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Conventional Prompt Strike in European Military Power

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Contents

Executive Summary

This paper examines the role of conventional prompt strike – including medium-range ballistic missiles and hypersonic glide vehicles – as an emerging component of European military power. Drawing on experience from recent conflicts, it argues that advances in missile accuracy, manoeuvrability and speed have eroded the traditional trade-off between speed and precision, enabling conventional missiles to hold at risk time-sensitive, hardened and high-value targets previously addressable only through airpower or nuclear means.

The paper argues that prompt strike must be understood not as a standalone weapon, but as a system – a reconnaissance-strike complex composed of missiles, ISR, command and control, and sustainment. The effectiveness of prompt strike is therefore determined by the interaction between three variables: assurance of effect, targeting dynamism and scale. How European states balance these variables will depend primarily on two economic inputs: the cost and availability of missiles, and access to ISR – particularly space-based ISR, which has historically been provided by the US.

While existing doctrine on prompt strike and hypersonic vehicles tends to reflect US and Chinese assumptions about mass, ISR saturation and global enablers, the paper instead focuses on the constraints and opportunities facing European middle powers. These states face acute resource competition, limited magazine depth and heavy dependence on US targeting infrastructure. As a result, European concepts of employment must differ fundamentally from those of military superpowers.

The paper outlines three increasingly ambitious concepts of operations:

- The irreducible minimum: This is a narrowly focused but strategically vital mission set centred on the ability to degrade or suppress Russian ballistic missile defence around Moscow. This mission underpins the credibility of Europe's independent nuclear deterrents in a context where US extended deterrence may be stretched by a two-peer nuclear challenge. Because the target set is small, geographically constrained and of existential importance, this role would constitute both the most achievable and the most urgent application of European prompt strike capabilities.
- Preplanned targeting at scale: Enabled by greater missile availability but still constrained ISR, this approach focuses on static or semi-static bottlenecks within Russia's integrated air and missile defence system and long-range strike architecture. In this scenario, by targeting early-warning radars, interceptor aircraft

bases and missile storage infrastructure, prompt strike could enable follow-on air and cruise missile operations and reduce the sustainability of Russian deep-strike campaigns.

- Dynamic targeting at scale: The most ambitious concept, which is analogous to the Russian notion of an integrated massive air strike. This would involve the coordinated use of large missile inventories and pervasive ISR to strike dynamic, hardened and time-sensitive targets across theatre depth. While currently beyond Europe's autonomous reach, such a capability – if costs decline and ISR becomes more accessible – could fundamentally alter deterrence dynamics by complicating Russian escalation calculus and 'recoupling' US and European security.

A central finding of this paper is that the economics of strike complexes are not fixed. The commercialisation of space-based ISR, advances in AI for data processing, and changes in defence industrial practices could substantially reduce the cost of sensing and effectors over the next decade. If missile costs fall and ISR becomes more available (independent of US support), the range of viable European concepts of operations expands significantly.

The paper concludes that European prompt strike capabilities should be developed incrementally, beginning with the irreducible minimum mission and expanding only as costs, industrial capacity and ISR access permit. Ballistic missiles and hypersonic glide vehicles should be treated as complementary instruments rather than substitutive, with different strengths against different target sets. European policymakers are urged to align near-term procurement with the most strategically necessary missions, while preserving pathways toward more ambitious concepts (should technological and economic conditions change).

Introduction

Long-range conventionally armed precision strike capabilities have played an increasingly important role in 21st-century conflict. This has been especially true of conventional prompt strike (CPS), a subcomponent of precision strike which can engage targets rapidly due to their high speeds. In Ukraine, for example, Russia has employed several hundred Kh-47M2 Kinzhal air-launched ballistic missiles which reach hypersonic speeds, along with the Zircon (a scramjet-powered cruise missile) and the 9M723 Iskander-M ballistic missile.[1] Both Israel and Iran employed ballistic missiles at critical junctures during their two-year conflict: Iran employed roughly 550 ballistic missiles during the 12-day war with Israel,[2] while Israel employed air-launched ballistic missiles – such as the Rampage and Blue Sparrow – on a more limited scale against critical targets such as Iran's five S-300PMU2 batteries. This allowed for the application of Israel's airpower in ways that might otherwise have not been as easily achieved.

Historically, missile warfare had been characterised by a trade-off between speed and accuracy; faster ballistic missiles primarily were used as terror weapons, due to their inaccuracy, in conflicts such as the Iran–Iraq War and the 1991 Gulf War. However, steady improvements in missile guidance and terminal phase manoeuvrability have driven a reduction in the circular error probable of ballistic missiles, to the extent that they are now employed against targets such as air defence systems, dynamic maritime targets and high-value human targets. The introduction of hypersonic glide vehicles (HGVs), which combine speed with greater manoeuvrability and accuracy than most ballistic missiles, could add a new capability to the repertoire of states pursuing CPS. High-speed cruise missiles, including ramjet-powered supersonic systems and scramjet-powered hypersonic cruise missiles, further erode the trade-off between

1. See Center for Strategic and International Studies (CSIS), ' Russian Firepower Strike Tracker: Analyzing Missile Attacks in Ukraine', <https://www.csis.org/programs/futures-lab/projects/russian-firepower-strike-tracker-analyzing-missile-attacks-ukraine>, accessed 4 February 2026.
2. Bilal Y Saab and Darren D White, 'Lessons Observed from the War Between Israel and Iran', *War on the Rocks*, 16 July 2025, <https://warontherocks.com/2025/07/lessons-observed-from-the-war-between-israel-and-iran/>, accessed 4 February 2026.

speed and accuracy.[3] Accurate and high-speed missiles can play a range of roles alongside slower missiles and aircraft and will be of value against targets that are either time-sensitive or hardened and buried.

The scale at which missiles have been employed in recent conflicts has, perhaps unsurprisingly, driven a growing interest in conventional deep-strike capabilities within Europe. Several overlapping initiatives include the European Long-Range Strike Approach[4] and a separate UK–Germany initiative that aims to deliver missiles which can cover ranges of 2,000 km.[5] France, the UK and Italy are also collaborating on the development of the supersonic STRATUS anti-ship weapon.[6] Additionally, Germany will purchase the Typhon, a system capable of launching both the Tomahawk surface-to-surface cruise and SM-6 surface-to-air missile.[7] A range of tactical missiles are also being pursued, both by smaller states closer to NATO's Eastern flank and by armies which intend to use them against high-value targets at the tactical and operational levels.[8]

Hypersonics are also a subject of considerable interest in European capitals. The UK will collaborate with the US and Australia on the development of hypersonic weapons as part of AUKUS Pillar II,[9] and in 2023, France conducted its first HGV test.[10] The US, too, is focusing on placing hypersonic weapons in Europe, and in 2026 the Dark Eagle HGV will be delivered to Multidomain Task Force 2 in Germany.[11] This mirrors

3. Sidharth Kaushal, 'The Zircon: How Much of a Threat Does Russia's Hypersonic Missile Pose?', *RUSI Commentary*, 24 January 2023, <https://www.rusi.org/explore-our-research/publications/commentary/zircon-how-much-threat-does-russias-hypersonic-missile-pose>, accessed 6 February 2026.
4. Saif Ul Haq, 'European Long Range Strike Approach (ELSA): Future Developmental Trajectories', *Modern Diplomacy*, 22 May 2025, <https://moderndiplomacy.eu/2025/05/22/european-long-range-strike-approach-elsa-future-developmental-trajectories/>, accessed 23 January 2026.
5. George Allison, 'UK and Germany Speeding Up New 2,000 km Strike Missile', *UK Defence Journal*, 5 November 2025, <https://ukdefencejournal.org.uk/uk-and-germany-speeding-up-new-2000km-strike-missile/>, accessed 2 February 2026.
6. MBDA, 'MBDA Unveils Stratus for Future Cruise and Anti-Ship Capabilities', press release, 10 September 2025, <https://www.mbda-systems.com/mbda-unveils-stratus-future-cruise-and-anti-ship-capabilities>, accessed 23 January 2026.
7. Sebastian Sprenger, 'Lockheed Vows Quick Action on German Typhon Launcher Request', *Defense News*, 28 July 2025, <https://www.defensenews.com/global/europe/2025/07/28/lockheed-vows-quick-action-on-german-typhon-missile-launcher-request/>, accessed 4 February 2026.
8. *Ibid.*
9. Louisa Brooke-Holland, 'AUKUS Pillar 2: Advanced Capabilities', House of Commons Library, 2 September 2024, <https://commonslibrary.parliament.uk/research-briefings/cbp-9842/>, accessed 23 January 2026.
10. UK Ministry of Defence, 'Development of Battle-Winning Hypersonic Technology Accelerated Under New AUKUS Deal', press release, 18 November 2024, <https://www.gov.uk/government/news/development-of-battle-winning-hypersonic-technology-accelerated-under-new-aukus-deal>, accessed 4 February 2026; Timothy Wright, 'France Conducts its First Hypersonic Glide Vehicle Test', International Institute for Strategic Studies (IISS), 29 June 2023, <https://www.iiss.org/online-analysis/online-analysis/2023/06/france-conducts-its-first-hypersonic-glide-vehicle-test/>, accessed 4 February 2026.
11. Alexander Graef and Tim Thies, 'Missiles on the Move: Why US Long-Range Missiles in Germany are Just the Tip of the Iceberg', *Bulletin of the Atomic Scientists*, 12 August 2024. <https://thebulletin.org/2024/08/missiles-on-the-move-why-us-long-range-missiles-in-germany-are-just-the-tip-of-the-iceberg/>, accessed 4 February 2026.

developments in middle powers elsewhere: Japan, for example, is advancing towards an eventual hypersonic capability as part of a three-phase counterstrike programme which will begin with the delivery of Tomahawk cruise missiles, followed by the production of an extended-range version of the supersonic Type 12 missile (currently in service with the Japan Maritime Self-Defense Force as an anti-ship weapon), and ultimately ending with the delivery of hypersonic weapons.[12]

However, the flurry of activity with respect to long-range precision strike obscures certain pressing questions regarding precisely what the concepts of operations underpinning the employment of these capabilities should be. This is particularly important because many concepts which presently exist for employing hypersonic weapons and other prompt strike capabilities are based on assumptions regarding both targets and enablers, which are specific to the world's military superpowers.

Take, for example, the Chinese concept of a joint firepower strike operation, which entails the coordinated employment of ballistic and hypersonic missiles to paralyse an opponent's military system. The Strategic Rocket Force that is expected to deliver this fields roughly 2,000 medium- and intermediate-range ballistic missiles (M/IRBMs), as well as HGVs such as the DF-17 and an even larger arsenal of short-range missiles.[13] The ability to find and strike targets such as aircraft carriers at sea depends on an ISR constellation of several hundred EO (Earth observation) and SAR (synthetic-aperture radar) satellites, in addition to other sources of data such as maritime patrol aircraft.[14] It is not just the cost of operations that is specific to a state, such as China or the US, but also the operational context. The missile threat to US forces in countries like Japan or aboard vessels in the Philippine Sea is meant to compel US airpower to be employed from greater distances, and thus increase their reliance on assets like tankers, which the People's Liberation Army can engage at much longer ranges than fighter aircraft. This concept of employment is one which is situated within the specific geography of the first island chain (islands forming a barrier between mainland Asia and the Pacific Ocean), where the US lacks strategic depth. US military concepts are, similarly, rooted in a set of assumptions regarding available enablers and are also increasingly driven by the dynamics of the Indo-Pacific.

