations internationales*, Octobre 2024.

<sup>58</sup> Ellen Boonen and Jakob Hankevela, “[Von der Leven backs Polish, Greek calls for EU air defence shield](#),” *Politico*, 23 May 2024.

<sup>59</sup> Lucy Petrie, “[What is the Global Combat Air Programme \(GCAP\)?](#)” Research Briefing, *House of Commons Library*, 14 November 2024.

<sup>60</sup> Claire Mills and Nigel Walker, “[UK air and missile defences](#),” Research Briefing, *House of Commons Library*, 22 November 2024.

<sup>61</sup> Ministry of Defence (Estonia) “[Estonia and Latvia to begin medium-range air defence procurement negotiations with German manufacturer](#),” 21 May 2023.

<sup>62</sup> Ministry of Defence (UK), “[£4 billion UK-Poland air defence deal strengthens European security](#),” *Gov.uk*, 7 November 2023.

<sup>63</sup> “[Poland Orders PILICA+ Air Defense Systems from PGZ-PILICA+ Consortium](#),” *Military Leak*, 20 December 2023.

<sup>64</sup> Agata Pyka, “[Poland signs \\$2.5bn deal with US for air defence system](#),” *Notes from Poland*, 1 March 2024.

<sup>65</sup> “[Four European countries to jointly procure Piorun air defence systems from Poland](#),” *Defence Industry Europe*, 27 July 2024.

MSHORAD <sup>66</sup>	Oct. 2024	Procurement of short-range air defence system	LTU
IRIS-T <sup>67</sup>		Procurement of air defence system	BUL
CITADEL <sup>68</sup>		Procure NASAMS and NOMADS air defence systems from KONGSBERG	NLD
Air-to-Air Missiles <sup>69</sup>		Procurement of 212 missiles	DNK
Air-to-Air Missile <sup>70</sup>		Procurement of missiles	NOR
Short-range man-portable Air Defense System <sup>71</sup>	Nov. 2024	Joint procurement to save costs	EST, LTU, NOR, POL
MISTRAL <sup>72</sup>		Joint procurement project	BEL, CYP, DNK, EST, FRA, HUN, ROU, ESP, SVN
Skyranger <sup>73</sup>	Dec. 2024	Procurement of an anti-drone gun system	DNK
NASAMS <sup>74</sup>		Procurement of an air defence system	NOR
Skynex <sup>75</sup>	Jan. 2025	Procurement of an air defence system	ITA
Skyranger <sup>76</sup>		Procurement of an anti-drone gun system	NLD
RBS 70 NG <sup>77</sup>	Mar. 2025	Procurement of an air defence system	LVA

<sup>66</sup> Saab, "[Saab receives additional mobile air defence order from Lithuania](#)," 4 October 2024.

<sup>67</sup> Harry McNeil, "[Diehl Defence welcomes Bulgaria into the IRIS-T SLM user family](#)," *Army Technology*, 9 October 2024.

<sup>68</sup> Kongsberg, "[Netherlands to acquire NASAMS and NOMADS air defence systems from KONGSBERG](#)," 14 October 2024.

<sup>69</sup> Peter Felstead, "[Denmark cleared to buy over 200 more AMRAAMs via FMS](#)," *European Security and Defence*, 30 October 2024.

<sup>70</sup> "[Norway buys US-made air defence missiles for over \\$360 mln](#)," *Reuters*, 28 October 2024.

<sup>71</sup> "[Estonia signs joint agreement to buy short-range man-portable air defence system](#)," *ERR*, 15 November 2024.

<sup>72</sup> "[EU approves joint procurement of Mistral 3 air defence missiles led by France](#)," *Defence Industry Europe*, 24 November 2024.

<sup>73</sup> Dylan Malyasov, "[Denmark signs deal for new air defense system](#)," *Defence Blog*, 3 December 2024.

<sup>74</sup> Kongsberg, "[Norway acquires more NASAMS air defence systems](#)," 19 December 2024.

<sup>75</sup> Tim Martin, "[Italy sets up \\$289 million Skynex air defense deal with Rheinmetall](#)," *Breaking Defense*, 15 January 2025.

<sup>76</sup> Ministry of Defence (Netherlands), "[Defensie versterkt luchtverdediging met anti-drone kanonsystemen](#) [Defense strengthens air defence with anti-drone gun systems]," 29 January 2025.

<sup>77</sup> Dylan Malyasov, "[Latvia buys Saab's RBS 70 NG air defense system](#)," *Defence Blog*, 31 March 2025.

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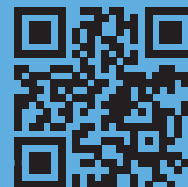
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