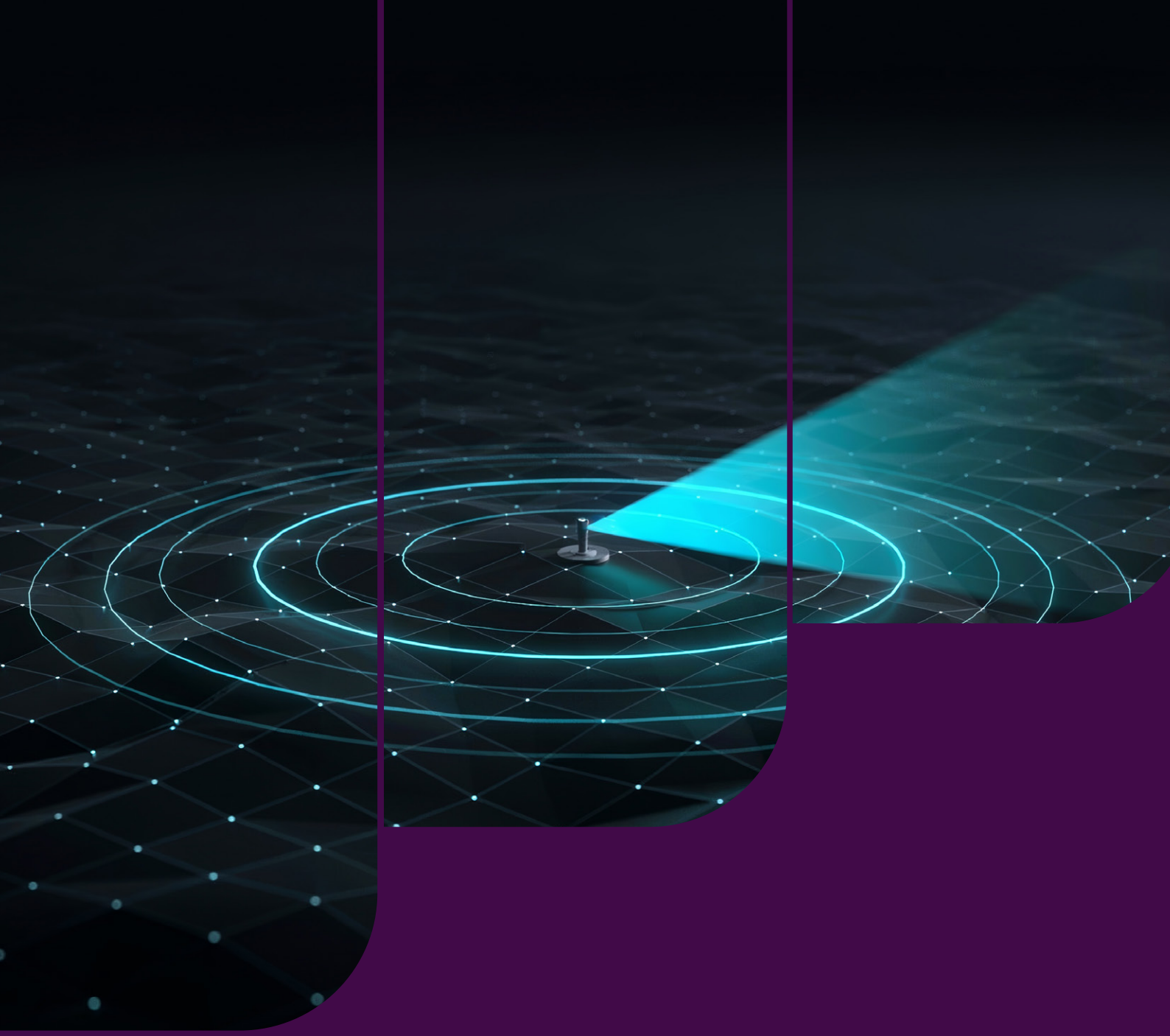

Research Papers

November 2026

Atlantic Shield

Sidharth Kaushal

RUSI

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Get in touch

www.rusi.org

enquiries@rusi.org

+44 (0)207 747 2600

The Royal United Services Institute for Defence and Security

61 Whitehall, London

SW1A 2ET

United Kingdom

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Methodology

Research for this paper was conducted between 1 June 2026 and 1 August 2026. The findings are based on a combination of desk-based operations analysis, combat modelling, an analysis of secondary literature and interviews with subject matter experts, including from the Royal Navy's Develop Directorate, the Naval Staff, Navy Digital, the UK Ministry of Defence's Military Strategic Headquarters and the Royal Netherlands Navy. The Monte Carlo simulation was created through Python coding software, using code generated with AI support (Claude model), based on Wayne Hughes' salvo combat model. Given the sensitive nature of the areas discussed in the paper, interviewees are anonymous and most interviews have been used as research background rather than cited in the paper. The report was submitted on 5 August 2026 and approved for copy editing on 12 October 2026.