For middle powers, the employment of CPS capabilities will be conditioned by several factors, the first of which is resource competition and constraint. The costs of individual prompt strike capabilities are considerable: for example, the US Dark Eagle

12. Author interview with Japanese Ministry of Defence official, Tokyo, July 2023.
13. Medium-range ballistic missiles have a range of 1,000–3,000 km, while intermediate range ballistic missiles have a range of 3,000–5,500 km. See Peter Roberts, *'UK Ballistic-Missile Defence: Drivers and Options',* RUSI Occasional Paper, August 2015, p. 6, <https://www.rusi.org/explore-our-research/publications/occasional-papers/uk-ballistic-missile-defence>, accessed 25 February 2026.
14. US Department of Defense (DoD), 'Military and Security Developments Involving the People's Republic of China 2024', <https://fas.org/publication/the-2024-dod-china-military-power-report/>, accessed 4 February 2026.

HGV has an estimated unit cost of $40 million,[15] plus programmatic costs and the associated costs of combat sustainment and support. The cost of individual missiles is, however, a function of the ability of a given missile to breach adversary air defences without the levels of preparation and shaping which might characterise the employment of existing systems, such as cruise missiles, in the face of a robust integrated air defence network. In effect, a higher cost per individual missile may not necessarily imply a more expensive capability, since less exquisite missiles may need to be enabled by a range of assets and used in larger numbers – all of which adds to the cost of employment.

The production and deployment of prompt strike missiles depend on reducing costs or fulfilling unique operational requirements to justify the significant investment needed alongside competing military priorities. The second variable for middle powers aligned with the US is the degree of access they have to the infrastructure which allows them to conclude a kill chain, including to ISR and the personnel needed for target development. Since most US allies have relied heavily on US assets for these tasks, their ability to use prompt strike capabilities is conditioned by the extent to which they can either access or substitute US enablers – including space-based ISR and mapping of air defence coverage, as well as personnel involved in mission planning and target development.

Potential use cases for prompt strike capabilities will be conditioned both by a state's position and specific interests, and by the underlying economics of prompt strike. Several concepts of employment can be envisioned, ranging from relatively narrow focused concepts which view prompt strike capabilities as an exquisite capability to be used against a narrow target set, to much more ambitious approaches that would see prompt strike used against a much wider operational target set. What determines the viability of different approaches is the underlying cost of the inputs – including data and missiles – which make up a strike complex.

The function of this paper is to examine prompt strike as a system. Based on the inputs described above, the paper examines the outputs – in the form of concepts of operations – which might emerge as middle powers seek to build their capabilities in this area. The first chapter discusses how prompt strike might be conceptualised as a system and how this conditions employment by a state other than a superpower. The second chapter examines concepts of operations which might guide the employment of prompt strike by Europe's middle powers, ranging from an irreducible minimum – missions which are both an absolute necessity and less taxing in terms of missiles and enablers – through to more ambitious concepts of operations. The third chapter examines how different concepts of operations affect the types of munitions and

15. Andrew Feickert, 'The US Army's Long-Range Hypersonic Weapon Dark Eagle', Congressional Research Service, In Focus, IF11991, 12 June 2025, p. 2, <https://www.congress.gov/crs-product/IF11991>, accessed 23 January 2026.

enablers which might be sought. The fourth chapter discusses how developments that have an impact on each of the inputs described can change the operational output.

Methodology

This paper has drawn on various sources. Research was conducted from October to December 2025 and was based on several sources of evidence. First, operational analysis around the possible use cases for different missile types was conducted using publicly available data on details such as missile kinematics, which, while partially inaccurate due to sensitivities, is sufficiently granular to underpin conclusions about how capabilities might be used.

Desk-based research was conducted using both information from recent conflicts and historical studies, as well as an analysis of Russian primary sources to understand adversary concerns. Data regarding missile use from conflicts such as the war in Ukraine was gathered based on public reporting and using pre-existing databases such as the Center for Strategic and International Studies (CSIS) firepower tracker.

A limited number of semi-formal interviews with analysts, former policymakers and industry subject matter experts (SMEs) were also used to inform specific parts of the paper.

It should be noted that the industry SMEs who provided interviews work for Hypersonica, who supported this research. The interviews dealt with the regulatory and defence industrial environment, however, rather than the merits of specific products.

Conventional Prompt Strike as a System

A missile such as an MRBM or HGV is best viewed as a subcomponent of a system of systems, which enables its effective employment: a 'reconnaissance-strike complex',[16] to borrow a phrase from Russian parlance. The characteristics of a missile which matter most – their high speed, and in the case of HGVs, their manoeuvrability – can be leveraged in different ways depending on the supporting system enabling them. For example, speed can enable prompt strike to be used against hardened and buried targets which are resilient to most long-range capabilities, since the kinetic energy of these weapons can enable the penetration of hardened concrete.[17] Alternatively, speed and manoeuvrability can be used to enable the dynamic targeting of relocatable adversary assets; the function which speed serves is a product of the system supporting it.

Conceptualising the missile as a system with inputs (magazine depth, enablers, support) and outputs (concepts of operations) results in a requirement for planners to prioritise three factors: assurance of effect, scale and dynamism.

CPS capabilities such as MRBMs and HGVs can contribute to both assurance of effect and dynamic targeting at the operational and strategic levels. By virtue of their speed, prompt strike capabilities can strike fleeting relocatable targets with limited time between detection and engagement – potentially allowing for greater targeting dynamism. A combination of speed and, in the case of HGVs, manoeuvrability can also improve a single missile's odds of penetrating an air defence network without significant preparation and shaping – implying greater assurance of effect. While this is especially true of HGVs, it applies to MRBMs as well. Even when targets are protected by air defences, most air defence systems, such as the Patriot or S-400, have a much

16. Benjamin Jensen and Jose M Macias III, 'Operational Fires in the Age of Punishment', Center for Strategic and International Studies (CSIS), 6 May 2025, <https://www.csis.org/analysis/operational-fires-age-punishment>, accessed 23 January 2026.
17. Eli Sanchez, 'Conventional Precision-Guided Hypersonic Weapons: An Unconventional Threat to Strategic Stability?', unpublished thesis, Massachusetts Institute of Technology, 2024, p. 87.

smaller defended area against fast-moving ballistic missiles unless defended by specialised (and scarce) upper-tier systems such as Terminal High Altitude Area Defense (THAAD).[18]

An operational use case for prompt strike capabilities can best be envisioned as the management of a triangular relationship between assurance, dynamism and scale. The management of this balance is a function of the cost of both missiles themselves and enabling capabilities such as ISR. For example, a small set of dynamic and high-value targets can be struck with a high assurance of effect through the prioritisation of ISR assets to tracking the target in question. The 2018 Iranian strike on a Kurdish separatist leader in Iraq, using a short-range ballistic missile cued by UAVs (and probably other intelligence assets), is an example, as was the 2003 strike on Dora Farms that aimed to decapitate the Iraqi regime.[19] The level of prior planning and intelligence support involved would constrain most states' ability to conduct such strikes at scale, however. Although this was not necessarily the case in either of the two case cited in this paper, if the effector used is expensive, and thus scarce, this would represent an additional limitation.

A second approach, viable in a context where magazine depth is available but ISR is not, prioritises scale and assurance of effect at the expense of dynamic targeting. The Russian strike campaign in Ukraine, which has seen the steady employment of ballistic missiles such as the 9M723 Iskander and Kh-47M2 Kinzhal against high-value fixed targets, is an example.

Finally, a combination of both magazine depth and ISR saturation can enable a combination of dynamic targeting and scale. The aforementioned Chinese concept of a joint firepower strike operation – involving the coordinated use of China's arsenal of thousands of ballistic and cruise missiles (as well as, increasingly, hypersonics), supported by an increasingly robust space-based ISR capability – would be an example of this, if executed, since many of its targets (such as naval vessels) are dynamic.[20]

18. Justin Bronk and Jack Watling, 'Rebalancing European Joint Fires to Deter Russia', *RUSI Occasional Papers* (April 2025), <https://www.rusi.org/explore-our-research/publications/occasional-papers/rebalancing-european-joint-fires-deter-russia>, accessed 23 January 2026.
19. Michael Gordon and Bernard Trainor, *Cobra II: The Inside Story of the Invasion and Occupation of Iraq* (New York, NY: Atlantic Books, 2006); Michael Knights, 'Iran's Cross-Border Strikes: A Pattern in Search of a Policy', Washington Institute for Near East Policy, 15 March 2022, <https://www.washingtoninstitute.org/policy-analysis/irans-cross-border-strikes-pattern-search-policy>, accessed 4 February 2026.
20. Sidharth Kaushal and Juliana Suess, 'The Impact of a Taiwan Strait Crisis on European Defence', *Whitehall Report*, 1-24 (November 2024).

Table 1: Relationship Between Magazine Depth and Time-Sensitivity of Information

		Magazine Depth	
		High	**Low**
Availability of Time-Sensitive Information	**High**	Dynamic targeting at scale	Dynamic targeting of vital targets
	Low	Primarily preplanned targeting at scale	Preplanned and limited dynamic targeting of vital targets

Source: The author.

The Changing Economics of Strike Complexes

As discussed, the potential use case for a strike complex is driven by the costs of its key inputs; specifically, the cost of effectors and supporting ISR (although other factors also bear consideration). Several interlocking trends might have an impact on the cost of these inputs and determine what is possible for NATO European states over the next decade and beyond. The trends discussed in this chapter are not certain; rather, they can be understood as developing variables which can impact the types of concepts of operations that can guide the use of prompt strike capabilities.

The Cost of Sensing and Processing

A major determinant of the utility of prompt strike capabilities will be the extent to which they can be employed without access to US enablers, which may not always be available, for several reasons. One involves the two-theatre challenge which the US faces; since US pace-based ISR provides the majority of Allied situational awareness at operational and strategic depths (beyond 300 km), its absence would require substitution, either with comparable European assets or functional equivalents like the location of targets through means such as cyber penetration or human intelligence (HUMINT). As recently as 2011, the US provided 78% of the targets identified for coalition air operations in Libya.[21] While European sovereign ISR capabilities are growing, the extent to which US assets can be substituted for will, to a great extent, determine the potential use cases for CPS.[22] What is known about the space-based ISR assets that will probably be available under the rubric of France's CERES constellation

21. Chance Smith, 'The Continued Evolution of Air Force Targeting', *Air and Space Operations Review* (Vol. 4, No. 2, 2025), p. 45.
22. Alexander Bolfrass et al., 'Space Capabilities to Support Military Operations in the European Theatre', IISS, 30 January 2025, <https://www.iiss.org/research-paper/2025/space-capabilities-to-support-military-operations-in-the-european-theatre/>, accessed 23 January 2026.

and the UK's ISTARI, as well as NATO's Aquila, would strongly imply that a refocusing of US capabilities would imply a significant reduction in state-owned ISR within NATO.[23]

Other means of gathering data – including cyber penetration, signals intelligence and HUMINT – can also be used to identify targets.[24] However, the complexity of these means of gathering information and the (often) years-long process involved in deploying them has the effect of narrowing target sets. This is for two reasons: first, because complexity limits the number of targets trackable, and second, because information, once used, can compromise the source.[25] The more costly it is to generate information, the narrower the use case for long-range strike will be.

