The Hague Centre
for Strategic Studies

Surviving the Deadly Skies

Integrated Air and Missile Defence 2021-2035

Authors: Paul van Hooft and Lotje Boswinkel

November 2021

Executive Summary

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Executive Summary

This report argues that interacting geopolitical and technological trends have raised the type and level of threats that European states face from ballistic missiles or cruise missiles, manned and unmanned aircraft, or other weapon systems. This adds serious urgency to the need for better and more integrated air and missile defence (IAMD) for European states. Current European air and missile defence capabilities are not up to the task to effectively defend against the full spectrum of threats.

The transparency of the battlefield is increasing due to improved space-based sensors and sensors based on unmanned systems. At the same time, technologies for more precision, speed, and integration of air and missile weapons systems are becoming more accessible to more actors. Consequently, not only great powers, but regional powers and non-state actors as well, are more able than before to use or to threaten with the use of these weapons. European military infrastructure and forces, as well as civilian targets, are particularly vulnerable to attacks that use an extensive mix of sophisticated and unsophisticated weapons to overwhelm and confuse the defender.

Air and missile defence is thus relevant at the strategic, theatre, and tactical level

Active air and missile defence systems consist of sensors, interceptors, and command and control (C2) nodes. The challenge for the defender is to find threats as early as possible, to track them, and to stop them with an interceptor. A range of different types of sensors are required at different stages, and although the interceptor is generally a missile, alternatives exist. This complex of systems is tied together through C2 units. Both human operators and automated units process the information from the sensors and send out commands to the launchers. These defensive systems are generally designed for various types of threats but are often stronger versus certain threats than others. Defensive systems can be based on land, sea, air, or space, and combined across these domains. They defend against threats to everything from cities and civilian infrastructure in our homelands, to military infrastructure and deployed units far from home. Air and missile defence is thus relevant at the strategic, theatre, and tactical level.

In short, active air and missile defence is a demanding and high-stake task. Attackers and defenders are engaged in a highly competitive struggle for advantage. Defenders therefore not only rely on active defence, but also on passive defence measures: concealment, dispersion, mobility, and hardening. Moreover, deterrence and arms control measures should highly reduce the risks that adversaries in fact use these weapons. Defenders may also employ pre-emptive measures, attempting to destroy hostile capabilities using air power or cyber weapons before they can launch (another) attack.

The report focuses on active defence measures and underlines that they have become newly important again. Recent illustrations are easy to find, from the 2021 Israel-Hamas conflict, the 2020 Nagorno-Karabakh conflict, to the 2019 attack on the Saudi oilfields. All show how minor states and non-state actors can creatively and effectively use missiles and unmanned vehicles to find and destroy targets, either bypassing defences or saturating them.

Even more worrying is what could happen at a larger scale. Russia and China have invested in missile arsenals to hold ports, airbases, C2-nodes, and major military forces at risk. These

so-called anti-access area denial (A2/AD) capabilities can either stop or raise the costs of forces operating in their vicinity or dissuade them from coming to the aid of allies and partners under direct threat. Russia and China, alongside the United States and other major states, are also investing in hypersonic weapons, which adds another level of speed and unpredictability to great power politics.

For European states, improved air and missile defences are therefore not only a question of protecting their populations and militaries on a national basis: alliance commitments, the geographic reach and the complexity of the threats require multinational approaches as well. The rate at which the threat environment is developing, and the impact across the strategic, theatre, and tactical levels require a greater sense of political urgency in European capitals.

The notion that the US may be (or become) overcommitted militarily in multiple regions means that a viable air and missile defence has strong implications for European strategic autonomy and European commitments to NATO. European states need solutions if the US is incapable of quickly acting in Europe, both to protect their own security and to maintain the credibility of NATO as a whole. It also creates manoeuvre space for the US during crises in multiple regions and can dampen paths to rapid escalation up to and including the nuclear level by the major powers during a crisis. The changing air and missile threat environment spells out the need for European industrial solutions. Air and missile defence against threats to European population, infrastructure, and forces represents a minimal capability that Europeans should be able to master without depending on others. But it is also a matter of strengthening the transatlantic relationship, as the alliance cannot effectively deter threats without core assets in individual member states being properly protected. The specific parts of the report can be broken down as follows.

Threats

The conventional nature of the threat particularly stands out

The threat environment is changing due to interacting geopolitical and technological developments. The report finds three geopolitical developments that together directly and indirectly affect European security: (1) the intensifying competition between the US, and Russia and China has created new incentives to (2) invest in military technologies in Europe and Asia, specifically missile-related technologies. This trend is reinforced by (3) the dynamics regarding minor states and non-state actors in the regions surrounding Europe.