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Executive Summary

The 2026 UK Defence Investment Plan committed £1.3 billion to Atlantic Shield, a hybrid fleet in which uncrewed Type 91 missiles and Type 94 sensor platforms, directed by a Common Combat Vessel, will assume the air defence role now held by the Type 45. This paper examines how the resulting force should be optimised for its intended role in the High North, and what follows for its design and doctrine and the sequence in which it is fielded.

This paper argues that the uncrewed component's most valuable contribution is enabling theatre air defence through the long-range detection and tracking of the fastest, highest-flying threats. This represents the most difficult problem in the wider integrated air and missile defence (IAMD) battle, and the one least well served by existing assets. The Russian threat in the High North rests on a small number of launch platforms rather than on mass and will probably continue relying on these platforms. Climate, terrain and the difficulty of sustaining dispersed launchers in the Arctic all work against a shift towards cheap massed systems. Both NATO and Russia have limited time to achieve effects, and marginal losses matter disproportionately to each. In that context, the value of a disaggregated fleet lies in specialisation rather than in hull numbers.

As a result, the principal implication concerns design. Building a vessel around its sensor – with power generation, displacement and hull form set by the radar rather than by a length target – is the way to unlock advantage which a single purpose platform uniquely offers. Fitting the SPY-6 radar to the *Arleigh Burke*-class Flight III added 400 tonnes of structural weight, while propulsion and radar together account for roughly 6% of a Type 45's displacement. Space and weight are the binding constraints, rather than power.

Modelling undertaken for this paper further suggests that degrading Russian scouting contributes more to a task group's survival than additional magazine depth, and that it can be done comparatively cheaply with dedicated decoy vessels. Because the system is unprecedented, its simpler elements – missile barges and electronic decoy vessels (as proposed by this paper) – should be fielded first, with the lessons applied to the radar ship.

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The more difficult problems to address may be doctrinal rather than technical. A system with an uncrewed principal sensor that emits at high power and is separable from both the shooters and the command node raises questions of radar policy, engagement authority and command relationships. These questions currently have no settled answer, but resolving them would give the UK a distinctive contribution to Allied air defence in a theatre where NATO currently starts at a time disadvantage.

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Introduction

This is the latest paper in a RUSI series in support of the Royal Navy's Atlantic Series and the wider development of the hybrid navy. As with preceding papers in the series,[1] it examines a specific dimension of maritime competition in the High North. Its purpose is to articulate the rationale for Atlantic Shield, which is the Royal Navy's contribution to the wider maritime IAMD battle in the North. It identifies the conditions required for its success.

The concept of Atlantic Shield is not synonymous with any particular capability. Instead, it encompasses the full spectrum of naval capabilities relevant to IAMD which will be embedded within a wider IAMD battle. However, the initiative is being undertaken in the context of a major shift in the way air defence will be delivered at sea; in 2026, the UK's Defence Investment Plan announced that £1.3 billion would be invested into hybrid Navy platforms.[2] In the context of maritime air defence, given that the Royal Navy will not pursue a like-for-like replacement for the Type 45 Destroyer, it will develop three classes of vessel that will collectively form an air defence system: the Type 94 radar ship, the Type 91 missile barge and the Common Combat Vessel.

This paper proposes that the Royal Navy's contribution to air defence in the High North should be based on an approach which involves initial optimisation around a portion of the problem set, as a means of narrowing the task ahead and setting the conditions for capability iteration. It also proposes a staged approach to fielding a distributed maritime contribution to the wider IAMD architecture. In this approach, some components might be delivered before the Type 45's out-of-service date, while others are fielded later.

This paper does not consider whether a more novel approach to maritime air defence is better than alternatives, since the decisions relevant to this have already been made.

1. Sidharth Kaushal and Edward Black, 'The Atlantic Bastion', *RUSI Research Papers* (December 2025), https://www.rusi.org/explore-our-research/publications/research-papers/atlantic-bastion, accessed 22 October 2026; Sidharth Kaushal and Edward Black, 'The Royal Marines in the High North: Shaping the Maritime Battle', *RUSI Research Papers* (July 2026), https://www.rusi.org/explore-our-research/publications/research-papers/royal-marines-high-north, accessed 22 October 2026.
2. Ministry of Defence, 'The Defence Investment Plan: Equipping Our Forces, Defending Our Future, 2026', p. 26, https://www.gov.uk/government/publications/the-defence-investment-plan, accessed 22 October 2026.

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Instead, it seeks to analyse how the opportunities that this approach offers can be best leveraged by the Royal Navy and how risks inherent to it can be mitigated.

The paper has three aims.

1. It situates the concept of an Atlantic Shield within a wider air battle in the High North, of which the Royal Navy would be part.
2. It identifies how the characteristics of the air battle in the High North could influence the development of a hybrid air defence solution.
3. It offers suggestions for how the use cases described should inform technical and organisational considerations of how the Royal Navy fights such an air battle.

The first chapter examines the nature of the air threat to both Allied forces and the UK emerging from the High North and discusses to which part of the wider air battle the Royal Navy can contribute as part of a multiservice effort. The second chapter examines how this role should inform the design of uncrewed systems for the Royal Navy and the specific opportunities that uncrewed systems can offer in the context of the air defence mission. The third chapter explores technical and organisational considerations, as well as risks, associated with a new model of surface-based air defence and outlines mitigations to these risks.