The cost of sensing may be impacted substantially by two factors. The first is the commercialisation of space-based ISR. An individual company, such as BlackSky, can currently survey the Earth twice a day with its satellite constellation, and the ecosystem within which BlackSky resides is growing.[26] Similar to how commercial sources of communications, such as Starlink, have altered battlefield communications, commercial satellites will alter Russian battlefield ISR. This point is not lost on Russia: Russian military officers assert that while even the US could only generate real-time data over a relatively small, targeted area today, the commercial ecosystem emerging will radically alter this.[27] Furthermore, it is not just the quantity of space-based ISR which is increasing, but the quality. To use an example, Digital Globe generates images with a 1.3-m resolution, which is what Russian authors deem sufficient for classifying elusive targets like transporter erector launchers (TELs).[28] Companies such as Finland's ICEYE are currently offering considerably better resolution on a commercial basis.[29]

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23. Sidharth Kaushal and Juliana Suess, 'A Net Assessment of Russian and Allied Capabilities in a Modern Strike Campaign', *RUSI Occasional Papers* (February 2025), p. 30, <https://www.rusi.org/explore-our-research/publications/occasional-papers/net-assessment-russian-and-nato-capabilities-modern-strike-campaign>, accessed 26 January 2026.
24. For historical examples, see John Ferris, *Behind the Enigma: The Authorized History of GCHQ* (London: Bloomsbury, 2021), pp. 251–65; Itay Ilnai, 'How the Mossad Stole Iran's Nuclear Playbook', *Jewish News Syndicate*, 27 April 2025, <https://www.jns.org/how-the-mossad-stole-irans-nuclear-playbook/>, accessed 4 February 2026.
25. Examples include the speed at which spy networks are compromised after a single member is caught. See Owen Matthews, *An Impeccable Spy: Richard Sorge, Stalin's Master Agent* (London: Bloomsbury, 2019), pp. 338–45.
26. Sandra Erwin, 'US Wargame Highlights Role of Commercial Space Imagery in Military Conflicts', *SpaceNews*, 29 November 2017, <https://spacenews.com/u-s-wargame-highlights-role-of-commercial-space-imagery-in-military-conflicts/>, accessed 4 February 2026.
27. Щербаков Николай Борисович and Никулин Андрей Сергеевич, « Взгляды руководства вооруженных сил США и их союзников на проблемы информационно-космического обеспечения стратегических операций » ['Views of the Leadership of the US Armed Forces and Their Allies on the Problems of Information and Space Support for Strategic Operations'], *Военная Мысль* (Vol. 10, 2023), pp. 134–35.
28. *Ibid.*, p. 134.
29. Sam Cranny-Evans, 'ICEYE Gen4 Satellites Now Commercially Available', *Calibre Defence*, 10 September 2025, <https://www.calibredefence.co.uk/iceye-gen4-satellites-now-commercially-available/>, accessed 22 January 2026.

The vast majority of companies involved in this ecosystem are (with the exception of Chinese companies) Western or Allied.

AI also makes it faster to process data. This is relevant to both new and old sources of information: for example, in 2011, US UAVs generated 327,000 hours of data which can be used for a range of tasks such as pattern of life analysis (but which is currently largely unused). Although UAVs may offer limited value at operational and strategic depth, the case of UAVs illustrates a wider point about the significant amounts of data from various sources which is theoretically available to militaries but is underused. The ability to use available data more effectively would considerably accelerate the process of target development.[30]

The Cost of Effectors

The economics of effector design, testing and fielding could be changed by several factors.

The first consideration is that, to a certain degree, the drivers of cost are a function of policy rather than objective material constraints. Take, for example, the present shortfall of solid fuel propellant, a major long lead item for many missile types. The underlying technology is not especially complex; North Korea has had little trouble building an arsenal of 1,000 ballistic missiles of various types. Rather, solid fuel mixers are difficult to install in Europe because of underlying regulations, which add cost to the process.[31] REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) regulations add considerable cost across areas of defence both in terms of compliance requirements and constraints on the use of inputs like ammonium perchlorate.[32]

The second consideration relates to the ways in which existing defence industrial processes can add both time and cost to missile production. A useful analogue can be found in the space sector, where companies such as SpaceX have reduced the cost of shuttling loads to the International Space Station by a factor of four.

30. Mark Owen, Katie Rainey and Rachel Volner, 'How AI is Shaping Navy Intelligence Surveillance and Reconnaisance', in Sam J Tangredi and George Galdorisi (eds), *AI at War: How Big Data, Artificial Intelligence, and Machine Learning are Changing Naval Warfare* (Annapolis, MD: Naval Institute Press, 2021), p. 169.
31. Author interview with the founders of Hypersonica, an Anglo-German startup focused on missile development, online, 28 November 2025; REACH Law, 'Study on the Impact of REACH and CLP European Chemical Regulations on the Defence Sector: Final Report', 16 December 2016, <https://www.eda.europa.eu/news-and-events/news/2017/01/26/eda-study-on-the-impact-of-reach-clp-european-chemical-regulations-on-the-defence-sector-released>, accessed 6 February 2026.
32. European Commission Directorate-General for Internal Market, Industry, Entrepreneurship and SME, 'Cost of the Cumulative Effects of Compliance with EU Law for SMEs: Final Report', May 2015, pp. 67–69, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELLAR:2c74690f-9aa0-11e6-9bca-01aa75ed71a1>, accessed 6 February 2026.

Studies of the drivers of this reduction in cost suggest major factors including:

- An emphasis on in-house design and reducing subcontracting.
- A firm, fixed-price approach to procurement, as opposed to a traditional government cost.
- A fixed-funding approach, as contrasted to an annual budgeting cycle.[33]

If the costs of a prompt strike capability that are comparable to the Dark Eagle could be reduced by a comparable margin, this would imply a cost of $8–10 million (a cost similar to the US' SM-6). While this is still costly by comparison to missiles such as the Tomahawk on a unit basis, the fact that fewer HGVs than cruise missiles would need to be employed to penetrate most air defences would mean that, at this price point, the cost of a salvo of HGVs may not differ considerably from that of a salvo of cruise missiles. A similar reduction to the currently estimated unit cost of a conventional M/IRBM, produced in the West (roughly $15 million), would imply a unit cost comparable to many cruise missiles (for a missile against which existing Russian defences are more limited, and which can penetrate hardened and buried targets that cruise missiles cannot).[34]

To a considerable extent, the costs of defence procurement are a function of an approach whereby defence sets requirements to which industry must respond. Several recent projects – in areas such as the delivery of uncrewed systems – have proceeded based on a different model, whereby technology development up to technology readiness levels 3–4 is privately financed, with defence being presented with a product rather than a programme.[35] The elimination of defence-specified requirements can remove some requirements for long lead items; for example, some industry SMEs hold that the design of HGVs can involve a greater reliance on carbon fibre, reducing the reliance on heat-resistant ceramics which are a major bottleneck in production.[36] Chinese weapons designers claim to have produced a low-cost hypersonic – the YKJ 2000 – by using a concrete-based heat shield, although the viability of this system remains to be seen.[37] The requirement for long system shelf lives has also been cited as both a driver of unit costs for complex weapons more broadly and an impediment to

33. Harry W Jones, 'The Recent Large Reduction in Space Launch Cost', paper presented to the 48th International Conference on Environmental Systems, Albuquerque, 8–12 July 2018, pp. 1–10.
34. On the estimated costs of a ballistic missile, see Sam Tangredi, 'Working Paper in Future Warfare Studies', No. 1-17-1, US Naval War College, August 2017, p. 4.
35. See Sidharth Kaushal and John Louth, 'Prototype Warfare in the Maritime Domain: Opportunities and Approaches', *RUSI Research Papers* (January 2026), <https://www.rusi.org/explore-our-research/publications/research-papers/prototype-warfare-maritime-domain-opportunities-and-approaches>, accessed 6 February 2026.
36. Author interview with Hypersonica founders, online, 9 December 2025.
37. Zhang Tong, '90% Cost Cut: Chinese Civilian Firm Enters Mass Production of Mach 7 Hypersonic Missiles', *South China Morning Post*, 25 November 2025, <https://www.scmp.com/news/china/science/article/3334140/90-cost-cut-chinese-civilian-firm-enters-mass-production-mach-7-hypersonic-missiles>, accessed 4 February 2026.

the process of continuous production (which might generate defence industrial capacity). Reducing required shelf life may substantially impact unit costs.[38]

Finally, it must be considered that technology costs almost always reduce over time as a technology is better understood. For example, in 1980 a Tomahawk missile cost $1 million (roughly $4 million today). By contrast, the Tomahawk Block V, which is more sophisticated by an order of magnitude, costs $2 million today.[39] There is, thus, a basis for believing that the present costs of missiles, such as MRBMs and HGVs, are a function of both policy constraints and market assumptions which may rapidly change.

This does not represent a certain outcome, however. Instead, as policymakers and planners consider how they might employ prompt strike capabilities, they might consider three potential scenarios:

- Missile costs remain comparable to those of today and ISR is limited. Prompt strike would thus be concentrated on a small number of high-value targets which no other system could easily reach, but which must be engaged.
- Missile costs drop but ISR is limited. In this contingency, prompt strike could be used dynamically against some targets but might be used more regularly against static or relatively less mobile high-value targets in preplanned attacks.
- Both the cost of missiles and the cost of munitions decline. In this scenario, prompt strike could be used dynamically against a much broader range of targets, allowing for the dynamic engagement of targets at depths where, currently, only preplanned engagement is possible.

38. Sam Cranny-Evans, 'T-Dome: Look for the Budget, Not the Statements', *Calibre Defence*, 10 October 2025, <https://www.calibredefence.co.uk/t-dome-look-for-the-budget-not-the-statements/>, accessed 4 February 2026.
39. DoD, Office of the Historian, 'Memorandum from the President's Assistant for National Security Affairs (Brzezinski) to President Carter', 3 August 1977, <https://history.state.gov/historicaldocuments/frus1977-80v04/d33>, accessed 4 February 2026.

Strategic and Operational Scenarios

Based on the discussions in the previous chapter, this chapter examines potential use cases for prompt strike capabilities in Europe under different conditions. The scenarios correspond to three contingencies:

- Limited ISR and magazine depth, focusing on functions which are vital to be able to achieve with prompt strike, even under considerable resource constraints.
- Greater magazine depth but limited ISR, focusing on scenarios in which the cost of missiles decreases but the availability of ISR remains constrained.
- Greater magazine depth and access to ISR, examining the potential for dynamic targeting at the theatre level.

Case One: The Irreducible Minimum – Assured Effect at a Limited Scale

Supporting the strategic deterrents of Europe's two nuclear powers by providing the ability to disable the Russian ballistic missile defence (BMD) system represents both a comparatively modest and strategically vital function for prompt strike capabilities. This function would be central – even under resource-constrained conditions – given both the limited number of targets which need to be struck and the considerable difficulties of using other capabilities (such as cruise missiles) against them, given the protection afforded by the other layers of Russia's air defence network. In this role, the qualities of speed and manoeuvrability would serve as a means of maximising probability of effect against a small but very well-defended target set which cannot be left functional if deterrent stability is to hold in Europe. Given both the salience of this task but also the relatively modest target set, prioritising this mission to the exclusion of others would be especially reasonable if the costs of missiles and availability of ISR do not substantially change.

While of immediate significance to the two nuclear states themselves, this potential use case could also be envisioned as one which could be delivered by other European states to reinforce Europe's non-US nuclear deterrents and become a factor in the calculations and planning of the two nuclear powers. This is of particular significance to both Europe's nuclear powers and non-nuclear states because, by 2030, the emergence of China as a nuclear peer of the US and Russia will most likely compel the US to deter its two nuclear peers. This does not imply the disappearance of US extended deterrence, but it could encourage Russian leaders to assume a weakening of this extended deterrent.