The conventional nature of the threat particularly stands out. Since the end of the Cold War, the focus in missile defence has been on defending against small numbers of nuclear-armed, but fairly unsophisticated, ballistic missiles from so-called rogue states in the European periphery. However, the increasing quality and quantity of conventional missiles should be cause to reconsider this focus. Particularly because these missile capabilities are now supplemented by unmanned vehicles that contribute to a more transparent battlefield and to precision attacks, and be used to destroy crucial nodes to pave the way for more sophisticated weapons. The 2020 war in Nagorno-Karabakh was an illustration of new creative ways to use these kinds of assets; yet, while highly destructive, it was still small-scale compared to what a potential conflict between major states would look like.

To offset the ability of the US to project power in their vicinity, peer competitors Russia and China are adding to their ability to strike at military infrastructure and at forces on land, sea, and in the air. Their arsenal includes short- and intermediate-range ballistic and cruise

missiles, manned and unmanned aircraft, and possibly in the near future hypersonic weapons. Through these capabilities, Russia can raise the difficulty for American and Western European forces to reinforce NATO's Eastern Flank. While probably not the most immediate threat to the security of Europe's northeast, these capabilities still make it more difficult to rule out Russia creating a *fait accompli*. In addition, most of these missile technologies can be used to target cities with nuclear or other non-conventional warheads. Russia could potentially use these capabilities to blackmail European allies and the US to forego assistance to allies.

Russia can raise the difficulty for American and Western European forces to reinforce NATO's Eastern Flank

In the maritime domain, regional powers like Iran can threaten ships further and further from shore, also using non-state proxies, thus undermining the safe passage of European vessels to and from the Indian Ocean and through the Persian Gulf. Moreover, minor states and non-state actors are increasingly effective in exploiting the possibilities of combining unmanned aerial vehicles for sensing, loitering munitions, and rockets and artillery. This particularly poses a threat against land-based military units at the tactical level. This renders, for instance, stability missions of European land forces riskier than before.

Technological developments matter as well. The report recognises four trends and developments: (1) increased accessibility due to declining costs; (2) improvements in precision and transparency; (3) compression of time and space diminishing reaction time; and (4) the ability to combine different weapons during an attack and confuse and overwhelm a defender.

Unmanned vehicles will have an effect at all levels and across the land, sea, and air domains. Specifically, unmanned vehicles can enable or multiply the effects of other capabilities. They can contribute persistent sensing to increase the transparency of the battlefield, or, in their more sophisticated form, increase the precision of more sophisticated weapons. As loitering munitions, they can be used to destroy key C2 or radar installations, and by removing these key nodes, clear the way for larger-scale, and more sophisticated attacks. While more advanced models may stay out of reach of many states and non-state actors, in general they are quickly becoming more accessible to more actors.

In the maritime domain, regional powers like Iran can threaten ships further and further from shore, also using non-state proxies

The extent to which hypersonic weapons will present a threat in the short-term is uncertain. Yet, they could undermine stability in the medium-to-long term. Given the limited number of states that are likely to have access to them, their effect might not be felt at the strategic level where most nuclear-armed states already have ample capabilities. What is arguably underrated is the potential ability of hypersonic weapons to quickly eliminate key military infrastructure – ports, airbases, C2-nodes – and thereby reshape the parameters of the conflict at the theatre level. Their speed, manoeuvrability, and ability to be deployed from multiple platforms could achieve significant effects during a conventional theatre-level conflict.

One of the report's central messages is that, more than individual technologies, the real emerging danger regarding air and missile threats lies in the emerging ability to combine different types of weapons, with vastly different qualities, to overwhelm and confuse the defender's systems, or blind them by striking at specific nodes. After the Cold War, European states have become used to treating most of the dangers of air and missile threats as distinct problems at the strategic and tactical level, while being able to largely ignore theatre-level threats by major states. In the emerging threat environment, combinations of high-end and low-end weapons pose a major challenge, while defences at the theatre-level are specifically underdeveloped, not necessarily in terms of technologies, but in terms of conceptual and doctrinal employment, as well as numbers of interceptors. Our study underlines that the conventional threat at the theatre level against military infrastructure such as ports, airports, nodes, as well as high-value naval vessels has been underrated.