Background

Atlantic Shield represents a departure from the model of air defence at sea that has prevailed since the mid-20th century. The *County*-class cruiser, equipped with the Sea Slug missile, was developed in response to the requirement to engage threats such as bombers.[3] Since then, air defence destroyers have evolved considerably, but within a recognisable lineage. The Royal Navy's vision for its future air defence capability is a more radical shift.

There are parallels with the approaches being explored by Allied navies, including those of the US, the Netherlands and Australia, which envisage pairing existing platforms (such as destroyers) with uncrewed surface vessels acting as offboard missile carriers.[4] The Royal Navy's concept, however, takes the logic of specialised platforms at sea, enabled by uncrewed systems, considerably further. The hybrid fleet will retain numerous crewed assets relevant to the air battle, including the carrier air wing and

3. GlobalSecurity.org, 'Sea Slug', https://www.globalsecurity.org/military/world/europe/sea-slug.htm, accessed 22 October 2026.
4. Carter Johnston, 'US Navy Sets Sights on Fleet Wide Family of Unmanned Ships', *Naval News*, 29 July 2025, https://www.navalnews.com/naval-news/2025/07/u-s-navy-sets-sights-on-fleet-wide-family-of-unmanned-ships/, accessed 22 October 2026; Sidharth Kaushal, 'Optimising the Royal Netherlands Navy for its Role within NATO', *Whitehall Report*, 3-24 (December 2024), https://www.rusi.org/explore-our-research/publications/whitehall-reports/optimising-royal-netherlands-navy-its-role-within-nato, accessed 22 October 2026.

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the Type 26 and Type 31 frigates. Its core surface-based air-defence system will nevertheless differ fundamentally from those of other navies.

This approach creates both opportunities and risks. Platform specialisation within a wider ecosystem offers clear advantages, not least because it lends itself to scale.[5] Large numbers of single-purpose platforms can be considerably cheaper to build than a comparably capable force composed of multifunctional vessels; the costs of multifunctional vessels are chiefly driven by the integration of multiple complex systems. Furthermore, some naval historians add that fleet size is the single best predictor of success in naval warfare.[6] Modelling suggests that a distributed fleet often outperforms a similarly priced force of multifunctional vessels.[7]

However, simplicity at one level – for example, the individual platform – can displace complexity to another part of the system, particularly into the network that enables it. In Ukraine, for example, relatively simple line-of-sight, ground-based air-defence systems can engage targets such as Shahed or Geran one-way attack UAVs. However, this is possible only because they are cued by a sophisticated network of distributed sensors and the battle management architecture connecting them. Simple platforms can often depend on a complex enabling infrastructure, which has its own bottlenecks for an opponent to target.[8]

Additionally, three decades of data on megaprojects suggests that first-of-a-kind programmes carry disproportionate technical, organisational and financial risk – albeit with successful projects providing commensurate rewards.[9] Those first-of-a-kind projects which did succeed tended to owe their success to both a careful analysis of the desired end state, which justified the adoption of a novel solution, and to modularity and iteration across the project.[10] An illustrative military case would be Wayne Meyer's 'build a little, test a little' approach to the rollout of the Aegis combat management system. The modularity inherent to a disaggregated fleet can be conducive to iteration at the platform level if different parts of the fleet are rolled out on different timetables.

5. Bryan Clark, Daniel Patt and Harrison Schramm, 'Mosaic Warfare: Exploiting Artificial Intelligence and Autonomous Systems to Implement Decision-Centric Operations', CSBA, 11 February 2020, https://csbaonline.org/resource/mosaic-warfare-exploiting-artificial-intelligence-and-autonomous-systems-to-implement-decision-centric-operations/, accessed 22 October 2026.
6. Sam J Tangredi, 'Bigger Fleets Win', *Proceedings* (Vol. 149, No. 1, January 2023).
7. Clark, Patt and Schramm, 'Mosaic Warfare'; Justin Grana, Jonathan Lamb and Nicholas A O'Donoughue, *Findings on Mosaic Warfare from a Colonel Blotto Game* (Santa Monica, CA: RAND Corporation, 2021).
8. Annika Burgess, 'How Israel Managed to Intercept "99 per Cent" of Iran's Drone and Missile Attack', *ABC News*, 16 April 2024.
9. Bent Flyvbjerg and Dan Gardner, *How Big Things Get Done: The Surprising Factors That Determine the Fate of Every Project, from Home Renovations to Space Exploration and Everything In Between* (London: Macmillan, 2023), pp. 131–55.
10. Bent Flyvbjerg and Dan Gardner, 'How Frank Gehry Delivers on Time and on Budget', Harvard Business Review, January 2023, https://hbr.org/2023/01/how-frank-gehry-delivers-on-time-and-on-budget, accessed 22 October 2026.