To an extent, the Northwood Agreement between the UK and France could be viewed as a hedge against this challenge. The coordination of British-French nuclear planning does not provide a substitute for the US, but it does represent an additional consideration for Russian planners. Russian officers do not exclude the possibility of using non-strategic nuclear weapons on a large scale in Europe to suppress critical military targets, but this would be more easily contemplated if Russia believed the US deterrent to be less credible. The twin deterrents of Europe's nuclear powers provide a backstop through the existence of an independent decision-making centre.[40] Even if Russian planners were to calculate that they can finesse the employment of nuclear weapons in a way that renders the use of Europe's two strategic deterrents unlikely, they would face uncertainty regarding where the threshold lies. This is because their concepts of operations involve strikingly large numbers of targets with nuclear weapons in a way that could plausibly justify a strategic response.[41] A second centre of nuclear decision-making could not replicate what the US provides Europe, but it could deter some of the most extreme consequences of possible US retrenchment or overstretch.

This depends, however, on Europe's two nuclear powers maintaining an assured retaliation capability regarding Russia, which could be challenged in the next decade. In the coming decade, an increasingly robust BMD system around Moscow may emerge in the form of the A-235 and the S-500, which may form a layered defence. The A-235 is Russia's first conventional exo-atmospheric missile, and it deploys the PL-19, an interceptor with a kinetic kill vehicle which has been demonstrated in an anti-satellite weapon role against a target at an altitude of 480 km.[42] A missile should typically be capable of targeting satellites at a higher altitude than ballistic missiles, because planned intercepts against targets on known orbits require less lateral manoeuvre.

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40. On the logic of a second centre, see Michael Quinlan, *Thinking About Nuclear Weapons* (Oxford: Oxford University Press, 2009), p. 44.
41. See, for example, S A Ponomarev, V V Poddubnyi and V I Polegaev, « Критерии и показатели неядерного сдерживания: военный аспект » ['Criteria and Indicators of Non-Nuclear Deterrence: Military Aspect'], *Военная Мысль* (No. 11, 2019), p. 100.
42. Jacob Mezey, 'Russian and Chinese Strategic Missile Defense: Doctrine, Capabilities, and Development', Issue Brief, Atlantic Council, Scowcroft Center for Strategy and Security, August 2024, p. 7, <https://www.atlanticcouncil.org/in-depth-research-reports/issue-brief/russian-and-chinese-strategic-missile-defense-doctrine-capabilities-and-development/>, accessed 7 February 2026.

Consequently, an altitude of 480 km is probably close to the PL-19's upper ceiling, suggesting an exo-atmospheric interceptor comparable to the interceptor of the SM3 Block IB surface-based BMD interceptor. While work on a longer-ranged interceptor comparable to the SM-3 Block II appears to have stalled after initial rumours, this would be a logical next step if Russia is to achieve its stated aim of providing cover for key cities and the strategic nuclear deterrent.[43]

In addition, Russia has had a longstanding (if, as yet, only partially fulfilled) plan to deliver 10 S-500 long-range, high-altitude surface-to-air missile batteries.[44] Despite conflicting (and, in many cases, non-credible) claims regarding the 77N6/77N6-1 BMD interceptors employed on the S-500, the most authoritative public statements on them observed that the system has a 100-km interception altitude, which would make it comparable to THAAD.[45] Finally, the S-300V can act as a last line of defence, although its single shot probability of kill (SSPK) against a submarine-launched ballistic missile (SLBM) would be very limited.[46]

The challenge posed by Russian BMD is of salience to states which operate Europe's independent nuclear deterrents. While the US has enough missiles to saturate any plausible system, the deterrent credibility of smaller nuclear arsenals can be constrained by adversary ballistic missile defences. Consider, for example, that during the April and October 2024 attacks by Iran on Israel, Israel and the US intercepted 90% of two salvoes of 200 ballistic missiles each.[47] For reference, the UK's SSBNs (ballistic missile submarines) each carry a maximum of 16 SLBMs.

Simple worksheet modelling can indicate how effective Russian systems need to be to render assured retaliation less credible. A three-tier ballistic missile defence system can be highly effective against a small to medium-sized number of targets, even with a poor SSPK. For example, basic worksheet modelling would suggest that even with a very modest SSPK of around 0.5, a three-layer system can achieve a high rate of

43. Bart Hendrickx, 'Aerostat: A Russian Long-Range Anti-Ballistic Missile System with Possible Counterspace Capabilities', *Space Review*, 11 October 2021, <https://www.thespacereview.com/article/4262/1>, accessed 4 February 2026.
44. *РИА Новости*, « Военно-космическая оборона прикрывает 2/3 территории России » ['Aerospace Defense Covers Two-Thirds of Russia's Territory'], 22 July 2007, <http://ria.ru/defense_safety/20110722/405448162.html>, accessed 4 February 2026.
45. These statements were made by Pavel Sozinov, chief engineer at Almaz Antey, the S-500's prime contractor. See *РБК*, « Производитель рассказал о способности С-500 сбивать цели на высоте 100 км » ['The Manufacturer Spoke about the S-500's Ability to Shoot Down Targets at an Altitude of 100 km'], 24 April 2017, <https://www.rbc.ru/rbcfreenews/58fdb5b99a79477ba4477cce>, accessed 4 February 2026.
46. Carlo Kopp, 'NIEMI/Antey S-300V 9K81/9K81-1/9K81M/MK Self Propelled Air Defence System / SA-12/SA-23 Giant/Gladiator', *Air Power Australia*, April 2012, <https://www.ausairpower.net/APA-Giant-Gladiator.html#mozTocId627173>, accessed 4 February 2026.
47. Ran Kochav, 'Operational Case Study 2: The Multi Front Israeli Campaign', presented at the RUSI Integrated Air and Missile Defence Conference 2025, London, 24 April 2025.

effectiveness against a small salvo of ballistic missiles with MIRVS (multiple independently targetable re-entry vehicles).[48]

To some extent, this is a reprisal of the challenge which the original Moscow BMD system posed. At the time, the UK's chosen system was Chevaline, a system of penetration aids and decoys which equipped the Royal Navy's Polaris SLBMs. The latter solution may prove more challenging in a context where the A-235 can intercept missiles at altitudes comparable to the SM-3 surface-to-air missile before penetration aids have been deployed.[49] A second challenge is that there has clearly been some increase in the granularity provided by Russian radar, sufficient to make Russia confident enough to field an interceptor equipped with a non-nuclear kinetic kill interceptor on the A-235.[50] One plausible rationale is that the 77T6 radar on the S-500, which appears to be an evolution of the X-band 92N6E optimised for BMD, provides sufficient target discrimination for the system.[51] The granularity of an X-band radar makes system defeat via penetration aids a less certain outcome. It is thus plausible that in the future, nuclear strikes will be comparable to other air operations which have to be preceded by a period of suppression or destruction of enemy defences. To paraphrase, the SLBM will *not* always get through.

Pathways to Overcoming the BMD Threat

CPS capabilities could provide two pathways to overcoming the BMD threat. The first potential solution is saturation. BMD interceptors are costly and complex; the US, for example, will procure only 18 SM-3 Block IIA interceptors in FY26, despite its budget.[52] Depending on shot doctrine, two to three interceptors are employed against any incoming missile. Thus, an effective defence against 550 Iranian ballistic missiles required the employment of 150 THAAD interceptors, 80 US SM-3s, an unknown number of Israeli Arrow-3 interceptors, and a potentially even larger number of Arrow-2 and David's Sling interceptors. This represented almost a decade's worth of THAAD procurement for the US, for example.

48. For a discussion of the underlying operational analysis, see Eric V Larson and Glenn A Kent, *A New Methodology for Assessing Multilayer Missile Defence Options* (Santa Monica, CA: RAND, 1994).
49. UK Research and Innovation, '"Supreme National Interests": The Official History of Britain's Strategic Nuclear Deterrent and the Chevaline Programme, 1962–1982', Fellowship at the University of Nottingham, <https://gtr.ukri.org/projects?ref=AH%2FJ006564%2F1>, accessed 4 February 2026.
50. Ryan Christenson, 'The Russian Rhetoric: Missile Defense for Me, but Not for Thee', Center for Global Security Research, May 2025, <https://cgsr.llnl.gov/sites/cgsr/files/2025-06/Russian-Rhetoric-Missile-Defense-Me-Not-Thee.pdf>, accessed 4 February 2026.
51. Tom Withington, 'Defending Mother Russia's Skies', *RUSI Commentary*, 13 July 2022, <https://www.rusi.org/explore-our-research/publications/commentary/defending-mother-russias-skies>, accessed 4 February 2026.
52. Office of the Undersecretary of Defense, Comptroller/Chief Financial Officer, 'Programme Acquisition Cost by Weapons System: United States Department of Defense Fiscal Year 26 Budget Request', July 2025, p. 44, <https://comptroller.war.gov/Portals/45/Documents/defbudget/FY2026/FY2026_Weapons.pdf>, accessed 6 February 2026.

The challenge of the cost curve affects Russia's more nascent BMD system as well. Conventionally armed ballistic missiles could be employed to compel Moscow to expend A-235 and 77N6 interceptors during the initial conventional stages of a conflict, to set the conditions for credible nuclear use. Failure to engage these missiles could put radar or other high-value targets like command-and-control (C2) nodes at risk. As many Russian officers – including the deputy head of the VKS – have noted, MRBMs in Germany present Moscow with very short warning times, which are treated as a matter of some concern by Russia. Ballistic targets would have to be engaged, particularly if they were equipped with kinetic penetrators that posed a risk to hardened targets, at what has been estimated as the upper bound of penetration for manoeuvring re-entry vehicles (30 m).[53]

Although the depth to which a kinetic penetrator-equipped ballistic missile can penetrate is debatable, the Russian decision to equip the RS-26 with kinetic penetrators for use against Yuzmash (a factory built to withstand a nuclear strike) suggests a degree of institutional belief in their efficacy. Ballistic missiles would thus represent a target that Russia could not ignore, even if the system can likely distinguish conventionally armed medium-ranged targets from nuclear SLBMs. While Moscow would expend multiple interceptors for any missile, this approach would still require the employment of a moderately large number of conventionally armed ballistic missiles in a short period of time at considerable cost. There is also the question of escalation risk, although it is likely that Russian BMD radar can distinguish different missile types based on warhead size and missile trajectory.

A second approach to beating the Moscow BMD system would be to target or undermine the effectiveness of two specific elements of its kill chain: the PL-19, the Don-2N radar and the 77T6 radar. First, by virtue of their lower flight altitudes, HGVs can effectively circumvent the threat posed by the A-235 and target critical elements such as the Don-2N – removing the first, most daunting layer of the Moscow BMD system, which provides mid-course tracking against ballistic targets. Certainly, such an attack would risk nuclear escalation by Russia; however, this risk has to be balanced against the fact that, without the disabling of its BMD, Russia may opt for precisely this form of escalation because it perceives itself to be in a position of relative strength.

HGVs operate below the intercept envelope of the PL-19, since interceptors optimised for exo-atmospheric interception cannot engage lower-flying targets at altitudes where their infrared seekers are impeded by the heat generated in denser air. Although the S-500 has claimed functionality against hypersonic missiles, it would be surprising for the 77N6 both to achieve THAAD-like intercept altitudes against ballistic targets – typically achieved with an IR seeker – and to be capable of intercepting hypersonic missiles at lower altitudes.

53. A G Semyonov, « Вооруженная борьба на воздушно-космическом театре военных действий » ['Armed Struggle in the Air and Space Theatre of War'], *Военная Мысль* (Vol. 1, 2023), pp. 19–27.