In summary, technological developments, conceptual and doctrinal innovation, and investments in numbers have given potential aggressors distinct advantages. The ability to combine various weapon systems in attacks, with more varied sensors, has created a 360-degree threat environment. Weapon systems with varying levels of sophistication can be brought together to saturate, confuse, and overwhelm the defender's systems. Whether ballistic missiles or hypersonic weapons, fighter-bomber aircraft, cruise missiles, or unmanned aerial vehicles, each weapon system has distinct advantages in terms of speed, trajectory, manoeuvrability, expendability, and costs to leverage against the defender's systems. The threat is no longer primarily from small numbers of ballistic missiles from so-called rogue states, and from non-state actors. It is not only a matter of new or emerging sophisticated technologies like hypersonic weapons, but also one of raw numbers of weapons of varying kinds of sophistication, and especially the creative employment of these weapons. European answers regarding defence should also be sought in technology, numbers, and conceptual and doctrinal innovation. In short, rather than exploring the relative qualities of specific defensive systems versus specific weapons, throughout this report we specifically look at the question of air and missile defence through a comprehensive *strategic* lens.

Solutions

European answers regarding defence should be sought in technology, numbers, and conceptual and doctrinal innovation

The study suggests a number of solutions to improve active air and missile defence in Europe.

Stop overlooking the mid- and lower-level threats. The attention in air and missile defences over the past decades has been given primarily to higher-level strategic threats. But with the growing possibility of combining weapon systems for conventional attacks at the theatre level, investments should go there. The use of unmanned vehicles at every threat level, though for different purposes and often to pave the way for more destructive or sophisticated weapons, underlines that investments towards better point defence against UAVs are both necessary and cost-effective. The risk is that combination attacks will quickly exhaust the limited stock of high-end interceptors.

Combine defensive solutions. For successful air and missile defence, European states should not only invest in high-end technologies for the high-end threats, such as high energy weapons against hypersonic weapons, but also stimulate creative employments of emerging and existing technologies. After all, the emerging threat environment is not primarily a consequence of rapid technological advances, but rather of the attention paid to effectively combine existing weapons with newer systems, and of the investment in numbers of weapons. Consequently, improved passive defence measures such as dispersion, concealment, mobility, and hardening should be combined with the active defence measures. These measures are needed to offset the improvements in precision and battlefield transparency. Alongside improvement in active and passive defence measures, preventive solutions such as airpower, special forces, and cyber operations should be considered as effective solutions.

Invest in stocks. European states should continue to invest in numbers of interceptors, whether land-, sea-, or air-based systems. Numbers matter, especially when adversaries rely on saturation attacks with combinations of weapons to confuse and overwhelm defensive systems. Without built-in redundancies in interceptor stocks, the defensive system as a whole will become brittle. While this is costly, the price pales in comparison to the costs of losing the targets that are defended. But European states can be smarter about their acquisition processes and coordinate their acquisition processes to ensure a better deal from the

producers. Pressuring industrial players towards greater interoperability between systems would facilitate sharing interceptors between land- and sea-based systems and between European states and the US.

Integrate weapons, technologies, and investments. European states should better integrate their air and missile defence systems both nationally and internationally, within Europe and with the US. Further investments in the technologies to better integrate the various air-based systems of sensors, interceptors, and C2-nodes that make up active air and missile defence would pay high dividends. This is a matter of getting more out of what is already there, not a cost-saving measure. European projects underway as part of the Permanent Structured Cooperation and the European Defence Funds hold a great deal of promise. Yet this is not only in part a matter of technological solutions and smart acquisition policies, but also a matter of synchronising employment practices through simulations, testing, and exercises. The Netherlands could play a role, specifically with its sea-based sensing capabilities, which provide it with a mobile and flexible niche capability.

European states should better integrate their air and missile defence systems both nationally and internationally, within Europe and with the US

Underline political-strategic urgency. None of these solutions can be implemented without a shared European political urgency for investments in air and missile defence, as an integral part of the strive towards more strategic autonomy. These are political choices, not just technological matters. In the current constellation, European states are highly dependent on the US for strategic missile defence and theatre level defences. European improvements in integrated air and missile defence would go far in building the European ability to conduct conventional deterrence through its own anti-access area denial capabilities. Given that Europe can no longer be sure that the US can quickly reinforce both the Euro-Atlantic and the Indo-Pacific theatres, strengthening Europe's ability to protect key civilian and military infrastructure is required to protect high-value European assets as well as to raise the costs of aggression against Europe, while also buying allies time in case the US cannot quickly reinforce the European theatre.

In summary, strengthening air and missile defence within Europe is necessary and should receive much greater attention in the public debate, despite its technical nature. It cannot be a matter for individual governments on a national basis. Given the intricacies of the emerging threat environment, it is necessary to combine European defensive assets in smarter and more effective ways.

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