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The Air Battle in the North and Its Maritime Component

This chapter lays out what an air battle in the High North (as part of NATO's wider commitments under Regional Plan Northwest) would resemble, and the role of IAMD within this battle. It then lays out the author's assessment regarding which gaps the maritime component could contribute to filling within the air defence architecture.

The Air Battle in the High North

While the High North may not be the most likely location for the emergence of a conflict with Russia, it is likely that any conflict that did occur would rapidly spread north. For Russia, the defence of its strategic bastions on the Kola Peninsula requires operationally aggressive (if strategically defensive) action. For NATO, the area represents a key channel which must be closed to both Russian submarines and other missile-carrying platforms to protect both strategic rear areas and (in the case of nuclear member states) at-sea deterrents.

The hypothetical air battle in the High North combines elements of expeditionary force protection and homeland defence for the UK. Maritime forces deployed northward will require protection from a diverse and capable suite of Russian anti-ship missiles. In addition, the cruise missile threat to the UK will be most acute from the north, given that missiles fired from the east must cross a considerable amount of Allied airspace and are thus a less likely threat to the homeland. Over time, the expansion of the ballistic threat posed by Russia will change the geometry of the UK's threat environment. However, based on what is known about Russian production rates, the primary near- to mid-term air threat to the UK homeland will probably be air- and

sea-launched cruise missiles, which can more readily reach the UK if launched from the north and west.[11]

Based on statements by senior Russian officers and Russian doctrinal literature, there would be three functions to Russian missile launch platforms.

1. They would contribute to a strategy of damage limitation against superior Allied air and maritime power by destroying key air threats – particularly cruise missile platforms – at their bases.[12]
2. They would contribute to keeping deployed Allied maritime power at arm's length, at least for a time, primarily by targeting ships at sea.[13]
3. They would contribute to war termination through attacks on critical national infrastructure.[14]

Russian maritime and land-attack capabilities in the High North can be grouped by zone, based around the terminology Russian writing uses, each of which is associated with a different operational aim. The pattern matters more than the inventory: as distance from the Kola Peninsula increases, the threat narrows onto a smaller number of long-range platforms – chiefly long-range aviation and a submarine fleet that remains capable and well handled – while the coastal zone is dense with shorter-ranged systems that Allied forces would largely be able to avoid.

Table 1: Russian Maritime and Land-Attack Capabilities

Zone	Russian aim	Principal anti-ship threat	Principal land-attack threat
Coastal defence zone To around 500 km	Sea control	Coastal Defense Cruise Missile (CDCM) systems (Bal, Bastion-P); surveillance helicopters (Ka-27, Ka-31); missile corvettes such as the *Karakurt*-class	Short-range ballistic missiles; one-way attack UAVs; glide bombs; prospectively cheap cruise missiles, such as the 500-km Banderol
Near sea zone To around 1,000 km	Contested sea denial; land attack on airbases and critical national infrastructure	MiG-29 (Kh-31A) and MiG-31K; submarines carrying 3M54, P-800 Oniks and 3M22 Zircon; Tu-22M3 with the supersonic Kh-22/Kh-32	Cruise missiles (3M-14 Kalibr, Kh-101) reaching part of Norway; Kh-47M2 Kinzhal from bombers and MiG-31K

11. Sidharth Kaushal, 'An Integrated Air and Missile Defence Architecture for the UK', *RUSI Occasional Papers*, 28 August 2025, p. 16–20, https://www.rusi.org/explore-our-research/publications/occasional-papers/integrated-air-and-missile-defence-architecture-uk, accessed 22 October 2026.
12. Clint Reach et al., *Russia's Evolution Toward a Unified Strategic Operation: The Influence of Geography and Conventional Capacity* (Santa Monica, CA: RAND Corporation, 2023), p. 7.
13. Dmitry Adamsky, 'Moscow's Aerospace Theory of Victory: Western Assumptions and Russian Reality', CNA, February 2021, p. 5, https://www.cna.org/analyses/2021/03/moscows-aerospace-theory-of-victory, accessed 22 October 2026.
14. Michael Kofman et al., 'Russian Military Strategy: Core Tenets and Operational Concepts', CNA, August 2021, pp. 44–46, https://www.cna.org/analyses/2021/10/russian-military-strategy-core-tenets-and-concepts, accessed 22 October 2026.

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Zone	Russian aim	Principal anti-ship threat	Principal land-attack threat
Far sea zone To around 2,000 km	Temporary sea denial; land attack	Long-range aviation (Tu-22M3, MiG-31K as Kinzhal launch platform); submarine-launched missiles; *Gorshkov*-class frigates and the probable sole operable *Kirov*-class (*Admiral Nakhimov* with 80 VLS (vertical launching system) cells, P-800 and 3M22)	Cruise missiles (3M-14 Kalibr, Kh-101) reaching most of Norway principally from bombers and submarines
World ocean Beyond 2,000 km	Episodic disruption; land attack	Submarine-launched missiles	Submarine-launched cruise missiles and air-launched cruise missiles both capable of reaching the UK; air-launched ballistic missiles such as Kinzhal and to a lesser extent IRBMs such as Oreshnik

Source: The author, using zones derived from Michael Kofman, Anya Fink and Jeffrey Edmonds, 'Russian Strategy for Escalation Management: Evolution of Key Concepts', Centre for Naval Analysis, 13 April 2020, p. 17, https://www.cna.org/analyses/2020/04/russian-strategy-for-escalation-management-key-concepts, accessed 13 October 2026.