Even accepting Russian claims regarding the 77N6, HGVs could exploit a second limitation of Russia's kill chain – namely, the limitations of surface-based radar against HGVs. It would appear, based on available imagery, that the 77T6 radar of the S-500 is a sectored radar that can scan a specific angle, not unlike the AN/MPQ-65 or 92N6E. Unless physically moved, the radar can only cover a specific sector. This is of limited concern against ballistic targets but would represent a limitation against manoeuvring HGVs. The system can probably receive early warning from the Don-2N ultra-high frequency (UHF) radar, but the utility of this system for anything other than early warning is likely to be limited against a manoeuvring target which generates a plasma sheath that affects the returns generated by UHF.[54]

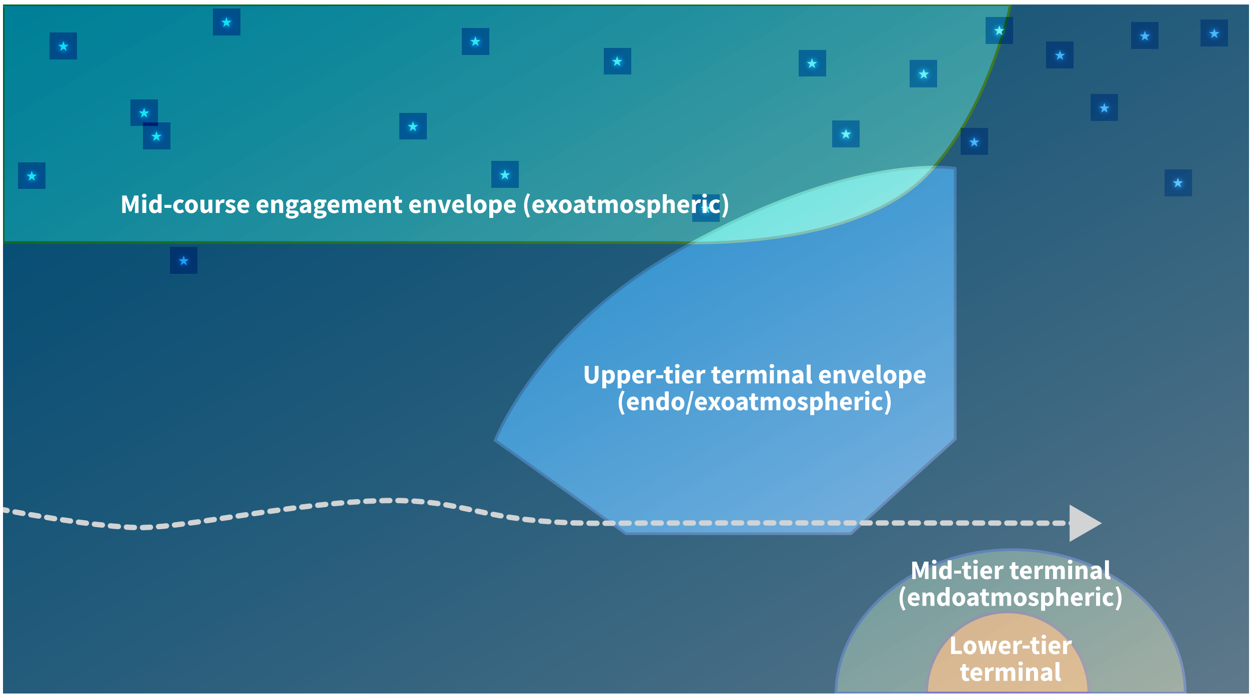
Multiple 77T6 radar would probably be used in overlapping fields around a target such as the city of Moscow, but passing data between multiple-sectored radar is rarely a seamless process. Seams often emerge in an IAMD architecture, costing the system valuable seconds that can be the difference between success and failure. Furthermore, radar horizon limitations mean that at the point at which a surface-based BMD radar detects a target such as an HGV, the target is in terminal phase. To be sure, a surface-based radar can still detect a target flying at 40 km from some distance, but it is in the terminal phase that an HGV is likely to manoeuvre the most (having conserved energy earlier in its flight), making the computation of fire control solutions more difficult.[55]

HGVs need not be fielded in especially large numbers to engage critical elements of the Russian BMD architecture. For example, striking targets such as the Don-2N or the 77T6 would involve a total of 10–15 targets. This represents concentrated, albeit very well defended, value – precisely the type of target against which the use of an HGV would be justifiable.

Moreover, although both the A-235 and S-500 are mobile, they must remain within a relatively well-bounded area to defend certain targets. For example, although the S-500 has a claimed intercept range of 600 km, since the system engages targets at the upper reaches of the Earth's atmosphere (like THAAD), its effective range – while still considerable – is more bounded. This is because it engages warheads while they are beginning their descent to their target. In real terms, this means that the locations of radar and launch systems can be narrowed down. For example, a Trident SLBM being fired on a depressed trajectory with an apogee of around 1,000 km descends to an altitude of 100 km, around 100 km from its target.[56] As such, a system defending Moscow, for example, must be within less than a 100-km radius of the city.

54. Jonathan Pinto et al., 'Statistical Analysis of Hypersonic Glide Vehicle Radar Cross Section', *IET Radar, Sonar & Navigation* (Vol. 18, No. 1, 2024), pp. 158–70.
55. Tom Karako and Masao Dahlgren, *Complex Air Defence: Countering the Hypersonic Missile Threat* (Washington, DC: CSIS, 2023), p. 44.
56. On the apogee of trident, see Astronautix, 'Trident D-5', <http://www.astronautix.com/t/tridentd-5.html>, accessed 4 February 2026; calculations of terminal descent performed by the author.

Figure 1: Gaps in a Notional Future Russian Layered Architecture Comparable to that of the US



Source: Center for Strategic and International Studies Missile Defense Project.

This is important as tracking a small number of targets in a known area can be achieved with a limited number of space-based assets. For example, a typical synthetic aperture radar satellite has a swath width of around 80 km.[57] European states collectively field a modest, but growing, satellite constellation including the UK's ISTARI and France's CERES. This constellation can provide coverage over well-defined areas, such as the 100 km around Moscow – an area within which an S-500 could deploy while remaining operationally useful. Furthermore, key targets such as the Don-2N are static and thus even easier to engage. In addition to space-based national technical means, other capabilities, including HUMINT and cyber penetration, are likely to be involved in establishing the locations of high-value targets, since SAR alone cannot provide certainty given the probable employment of decoys.

Air assets can also be employed to generate ISR, albeit with difficulty given the ranges involved. The employment of the F-35 as an ISR platform is possible with appropriate means of sharing data via a multifunction advanced data link, which is worked into programmes such as the joint UK–US Deimos programme.[58] This would, however, require aircraft to operate from airbases in countries such as Finland to avoid the

57. European Space Agency, 'SAR (ERS) Overview', <https://earth.esa.int/eogateway/instruments/sar-ers/description>, accessed 15 November 2025.
58. UK Government, 'Find a Tender Service: 708291450 – Project DEIMOS VTN', 4 October 2023, <https://www.find-tender.service.gov.uk/Notice/029252-2023>, accessed 27 January 2026.

requirement for tanker refuelling. Its presence could only be achieved for a limited period, and when the aircraft broadcasts, it places itself at some risk. Uncrewed combat aerial vehicles, which can be built in low-observable and fuel-efficient shapes not easily achieved with human pilots, are another prospective source of penetrating ISTAR; overlapping programmes in the UK, France and Germany should provide some capability in this area. Finally, capabilities such as stratospheric balloons can be employed to provide intermittent ISR subject to factors such as wind conditions.

Because of the sheer scale of the effort involved in tracking any single 77T6 at extended ranges and the all-source nature of the likely intelligence-gathering process, the task of engaging the Moscow BMD system's key components might be analogised to the Dora Farms strike, despite the different target types. The objective would be to concentrate resources against a small number of targets, against which certainty of effect is a necessity, given the difficulty of making multiple attempts against a target (which requires a complex tracking process). The use of hypersonics in this context would represent a means of maximising this certainty against well-defended targets.

The small number of targets, relatively concentrated areas and absolute necessity of success would make the irreducible minimum mission set the most achievable mission which European prompt strike capabilities can achieve autonomously. The centrality of suppressing Moscow's BMD makes this mission set the most vital one that can be achieved with prompt strike.

Case Two: Targeting at Scale on a Largely Preplanned Basis

A more ambitious target set would be the capabilities on which the Russian air defence network depends. Despite the mobility of many of its parts, the Russian system is dependent on some critical components that are either not easily moved or are relatively easily observed when static. Many of these targets can be engaged with relatively simple ballistic missiles, albeit used in large numbers. Unlike Moscow and the strategic deterrent, these targets are unlikely to enjoy very robust BMD protection for at least a decade, given that only one of the 10 S-500 systems ordered in 2021 has been procured thus far and that Moscow and the Strategic Rocket Forces will receive priority. Even when fielded, a limited BMD capability over operational targets can be saturated.

In a context where the cost of missiles declines but anticipated improvements in the availability of ISR do not materialise, the number of targets against which prompt strike capabilities could be used could be expanded, but an emphasis would have to be placed on static or less mobile assets against which preplanned targeting could occur.

Prompt strike would represent a means of penetrating air defences and engaging hardened targets but could not generally be used dynamically in this scenario.

MRBMs or HGVs can usefully contribute to two functions: degrading a limited number of core components of the Russian integrated air defence system (IADS) and reducing the challenge posed by Russian long-range strike, which depends on a limited number of launch platforms and enabling structures. This would entail a more expansive target set than the mission set previously discussed but might require a comparatively less complex set of effectors. For this concept to be viable, a larger range of actors within Europe would have to field ballistic missiles for Europe as a whole to enjoy the collective throw weight needed to engage a target set larger than the one previously discussed.

Degrading the Russian Air and IAMD Threats and Repelling Aerospace Attack

The Russian concept of a strategic air operation can be divided into two components. The first, repelling an aerospace attack, encompasses both offensive counter-air and active air and missile defence. The task of cross-domain fires, including air- and sea-launched cruise missiles as well as ballistic missiles such as the 9M723 Iskander and KH-47M2 Kinzhal, is to target NATO airpower on the ground.[59] While Russian deep strike cannot entirely negate the Allied air threat, it can force air operations to be conducted from greater distances. This magnifies the impact of Russian surface-based air defences against tankers and other enabling aircraft. A missile such as the 40N6, employed on the S-400, can achieve ranges close to its advertised 400-km range against enabling aircraft such as tankers, AWACs (such as the E-7) and ELINT (electronic intelligence) aircraft (such as the Rivet Joint), which would be salient over long distances in Europe's north, for example. In addition to ground-based SAM systems, aircraft such as the MIG-31BM and Su-35 also pose a threat. These aircraft are, respectively, equipped with the high-power Zaslon-M and Irbis-E radar complexes (rated at 10 kw and 20 kw of peak power), as well as the long-range R-77 air-to-air missile.[60] The fewer enablers Allied air forces can maintain, the slower their tempo of operations will become and the fewer kills per sortie they can achieve. In effect, Russia would not have to destroy NATO's air forces to functionally defeat them by limiting the damage they can inflict.