Note: The *Admiral Nakhimov*'s sister ship, the *Pyotr Velikiy*, will probably be retired at the point that the hybrid fleet becomes operational.

The air battle in the High North affords both parties relatively limited time to achieve effects. Russia faces considerable challenges with respect to strategic depth in and around the Kola Peninsula. Its operational posture is dependent on a limited number of well-defended nodes, including naval facilities such as Severomorsk and airbases such as Olenegorsk-2 and Monchegorsk. Most of these facilities are within several hundred kilometres of Russia's borders with Norway and Finland. In addition to the longstanding risk of air and missile attack from long distances, shorter-ranged systems such as JASSM and PrSM, along with special forces raids, could hold at-risk critical nodes on which Russia projects power, along with the sensitive platforms within these nodes.[15] Furthermore, the concentration of launch capacity on limited numbers of high-value platforms such as bombers and submarines means that small losses can have disproportionate effects. For example, losing a modernised Project 949AM *Oscar*-class II SSGN (nuclear-powered cruise missile submarine) and its 72 missiles removes a throw weight equivalent to the modernised backfire fleet. Even relatively small loss rates per sortie can rapidly degrade an air force – a matter of particular concern to Russia given its limited bomber fleet.[16] Logically, Russian planners must assume that many of their missile launch platforms will become less usable as a conflict progresses because of the threat to platforms and their supporting infrastructure.

Russia also fields limited numbers of key systems, such as maritime patrol aircraft. For example, the Russian Aerospace Forces currently field 30 modernised IL-38Ns, along

15. Kaushal and Black, 'The Royal Marines in the High North', pp. 10–20.
16. Barry R Posen, *Inadvertent Escalation: Conventional War and Nuclear Risks* (Ithaca, NY: Cornell University Press, 1991), p. 154.

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with older airframes.[17] Assuming readiness rates of 50–70% – comparable to Western air forces – this does not leave Russia with much slack to incur losses before gaps in its surveillance are created, which allow for the safer deployment of surface vessels.

Equally, however, Allied air defence for both force protection and territorial defence is constrained by several factors. The first of these is distance. For most NATO Allies, both air and maritime power must be deployed over considerable distances in support of Regional Plan Northwest. The time taken to achieve this, even if it goes uncontested, can be inferred to be long (judging from the 90-day mobilisation times involved in exercises such as *Trident Juncture 2018*). Bases in Norway can offer forward positions from which to operate and are robustly defended.[18] However, the probable heavy prioritisation of Norwegian bases for attack by Russia early in a conflict, and the fact that they are in range of many of the shorter-ranged systems at Russia's disposal (such as the Iskander-M, which Russia fields in relatively large numbers) at a minimum introduces uncertainties regarding the extent to which they will be available. Compounding this, many Allied nations, including the UK, are also dependant on consolidated main operating bases and other capabilities – for example, national command and intelligence facilities reside in well-known locations. Critical civilian infrastructure is also consolidated – for example, the UK operates three liquefied natural gas terminals. This means that the air forces at Allied disposal, although considerable, would have to divide capacity between defensive and offensive counter-air operations. Distance would limit their sortie rates and thus limit their tempo of activity.

In a sense, then, both sides are running against the clock and have limited room for error. Early success in the air battle therefore depends on limiting the friction which friendly forces experience while maximising the friction imposed on the opponent. Seen this way, IAMD does not need to provide airtight protection to be effective. Instead, it needs to act as a 'force in being': a capability that cannot be ignored and that forces the opponent to spend more time and effort on suppressing it than its operational timetable allows.[19] By this measure, Russia's IAMD architecture on the Kola Peninsula arguably comes closer to the mark than NATO's, if only marginally. This is less a matter of technical superiority than of presence. Russian systems are already in place, whereas many of the platforms on which an Allied IAMD effort in the High North would depend must first deploy into theatre during a crisis and then be transferred to SACEUR's control. That process can be disrupted in several ways, including by poor platform readiness or by NATO activating its plans late in a crisis.

17. Sidharth Kaushal et al., *The Balance of Power Between NATO and Russia in the Arctic and High North,* RUSI Whitehall Paper 100 (Abingdon: Taylor & Francis, 2022), p. 27.
18. Jack Watling, 'NATO's Trident Juncture 2018 Exercise: Political Theatre with a Purpose', *RUSI Commentary*, 20 November 2018, https://www.rusi.org/explore-our-research/publications/commentary/natos-trident-juncture-2018-exercise-political-theatre-purpose, accessed 22 October 2026.
19. Julian Corbett, *Some Principles of Maritime Strategy* (Project Gutenberg, 2005), pp. 224–50.

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The air battle in the High North has several characteristics which distinguish it from, for example, the air battle in Ukraine or the fighting in Middle Eastern theatres such as the Red Sea and the Persian Gulf.