The same approach applies to cruise missile launch platforms, to which Russia accords particular salience. Figures such as Valery Gerasimov have underscored the importance of destroying cruise missile carriers pre-emptively where possible.[61] However, as with

59. Dmitry Adamsky, 'Moscow's Aerospace Theory of Victory: Western Assumptions and Russian Reality', Center for Naval Analyses (CNA), February 2021, <https://www.cna.org/analyses/2021/03/moscows-aerospace-theory-of-victory>, accessed 4 February 2026.
60. Carlo Kopp, 'Flanker Radars in Beyond Visual Range Air Combat', *Air Power Australia*, April 2012, <https://www.ausairpower.net/APA-Flanker-Radars.html>, accessed 4 February 2026.
61. Clint Reach et al., *Russia's Evolution Towards a Unified Strategic Operation* (Santa Monica, CA: RAND, 2023), p. 21.

aircraft, Russian planners expect only to thin the herd. The second line of defence against cruise missiles are aircraft like the MIGi-31BM, which have the radar power output to track low radar cross-section targets against clutter. Ground-based SAM systems also provide coverage, although their defended areas are more limited against cruise missiles.

The defence against cruise missiles depends on both airborne sensors, such as the A-50 AWACS, and ground-based sensors, such as the 48Ya6-K1 Podlet ground-based over-the-horizon radar.[62] In addition, Russia's Sopka-2 radar in the High North appears to play a critical role in both early warning and the coordination of the MIG-31BM against low-altitude targets, with exercise readouts referencing the guidance that the MIG-31 received from known Sopka-2 sites such as Cape Schmidt.[63] Notably, previous assessments by authors such as Konstantin Sivkov (who served on the Russian General Staff) have suggested that Russia needs far more A-50s than it actually fields – Sivkov's assessment suggested around 50.[64]

The Russian IADS ability to mitigate the perceived cruise missile threat is highly dependent on a relatively small number of air- and ground-based systems, which are often static in bases. For example, the VKS fields around 100 MIG-31BM interceptors and there are currently three Rezonans-NE radar in service (although this number will grow by five radar in the next decade).[65] Numbers of the Sopka and Podlet are less well known but are probably relatively small. Russia had received 20 Sopka radars by 2014 – although the number is much larger now – and in Ukraine it operated two Podlets over key sectors.[66]

The radars being discussed are both more limited in number and less easily transported and dispersed than the components of a SAM system. While the average Russian SAM battalion contains two target acquisition and fire control radars, and can receive data from other sources such as nearby battalions (making for a target set of hundreds across a theatre), longer-range early-warning systems represent a smaller target set.[67] Some early-warning systems, such as the Sopka-2, are fixed, although others are movable and would represent time-sensitive targets. Many of the targets associated with this function

62. Dag Henriksen and Justin Bronk (eds), *The Air War in Ukraine: The First Year of Conflict*, First edition (Abingdon: Routledge, 2023), p. 19.
63. Dan Snell, 'The Sopka-2 Radar System and "Aviation Guidance Points" in the Russian Arctic', EW Analytics, 2020, <https://www.ewanalytics.llc/research>, accessed 4 February 2026.
64. Konstantin Sivkov, « Небесные бастионы » ['Sky Bastions'], *ВПК*, 2 February 2019, <https://vpk.name/news/250171_nebesnye_ bastiony.html>, accessed 4 February 2026.
65. Thomas Withington, 'Russian IADS Redux Part-1: Resonating with Resonance', *Armada International*, 2 March 2023, <https://www.armadainternational.com/2023/03/russian-air-defence-systems-part-1-resonance-radar/>, accessed 4 February 2026.
66. Henriksen and Bronk (eds), *The Air War in Ukraine*, p. 19.
67. On Russian SAM composition, see Jack Watling, Justin Bronk and Sidharth Kaushal, 'A UK Joint Methodology for Assuring Theatre Access', *Whitehall Report,* 4-22 (May 2022), pp. 10–13, <https://www.rusi.org/explore-our-research/publications/whitehall-reports/uk-joint-methodology-assuring-theatre-access>, accessed 28 January 2026.

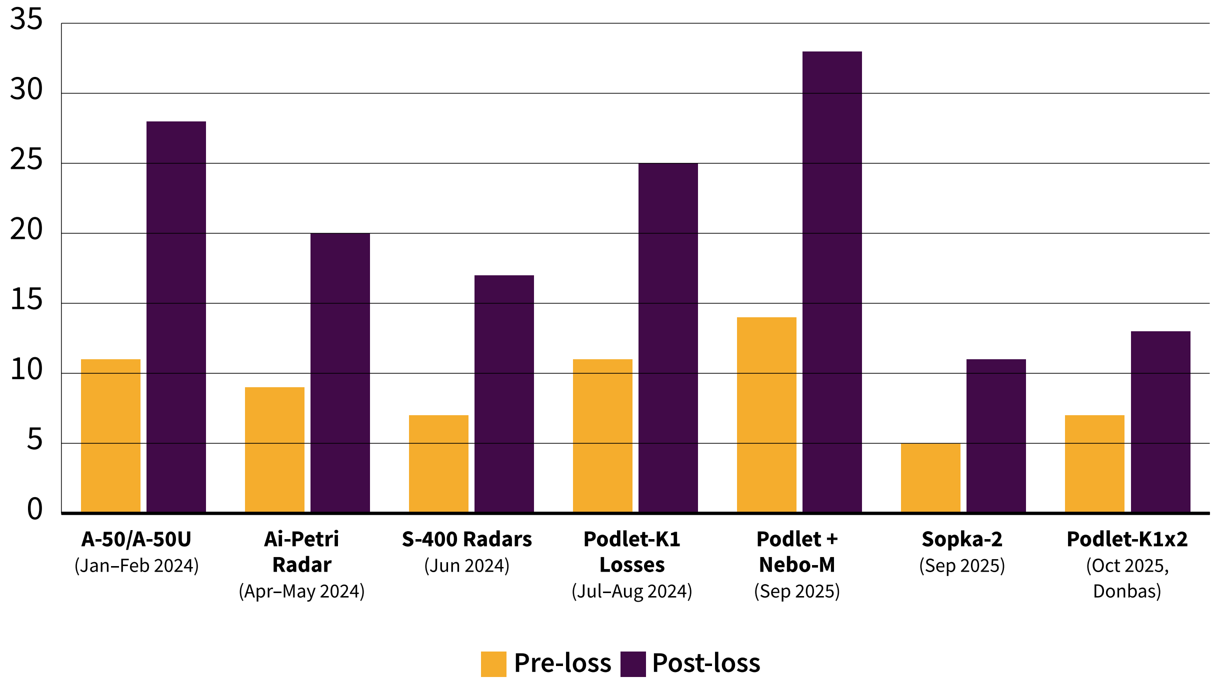
are not dynamic, however. Even aircraft such as the MIG-31, while obviously mobile, spend long periods of time at airbases. Furthermore, aircraft depend on a fixed infrastructure of interceptors, fuel and maintenance, which tends to incentivise the consolidation of their supporting infrastructure into main, well-known operating bases. For example, in the High North, two bases – Severomorsk-3 and Mochegorsk – support MIG-31 operations. The targeting challenge that these critical systems present primarily concerns the depths at which they are held – and with the robust SAM defences around them, targeting them is difficult, even if their locations are known. Fixed-wing operations at depth are limited by the IADS, which enables these systems and is, in turn, shielded by them.

Overcoming the Russian IADS would require it to be targeted from the inside outward. Should the early-warning systems and defences against cruise missiles be either eliminated or degraded on specific axes, several avenues for attack open up. First, subsonic cruise missiles, including relatively short-ranged systems such as the Storm Shadow, become far more capable when airborne and ground-based coverage against low-flying targets is less easily available. This would allow for the more effective employment of subsonic cruise missiles, such as the Storm Shadow, by aircraft which cannot initially operate within the Russian IADS – a category that includes much of NATO's fourth-generation airpower. There is conditional evidence of this in Ukraine, where the loss of either A-50 aircraft or Podlets correlated strongly with an increase in the number of successful deep strikes.

It is thus not coincidental that when Russian officers discuss future potential NATO air operations, they envision a relatively small breaching wave of ballistic and hypersonic missiles, expected to be followed by a much larger wave of subsonic cruise missiles.[68] The European component of the Alliance collectively fielded 3,000 conventional cruise missiles in 2022, which (even accounting for stockpile readiness and expenditure in Ukraine) represents a sizeable arsenal if properly enabled.[69] Currently, this missile arsenal (the bulk of which is short-ranged) would require considerable enablement to be used, as shown by the preparation preceding individual Storm Shadow strikes in Ukraine. Against a Russian IADS robbed of its inner layers, however, these missiles could be used with considerably greater effect and with smaller salvoes needed to achieve it. Conditional evidence from Ukraine can be used as partial confirmation of this hypothesis.

68. V I Stuchinsky and M V Korolkov, « Обоснование боевого приминения авиации для срыва интегрированного массированного воздушного удара в многосферной операции противника » ['Justification of the Use of Aviation for the Disruption of Integrated Massive Air Strike in a Multi-Sphere Operation of an Adversary'], *Воздушно-космические силы. Теория и практика*, 2020.
69. Fabian Hoffman, 'Europe's Missile Conundrum', *War on the Rocks*, 25 July 2023, <https://warontherocks.com/2023/07/europes-missile-conundrum/>, accessed 04/02/2026.

Figure 2: Comparison of Successful Deep Strikes (Approximate) Before and After Sensor Loss Events



Source: The author.

In a sense, this breaching function would be comparable to the role played by the Tomahawk and F-117 in the context of Operation *Instant Thunder* in 1991, during which capabilities such as the F-117 and Tomahawk were narrowly focused on destroying the sector command posts of Iraq's IADS on the assumption that, with this achieved, a much wider range of aircraft could more effectively chisel away at Iraq's air defences.[70] More recently, Israel's Rampage ballistic missiles were used against Iran's S-300PMU2 batteries in the initial, limited response to Iran's October ballistic missile attacks.[71]

Ballistic missiles could have considerable utility in this role. In certain respects, ballistic missiles would prove superior to HGVs when targeting known fixed or easily detected soft-skinned targets. The payloads of ballistic missiles tend to be larger than hypersonic missiles given the lack of a requirement for shaping the vehicle for manoeuvre, and they can thus achieve an effect against a soft-skinned target at some distance. Against aircraft in parking areas, the ability to deploy submunitions is also of considerable utility. Ballistic missiles with unitary warheads could also be employed against hardened air shelters.

70. Eliot A Cohen, 'Gulf War Air Power Survey, Volume II: Operations and Effects and Effectiveness', Johns Hopkins University, 1 January 1993, <https://apps.dtic.mil/sti/citations/ADA279742>, accessed 4 February 2026.
71. Arie Egozi, 'Israeli Air Force Hits Iranian S-300 Battery with Long-Range Missiles – Sources', *Defence Industry Europe*, 22 April 2024, <https://defence-industry.eu/israeli-air-force-hits-iranian-s-300-battery-with-long-range-missiles-sources/>, accessed 15 December 2025.

It might be considered that the Russian IADS can be rolled back from the outside in with fifth-generation aircraft armed with millimetric wave-equipped systems such as the AARGM-ER (Advanced Anti-Radiation Guided Missile-Extended Range) and SPEAR-3, which are cheap compared with deep-strike capabilities.[72] While this is a valid theory of success, there are two factors which bear considering:

- Deterrence is a function of what the other party deems threatening. Even if a stand-in approach to SEAD (suppression of enemy air defences) is viable, if Russian planners assume that a precondition for their air defence network being rolled back is the ability of forces to engage it across its depth, the ability to achieve this becomes significant.
- Any mechanism for attacking a given target such as air defences is time-limited. In air operations over Kosovo, for example, Serbian SAM operators adapted to the high speed anti-radiation missile threat relatively well, to a degree sufficient to compel NATO airpower to operate above the 15,000-ft flight altitude and to limit the impact of Allied airpower on Serbian ground forces.[73]

In Ukraine, Russian electronic warfare operators have become increasingly effective against some Allied munitions, such as joint direct attack munitions and the M31.[74] A single-vector mode of attack provides an opponent with a specific problem to optimise against, and while this does not mean Russia will overcome the threat posed by the AARGM and Spear-3, the possibility cannot be excluded. By contrast, if NATO's fourth-generation aircraft are enabled to present Russian IADS operators with another challenge in the form of short-range airfield lighting control and monitoring systems (ALCMS), this makes the Russian air defence challenge significantly more complex. Adding considerably to NATO's effective combat mass in the early stages of a conflict, enabling aircraft with ALCMS can bring a far larger range of threat types to bear against Russian SAM systems. Finally, the standoff ranges of missiles such as the Storm Shadow/SCALP and JASSM can reduce the reliance on tankers, against which the Russian air defence network is optimised.

Russian Use of Long-Range Missiles in Air Operations

The second component of Russian air operations is the use of long-range missiles to strike both military and civilian targets. The latter option, the Strategic Operation for the Destruction of Critical Infrastructure, has particular importance in the context of Russian planning.

The Russian missile threat presents two challenges for NATO. The first is one of scale. In 2024, for example, Russia produced 500 KH-101 cruise missiles, in addition to other

72. Observation by SME at RUSI workshop, London, 9 December 2023.
73. Benjamin S Lambeth, *NATO's Air War for Kosovo* (Santa Monica, CA: RAND, 2001), pp. 109–11.
74. Carlotta Gall and Vladyslav Golovin, 'Some US Weapons Stymied by Russian Jamming in Ukraine', *New York Times*, 25 May 2024.

cruise and ballistic missiles such as the 3M-14 Kalibr and 9M723 Iskander.[75] Currently, Lockheed Martin produces 500 PAC-3 MSE interceptors per year, while MBDA will produce roughly 300 Aster missiles from 2027.[76] Since interceptors are typically employed against missiles on a 'shoot-look-shoot'[77] doctrine, it should be expected that two to three interceptors will be expended for every incoming missile. Even before considering the mass production of cheaper, one-way attack drones such as the Shahed/Geran, the maths of missile defence does not necessarily favour Europe.

A lesson from the Iran–Israel conflict is that the ability to strike adversary launch platforms and munition storage sites is non-discretionary. Even with disruption, the costs of missile defence can prove prohibitive; the US expended roughly 25% of its THAAD stocks against an Iranian missile arsenal which, because of the impact of Israel's initial strikes, was in disarray and seemingly lost a third of its launchers to air strikes.[78] Without disruption on the ground, the expenditure of missiles can quickly prove unsustainable.

However, while Russian missiles may be plentiful, the management of a strike campaign still creates bottlenecks. First, Russia has largely relied on air and naval platforms to launch cruise missiles, partially due to the restrictions imposed by the Intermediate-Range Nuclear Forces (INF) Treaty on ground-based systems, and partially because repurposing some strategic systems for theatre-level roles was a cost-saving measure.[79] As a consequence, as of 2019, roughly 90% of Russia's throw weight at any given time was held on 107 bombers, surface ships and submarines.[80] While the numbers of platforms available to Russia have increased and the role of ground-based systems such as the SSC-8 has grown following the end of the INF Treaty, bombers and surface ships still carry the bulk of Russia's missiles.

Moreover, cruise missiles must be stored under specific conditions (for example, temperature control) and located in areas which allow launch platforms to be readily

75. Jack Watling and Oleksandr V Danyluk, 'Winning the Industrial War: Comparing Russia, Europe and Ukraine, 2022–2024', *RUSI Occasional Papers* (April 2025), p. 25, <https://www.rusi.org/explore-our-research/publications/occasional-papers/winning-industrial-war-comparing-russia-europe-and-ukraine-2022-24>, accessed 4 February 2026.
76. Rudy Ruitenberg, 'Europe's Top Missile Maker MBDA Boosts Output 33% Amid Record Orders', *Defense News*, 18 March 2025, <https://www.defensenews.com/global/europe/2025/03/18/europes-top-missile-maker-mbda-boosts-output-33-amid-record-orders/>, accessed 6 February 2026; Lockheed Martin, 'Lockheed Martin's PAC-3 MSE Achieves Record Production Year', 24 March 2025, <https://www.lockheedmartin.com/en-us/news/features/2025/lockheed-martins-pac-3mse-achieves-record-production-year.html>, accessed 4 February 2026.
77. Kevin Glazebrook and Alan Washburn, 'Shoot-Look-Shoot: A Review and Extension', *Operations Research* (Vol. 52, No. 3, May–June 2004), pp. 454–63.
78. Thomas Newdick and Howard Altman, 'One Third of Iran's Long-Range Missile Launchers Destroyed, Israel Claims', *The War Zone*, 16 June 2025, <https://www.twz.com/news-features/one-third-of-irans-long-range-missile-launchers-destroyed-israel-claims>, accessed 4 February 2026.
79. Nikolai Sokov, 'Why do States Rely on Nuclear Weapons? The Case of Russia and Beyond', *Nonproliferation Review* (Summer 2002), pp. 101–11.
80. Fredrik Westerlund et al., *Russia's Military Capability in a Ten-Year Perspective – 2019* (Stockholm: FOI, 2019), p. 37.

reloaded. Missiles are held in warehouses and transported to be stored at bases such as Engels, Okolnaya Bay and Baltiysk ahead of being loaded onto launch platforms. The locations of many cruise missile storage facilities can be mapped in peacetime; this has been demonstrated during the conflict in Ukraine, where partisan groups have released the locations of several storage warehouses in Crimea and the Kola Peninsula. The forward storage sites at which missiles are held before loading are, in many cases, common knowledge. In addition to missile storage, Russian naval and airbases check out points where mission programming and certification occurs.[81]

This infrastructure is robustly defended against air threats. Engels-2, for example, is beyond the range of most Allied fixed-wing aircraft. An airbase such as Olenya is protected by two S-400 regiments (the 1528th and 33rd) in addition to an S-300 regiment. Additionally, some (though not all) facilities are hardened.[82] In effect, finding targets is less difficult than striking them since the assets in question are not elusive but are well defended. Of course, in a conflict a certain number of S-300V batteries would be located around airbases if a ballistic missile threat were perceived, and while the SSPK of these systems against medium- and longer-range missiles is probably limited, their presence would increase missile expenditure rates. In due course, the fielding of a larger number of S-500 batteries will compound the challenge.

The defences of these targets against MRBMs are likely to be more limited. The S-400, for example, lacks a hit-to-kill interceptor and would probably have limited utility against an MRBM-type target. The absence of both a hit-to-kill interceptor and a Ka-band seeker on missiles such as the 9M96 (which the S-400 uses for BMD) might reflect the possibility that the Elbrus-800 computer is marginally too slow for the kinetic engagement of ballistic targets. This is because a greater distance between a target's estimated and real location incentivises the adoption of blast fragmentation warheads, which compensate for the error.[83]

Work conducted on the suppression of US airbases by the Chinese cruise and ballistic missile arsenal suggests that around 60 missiles with a circular error probable of 10 m or less would be required to arrive on target to render a target such as Kadena inoperable for several weeks.[84] This number excludes the impact of air defences on missile efficacy – a variable which will become more salient if Russia deploys a combination of the S-500 and S-300V for BMD. As such, any given target would require a considerable number of missiles to overcome, although certain targets may require fewer missiles to inflict considerable damage: for example, aircraft in parking areas represent a relatively

81. Based on both Soviet practice and current Western practice. See CIA, 'Naval Missile Facilities of the USSR', NPIC/R-98/63, June 1963, <https://www.cia.gov/readingroom/docs/CIA-RDP78B04560A000600010015-6.pdf>, accessed 4 February 2026.
82. Considering the Soviet origins of some storage sites, information about levels of hardening in some areas is available. See *ibid*.
83. Kaushal and Suess, 'A Net Assessment of Russian and Allied Capabilities in a Modern Strike Campaign',
84. Eric Heginbotham et al., *The US–China Military Scorecard* (Santa Monica, CA: RAND, 2015), p. 65.

vulnerable target. Early modelling implies that a 750-kg warhead can deploy around 850 bomblets over a 900-ft diameter.[85] This does require a degree of time-sensitive information regarding when aircraft are outside their shelters and on parking aprons.

The number of missiles needed to inflict critical damage on Russian facilities associated with cruise and ballistic missile attacks would be considerable, if assumptions regarding PLA attacks on the US are used as a baseline, as models of Chinese attacks assume 30 to 60 ballistic missiles allocated to each major facility struck.[86] However, the cost of the missiles needed to suppress an airbase must be weighed against the cost of active missile defence over an extended period of time. The requirements in terms of time-sensitive data and battle damage assessment would also be more taxing.

The second use case described would effectively involve largely (although not exclusively) preplanned targeting. As such, it is consistent with the assumption of greater access to missiles but more limited ISR. Many of the targets associated with this use case are either static or not easily moved, and the task of identifying them is a matter of peacetime intelligence-gathering rather than dynamic targeting. However, tasks such as identifying when aircraft are being prepared for launch outside their hangars and conducting battle damage assessment are typically more complex and are likely to involve at least some degree of access to either US ISR or a more robust European ISR capability. Even so, the ISR burden involved in offensive counter-air is moderate and the emphasis would be on preplanned targeting at scale.

Case Three: The IMAS – Dynamic Targeting at Scale

Perhaps the most ambitious course of action would be the employment of prompt strike capabilities as part of what some Russian authors call an IMAS (although other terms are sometimes used to describe the same threat). This involves the use of hundreds of hypersonic missiles and fixed-wing aircraft in successive echelons to paralyse the Russian military system. According to Russian concerns, CPS capabilities held at the theatre level pose two threats. The first is the prospect of prompt strike capabilities being employed against a range of high-value military targets across the

85. John Stillion and David T Orletsky, *Airbase Vulnerability to Conventional Cruise-Missile and Ballistic-Missile Attacks* (Santa Monica, CA: RAND, 1999), pp. 5–28.
86. Thomas Shugart and Javier Gonzalez, 'First Strike: China's Missile Threat to US Bases in Asia', Center for a New American Security, 2017, p.12, <https://www.cnas.org/publications/reports/first-strike-chinas-missile-threat-to-u-s-bases-to-asia>, accessed 4 February 2026.

depth of the theatre.[87] Second, there is a growing Russian concern that conventional missiles might be employed at scale against components of the Russian nuclear arsenal.[88] The concern, according to Russian planners, is not that conventional weapons alone could wipe out Russia's nuclear arsenal, but rather that they could inflict on it strategically significant damage without the crossing of the nuclear threshold.

The IMAS concept involves complexity, scale and assurance. Highly accurate missiles are envisioned as presenting a threat to both time-sensitive, and hardened and buried targets across the theatre by Russian planners.[89] The deterrent challenge for Russia is a conventional version of the Cold War Target Set B, which envisioned NATO striking all or most of Russia's theatre-level nuclear weapons along with key C2 nodes while withholding enough capacity to deter Russia from using its strategic arsenal.

In theory, many of the targets that might have historically required a nuclear weapon to be used can now be struck with conventional weapons which can, the Russians fear, penetrate to depths that only nuclear assets could achieve.[90] Prompt strike capabilities would make this viable, both because of their reach but also because, given their limited time to target, they could allow time-sensitive data to be more readily exploited than is currently the case. Allied air operations largely rely on preplanned target sets, with dynamic targeting at very long distances being difficult to achieve.