First, since the adversary threat is based on exquisite capabilities and a small number of launch platforms, the defensive challenge for both vessels at sea and critical infrastructure ashore is not mass. Distance and surveillance gaps are more significant challenges than magazine depth, so both sides have limited room for error.

Second, the nuclear dimension of the air battle in the High North cannot be ignored and this is especially relevant to maritime force protection. Since 2017, Russian naval doctrine has explicitly referenced the ability to inflict critical damage on an adversary navy with nuclear weapons as one of the criteria for effectiveness for the Russian navy (VMF).[20] This was recently reiterated by Aleksandr Moiseev, Commander-in-Chief of the VMF.[21] The physical destruction of a vessel by, for example, overpressure is more difficult to achieve than sometimes assumed – with Cold War experiments such as Operation *Crossroads* suggesting that a relatively large nuclear weapon needs to land within 800 m of a vessel to do critical structural damage. Yet, the impact of both electromagnetic pulse effects and contamination on operational tempo is potentially considerable.[22] The possibility that nuclear use at sea might not be viewed as politically comparable to use on or near land – given the limited civilian impact – has long been a matter of debate and concern, despite statements to the contrary.[23] This concern can only become more salient as a larger number of Allied forces become uncrewed.

The maritime component can play two roles within the wider air battle in the High North. First, the carrier air wing can contribute to both offensive and defensive counter-air (only to the extent that sufficient protection can be provided to aircraft carriers to move them towards the opponent). Second, the maritime component can feed into the wider sensor picture that the Alliance must build, in an area where it must track a small number of threats over a very large area.

20. President of Russia, « Указ Президента Российской Федерации от 20.07.2017 г. № 327 Об утверждении Основ государственной политики Российской Федерации в области военно-морской деятельности на период до 2030 года » [‘Decree of the President of the Russian Federation of 20.07.2017 No. 327 on the Fundamentals of the State Policy of the Russian Federation in the Field of Naval Activities for the Period Up to 2030’], 20 July 2017, http://kremlin.ru/acts/bank/42117, accessed 22 October 2026.
21. A A Moiseev, « Стратегические требования к развитию военно-морского потенциала России с учетом опыта специальной военной операции на Украине » [‘Strategic Requirements for the Development of Russia’s Naval Potential, Taking into Account the Experience of the Special Military Operation in Ukraine’], *Военная мысль* (Vol 9, 2024), pp. 8–21.
22. Sidharth Kaushal, ‘Nuclear Weapons at Sea: Is Their Use Viable’, *European Security and Defence*, 22 April 2024, https://euro-sd.com/2024/04/articles/37574/nuclear-weapons-at-sea-is-their-use-viable/, accessed 22 October 2026.
23. Desmond Ball, ‘Nuclear War at Sea’, *International Security* (Vol. 10, No. 3, Winter 1985–86), pp. 3–31.

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The Trajectory of the Russian Air Threat in the High North

The Russian air threat will not remain static, and it would be a mistake for naval planners to prepare for only the present Russian threat. However, this paper contends that the character of the threat will probably see fewer fundamental shifts than might be the case in other theatres.

Broadly, there are two types of air threat that a defensive system may encounter:

1. seeking to overcome a defence by compromising its decision-making; and
2. seeking to overwhelm an opponent through the saturation of its defensive systems, even if the threat missile is detected.

Compromising decision-making can be achieved through stealth, platform mobility or speed. Stealth or low observability limits the ranges at which detection and the development of fire control solutions can be achieved. Stealth can exist either at the level of the air threat itself – for example, via low observable cruise missiles or fifth-generation aircraft – or at the level of the surface platform from which an air threat is launched (for example, via submarines launching cruise missiles).

Platform mobility compresses decision-making time differently, by making it difficult to maintain a continuous track against a target, even if it is relatively easily detected. Russia's Tu-95 and Tu-160 bombers are an example of this; although these bombers are old and relatively easily detectable, their range allows them to cover a wide arc across the High North and the potential routes to the UK. The distances that these bombers can cover at relatively high speeds before launching their cruise missiles present a similar problem. Tracking them will require the coordination of a number of air- and surface-based radars to maintain contact, given the distances they can cover. Surface-based systems are (in many instances) limited by the horizon, while air-based assets have limited persistence. The possibility that mobile platforms launch their missiles from within a radar blind spot is compounded by the fact that the next generation of Russian air-launched cruise missiles, the 6,500-km range Kh-BD, will substantially increase the number of launch positions from which a bomber can launch cruise missiles.[24] The problem posed by mobility extends to missiles (and not only their platforms). For example, in Ukraine, Russian sea-launched Kalibr Cruise missiles can reportedly maneouver 147 times in flight.[25]

24. Thomas Newdick, 'Let's Talk About Russia's New Long-Range Kh-BD Cruise Missile', *The Warzone*, 19 September 2023, https://www.twz.com/lets-talk-about-russias-new-long-range-kh-bd-cruise-missile, accessed 22 October 2026.
25. Interfax, 'Russian Kalibr Missiles Fired on Targets in Syria Make 147 Turns in their Flight - Putin', 12 October 2015, https://www.interfax-russia.ru/military/news_eng/255300, accessed 18 November 2026.