Realising Russian fears would require both hundreds of hypersonic missiles and varying types of missiles, since missiles large enough to carry a kinetic penetrator would differ from those most useful against fleeting targets, for example. It would also require the ISR and coordination to make these missiles useful. If achieved, the capacity for an IMAS would both impose operational dilemmas on Russia and would also provide a conventional counter to the prospect of Russia using a single- or small-scale 'grouped' use of nuclear weapons (to either win or de-escalate a war on favourable terms, in addition to its conventional ramifications).[91]

87. V V Selivanov and Y D Illin, « Тенденции развития средств вооруженной борьбы в современных военных конфликтах, их влияние на развитие и смену поколений вооружения, военной и специальной техники » ['Trends in the Development of Means of Armed Struggle in Modern Military Conflicts, and Their Impact on the Development and Generational Change of Armaments, Military and Specialised Equipment'], *Военная мысль* (Vol. 9, 2022), pp. 29–45.
88. I L Fazletdinov and V I Lumpov, 'The Role of Strategic Missile Forces in Countering NATO's Strategic Multidomain Operation', *Военная мысль* (Vol. 3, 2023), pp. 53–64.
89. Stuchinsky and Korolkov, « Обоснование боевого приминения авиации для срыва интегрированного массированного воздушного удара в многосферной операции » ['Justification of the Use of Aviation for the Disruption of Integrated Massive Air Strike in a Multi-Sphere Operation of an Adversary'].
90. Author interview with Frank Rose, former deputy director of the National Nuclear Security Administration, online, 28 April 2025.
91. On Russian thinking, see Michael Kofman and Anya Fink, 'Russia's Approach to Escalation Management', CNA, April 2020, <https://www.cna.org/reports/2020/04/DRM-2019-U-022455-1Rev.pdf>, accessed 4 February 2026.

By virtue of the scale and ambition involved, the concept is typically envisioned by Russian planners as something only the US could achieve, with European capabilities barely featuring in strategic assessments.[92] Given the requirements in terms of both ISR and missile stockpiles, this is a rational assessment.

For the IMAS concept to be viable, one of two assumptions would have to be met. Either the approach would need to be predicated on a confidence in the deep involvement of the US in Europe, and a minimal loss of access to US enablers, or the cost of both producing missiles and enabling them with ISR would have to decline to a degree which makes this achievable with reduced US support.

If delivered, however, the capacity to deliver an IMAS would compel Russian planners to treat Europe's missile arsenals as if they were being enabled by the US – to assume that they were not, and be incorrect, could prove fatal. This could have the effect of 'recoupling' both sides of the Atlantic in strategic terms by making it impossible for Russia to escalate in Europe, in the hope that US involvement might remain limited.

More ambitiously, a combination of many European prompt strike missiles – backstopped by Europe's two nuclear powers and enabled by a better, independent ISR capability – would form the foundations of an independent European deterrent. CPS could serve as both an operational tool and a deterrent against Russia's large arsenal of substrategic nuclear weapons being used against military targets, while the independent arsenals of Europe would provide a backstop against strategic nuclear escalation by Russia against targets like cities. While not a perfect substitute for US capabilities, this would represent an independent European capability that could provide a degree of redundancy should US extended deterrence weaken.

Should Europe appear capable of credibly delivering something analogous to the Russian conception of an IMAS, this would also significantly complicate Russian assessments of the independent strike capabilities of middle or small powers. Any prompt strike capability in the hands of a European state would, if used, have to be treated as part of a much larger collective capability, since the risk of assuming that a small state is acting in isolation and is acting incorrectly would be considerable. Treating a launch from a single state as a national decision raises the risk of military catastrophe if it is the first element of a much larger salvo being launched by the Alliance. Equally, if military action in Europe had to begin with an attempt to suppress any prompt strike capabilities held across the Alliance, this would obviate any hope Russia might have of fighting wars that are containable and thus consistent with the state's wider political aims. This could have the effect of strategically binding Europe by making it too risky to engage individual member states in detail, given the speed

92. Fazletdinov and Lumpov, 'The Role of Strategic Missile Forces in Countering NATO's Strategic Multidomain Operation'.

with which a collective response underpinned by prompt strike capabilities could materialise.[93]

This vision would require three things to be realised. The first would be the price point of both ballistic missiles and hypersonics dropping to a degree that makes their fielding in large numbers by middle and small powers viable. The second development would be the availability of pervasive ISR in the absence of the US. Finally, a command structure capable of orchestrating an operation as complex as an IMAS would be required.

93. Nuclear weapons have often been envisioned in this capacity by small and medium-sized powers. See Vipin Narang, *Nuclear Strategy in the Modern Era: Regional Powers and International Conflict* (Princeton, NJ: Princeton University Press, 2014).

Physical Enablers: Launch Platforms and Combat Service and Support

Having discussed the strike complex in terms of both missiles and their enabling C4ISR, and the different concepts of operations that differing assumptions might support, this chapter briefly addresses the other key component of a strike complex: launch platforms.

When selecting launch platforms, the trade-off involved is between mobility, reach and payload. Maritime and air assets have the advantage of theatre mobility and can launch missiles from multiple vectors. The cost comes in the form of either reach or payload: for example, the Israeli Golden Horizon MRBM can be launched from an F-15, but this is achievable only because it has a small, 150-kg warhead.[94] This is a viable mode of attack against some targets, such as radar, but not against those which require a larger payload.

Maritime platforms can carry long-range missiles; indeed, the US *Virginia*-class submarine will carry the common hypersonic glide body in its payload modules.[95] They can, therefore, combine mobility, reach and payload. However, unlike vessels such as the Chinese Type 055, the size of the vertical launching system (VLS) on the surface means that combatants of European middle powers cannot house larger MRBMs there. The attack submarines operated by European navies currently tube-launch missiles and do not have VLS.

As European SSN (attack submarine) operators recapitalise their fleets, there is a strong argument for future classes of boat such as the SSN AUKUS to be built around prompt strike, much as Russian and US submarines already are. This would involve

94. Babak Taghavaee, 'Unique Insight into Israel's Retaliatory Strike on Iran', *Key Aero*, 19 March 2025, <https://www.key.aero/article/unique-insight-israels-retaliatory-strike-iran>, accessed 4 February 2026.
95. Carter Johnston, 'Hypersonic-Armed Destroyers and Submarines are Relocating to Hawaii', *Naval News*, 11 October 2025, <https://www.navalnews.com/naval-news/2025/10/hypersonic-armed-destroyers-and-submarines-are-relocating-to-hawaii/>, accessed 4 February 2026.

requirements in terms of characteristics such as vessel size, which would need to be built into these programmes from the outset.

A more radical option might be the employment of missiles on vessels such as aircraft carriers, which have the deck space to employ them. This has been demonstrated, in principle, with the US *San Antonio*-class landing platform dock (LPD) being used as a launch platform for high-mobility rocket missile launchers fired from its deck, and similarly, the concept of using an MRBM from an LPD-type vessel has been considered.[96] The impact of a launch, considering both thermal impact and the impact of overpressure, could render a flight deck unusable for aircraft. However, so much depends on whether a missile can be cold-launched to a sufficient altitude before its booster ignites.

Ground-based missiles can solve the problem of warhead weight and range; moreover, they represent a relatively elusive target for adversary ISR. This point has been noted by Russian planners discussing tracking ground-based targets such as SAM TELs.[97] Moreover, when launched from Germany, a ground-based hypersonic missile can present Russia with warning times of less than five minutes. The major challenge presented is that in peacetime, these missiles must be based at fixed (and known) sites and must be moved to launch points in a crisis. Forward basing is possible – as mentioned, the US will place the Dark Eagle in Germany from 2026 – and Germany might host additional non-US missiles in addition to its own. However, the fact that ground-based missiles are most easily eliminated at their bases creates an incentive to pre-empt.

Furthermore, ground operations require mobile maintenance and support as well as the ability to move reloads. A missile like the Chinese DF-21, for example, typically moves as part of a six-vehicle convoy.[98] A ground-based missile, therefore, requires the procurement of support vehicles and training of personnel, in addition to the construction of support facilities. This is unlike air and naval systems, which are largely maintained at bases and operate as relatively self-contained units when deployed. For example, a canisterised missile on a ship can draw on the ship's power generator and communications, eliminating the need for two vehicles associated with a ground-based system.

The right answer regarding launch platforms depends on the target. The task of stimulating radar, for example, might be best achieved with air-launched ballistic missiles, but strikes involving HGVs would probably require land or maritime

96. Tangredi, 'Working Paper in Future Warfare Studies', pp. 4–6.
97. A A Glushak and D A Peresypkin, « Пространственно-временная модель поражения объектов противоракетной обороны противника оперативно-тактической авиацией с применением высокоточного оружия » ['A Spatial and Temporal Model of the Defeat of Missile Defence Facilities of the Enemy by Use of Operational Tactical Aviation with the Use of High Precision Weapons'], *Военная мысль* (No. 10, 2023), p. 49.
98. Hans M Kristensen, 'DF-21C Missile Deploys to Central China', Federation of American Scientists, 28 September 2010, <https://fas.org/publication/df21c/>, accessed 4 February 2026.

platforms. A wider target set would increase the requirement for surface-based options with greater reach. Ground-launched systems are the easiest type of system to field without either adapting platforms or working around their limitations, but they also involve the highest ancillary costs.

Conclusion

This paper has articulated how the twin drivers of necessity and achievability will shape the requirements for European CPS capabilities. From the evidence surveyed, these twin drivers should be approached with varying levels of ambition.

A European prompt strike capability should develop in increments, beginning with the irreducible minimum mission sets before expanding to the offensive counter-air function and eventually, to the IMAS concept of operations.

At a minimum, the ability to destroy the city of Moscow's BMD system must be a capability held by European states, considering the extent to which this will underpin any backstop against the attenuation of US extended deterrence. This represents the most achievable goal in terms of both missiles and enablers. Initially, in the event of a conflict, saturation with ballistic targets would probably be most feasible, but a limited number of HGVs, when available, would allow this mission to be achieved more efficiently. Although least taxing in terms of ISR and missile numbers, this mission is the one requiring the greatest assurance. The combination of a pressing requirement which few other capabilities can easily achieve and a limited requirement in terms of missiles and sensors makes this the mission against which efforts by European states should initially be optimised.

However, should European capacity to scale the production of missiles increase moderately, a range of operationally relevant targets that are essential to the Russian system – including bombers, interceptor aircraft and fixed radar – might be added to a hypothetical target set, in a way that increases the scale of the system but only marginally impacts the complexity of its operation.

That being said, should the cost of both processing data and acquiring missiles decline considerably over the next decade, a much more ambitious approach might be considered, presenting Russian planners with the scenario of an integrated massive aerospace attack which they both fear and plan against.

As European mission sets expand, there will be a stronger case for a diversity of missile types, since there is a trade-off between the likelihood of penetrating missile defences and missile versatility. While HGVs are probably more capable of penetrating air defence networks, they will be more constrained in terms of the weight and munitions types they can carry. Even for limited target sets associated with the irreducible minimum, ballistic missiles and hypersonics can be mutually reinforcing, with the former serving to stimulate targets. As such, ballistic missiles and HGVs should be viewed as mutually reinforcing capabilities rather than alternatives.

European policymakers would thus do well to plan against the irreducible minimum immediately, while exploring avenues to deliver the more ambitious concepts of operation, which may become viable when most European militaries will recapitalise their force structures.

About the Author

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