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Additionally, the time available to a defender can be compressed through sheer speed. Supersonic anti-ship missiles such as the Russian Kh-22/32 and P-800 rely on speed to compress decision-making time. Although they typically cruise at high altitudes, limiting the impact of the radar horizon on surface-based radar, they offset this by covering the distance to their targets in a shorter time. Reliance on speed as a means of compressing decision-making time also characterises the hypersonic 3M22 Zircon and the air-launched Kinzhal ballistic missile (as well as ballistic missiles more broadly). Some threat types, such as hypersonic glide vehicles, combine speed and a degree of manoeuvrability, but the two qualities are still traded off against each other. When designing cruise missiles, speed is often traded off against range (all other things being equal with respect to size and fuel).

The second category of air threats seek to overwhelm an opponent by saturating the opponent's defensive systems. Saturation attacks can either overwhelm the logic of the air defence system by presenting it with more targets than it can handle, or they can take a more attritional form by running down interceptor stocks. Although saturation is a tactic and not a capability, systems which are cheaper and more scaleable, including one-way attack UAVs and cheaper cruise missiles, such as Ukraine's Flamingo, lend themselves to saturation attacks.

Additionally, climate and geography work against cheap mass. Strong winds for much of the year would reduce the reliability of one-way attack UAVs such as the Shahed / Geran.[26] Using them against moving targets, such as ships, would also require seekers and jet engines, which would narrow the cost gap with cruise missiles and make large saturation salvos harder to mount. Cheap cruise missiles such as the Ukrainian Flamingo or the Geran-5 might cope better with wind and could be launched from container ships on the Klub-K model.[27] They would still need temperature-controlled storage, however, and those sites would become high-value targets unless the missiles could be dispersed quickly.

Furthermore, the Kola Peninsula makes moving equipment away from bases difficult. This will directly affect whether Russia shifts from expensive bombers and SSGNs to cheaper ground-launched systems. Sparse road and rail links, and the difficulty of sustaining TELs (transporter-erector launchers) and crews far from main bases in winter, limit the viability of ground-launched missiles. These problems are solvable. Russia fields the P-800 coastal defence missile in its Bastion-P complex, but only with specialised vehicles and fuel blends that protect diesel engines and other

26. Windfinder, 'Norwegian Sea', https://www.windfinder.com/windstatistics/norwegian_sea, accessed 4 October 2026.
27. GlobalSecurity, 'Klub-K Container Launched 3M-54 Klub / Caliber – SS-N-27 Sizzler', https://www.globalsecurity.org/military/world/russia/club.htm, accessed 24 October 2026.

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systems from northern winters.[28] In an interview with a Russian outlet, a senior Russian officer also suggested that CDCM TELs practised long-distance patrols insufficiently, for precisely these reasons.[29] Because dispersing large numbers of TELs in the north or transporting missiles for loading on ships is neither cheap nor simple, Russia will continue to rely on highly mobile platforms such as aircraft and submarines.

This is not to suggest that the threat will not evolve. However, it will probably evolve within a familiar lineage, with a focus on platform mobility and speed. This makes launch platforms a bottleneck, albeit one not easily targeted.

There are several probable ways the threat will evolve. First, the addition of the fourth-and-a-half-generation aircraft such as the Su-57 and very low observable UCAVs (unmanned combat aerial vehicles), such as the S-70 Okhotnik, to the Russian arsenal will further enhance Russia's capacity to present a mobile low-observable threat in the region.[30] Both categories of aircraft will probably be fielded in limited numbers given programmatic delays, but the recovery of other Russian programmes (such as the *Yasen*-class SSGN) after initial long delays and overruns means that this should not be assumed. UCAVs offer Russia important opportunities, too. The absence of a pilot makes the adoption of shapes that minimise observability considerably easier – thus, stealth aircraft can leverage something with which Russia has traditionally struggled.[31]

Second, missile threat is also likely to evolve. The Zircon will probably join the supersonic P-800 on many Russian platforms, including SSGNs and surface ships, although there is some debate regarding whether the Zircon is a scramjet-powered cruise missile or is closer to a ballistic missile.[32] The relatively high reported rates of penetration achieved by Zircon against well-defended air defence bastions in Ukraine suggests that its high speed represents a considerable challenge for air defences.[33] The range of Russian air-launched subsonic cruise missiles will also be increased by the KH-BD.

28. Belevezhpromservice, 'Advanced Wheeled Chassis MZKT 7930 with Hydromechanical Transmission for Updated MLRS "Polonez-M" Qualified State Trials', https://www.bvpservice.by/en/novosti/advanced-wheeled-chassis-mzkt-7930-hydromechanical-transmission-updated-mlrs-polonez-m, accessed 24 October 2026.
29. Charles Bartles, 'The Modernization of Russia's Coastal Missiles', *OE Watch*, 2019, p. 3.
30. Kaushal et al., 'An Integrated Air and Missile Defence Architecture for the UK', p. 20.
31. Justin Bronk, 'First Flight of Russia's S-70 Okhotnik-B UCAV', *RUSI Defence Systems*, 9 August 2019, https://www.rusi.org/explore-our-research/publications/rusi-defence-systems/first-flight-russias-s-70-okhotnik-b-ucav, accessed 22 October 2026.
32. Fabin Hinz, 'Not Quite a Diamond', Luftlage Substack, 17 June 2026. https://luftlage.substack.com/p/not-quite-a-diamond, accessed 22 October 2026.
33. Illia Volynskyi, 'Hypersonic or Quasi-Ballistic? Inside Russia's Zircon Missiles Terrorising Kyiv', *Ukrainska Pravda*, 28 June 2026, https://www.pravda.com.ua/eng/articles/2026/06/28/8041466/, accessed 22 October 2026.

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Overall, the trajectory of the Russian threat appears stable but concerning, and the Russian bastion architecture will evolve as hypersonics and glide weapons become more prevalent. A formidable air threat is based around a relatively small number of launch platforms that must achieve early effects to serve wider Russian operational aims.

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The Maritime Contribution in the High North

This chapter assesses what Atlantic Shield can contribute to the IAMD battle in the High North.

The maritime component can contribute in two ways.

1. A carrier strike group (CSG) can be protected only if enough IAMD is available. If it is protected, its embarked F-35s can provide sensor coverage and engagement opportunities that make some Russian air approaches riskier.
2. Surface platforms in areas such as the Norwegian Sea can provide long-range detection of high-altitude targets on some approach routes. Ships combine large onboard power generation with mobility and persistence because these qualities suit them to tracking fast, high-altitude targets. This is why surface vessels are often used for ballistic missile defence.

The core contention of this paper is that Atlantic Shield platforms should be judged mainly by how well they perform the second role outlined above. Their task should be viewed in the context of enabling theatre air defence, a different philosophy from the task group defence for which destroyers such as the Type 45 were optimised. The uncrewed force will operate alongside both Allied crewed destroyers and, potentially, the Type 45 – the Royal Navy is studying whether to extend the Type 45's service life.[34] The Type 94's most valuable contribution is therefore long-range sensing and tracking of the fastest, highest-flying threats, which pose the most difficult problems. An effective theatre air defence system would also contribute to task group protection, as do the US Aegis destroyers, so the dichotomy between task group defence and theatre air defence is not absolute. This has implications for fleet and vessel design. In a theatre air defence context, the value of a disaggregated fleet thus lies in specialisation and the allocation of onboard power, not in mass or resilience.

34. *Navy Lookout*, 'Royal Navy to Study Extending Type 45 Destroyers Service Life', 28 August 2026, https://www.navylookout.com/royal-navy-to-study-extending-type-45-destroyer-service-life/, accessed 22 October 2026.

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Optimising for High-Altitude Bands

Many of the principal elements of the threat spectrum described above – including supersonic and hypersonic missiles, fixed-wing aircraft and UCAVs – operate at relatively high altitudes for substantial parts of their flight. Hypersonic cruise missiles, for example, typically cruise at altitudes of around 20,000 m, while quasi-ballistic missiles fly higher still.[35] The Kh-22 and Kh-32 likewise follow high-altitude trajectories before descending steeply towards their targets.[36] Such weapons primarily challenge air defence systems through speed and compressed engagement timelines rather than low observability. Lower-altitude approaches are nevertheless possible. Aircraft such as strategic bombers also cruise at relatively high altitudes of around 10,000 m, partially as a matter of efficiency in fuel expenditure.

The above should not be regarded as an absolute truth. Aircraft can fly at a low level, while missiles such as the P-800 can employ sea-skimming profiles. The Russian land-attack cruise missile threat also includes systems such as the 3M-14 Kalibr, which cruise at a relatively low altitude. However, altitude must generally be traded against range and operational flexibility. To launch an anti-ship missile on a low-altitude trajectory against a task group, for example, a platform such as an SSGN may have to approach more closely, increasing its exposure to the group's organic anti-submarine warfare (ASW) capabilities (including other hybrid fleet platforms).[37] Similarly, the longer a cruise missile remains at low altitude, the greater the penalty in fuel consumption, range and freedom of manoeuvre. Forcing an adversary towards low altitude profiles can therefore itself generate operational benefits.

The maritime component cannot, and is not expected to, provide the entirety of an IAMD solution. Other capabilities, including airborne early warning and control (AWACS) and fixed-wing aircraft (some of them carrier-based) can provide elevated sensing against lower-altitude targets. The maritime component's comparative advantage arguably lies in providing long-range detection and fire-control-quality tracks against higher-altitude threats. While this paper does not suggest an exclusive focus on this altitude band, it suggests that the uncrewed part of the maritime component of the IAMD architecture should be optimised for long-range detection and engagement in this part of the battlespace.

35. 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 22 October 2026.
36. Danylo Kramarenko, 'Nuclear Warfighter: Key Characteristics of Russian Tu-22M3 Bomber and Kh-22 "Blind" Missiles', *RBC Ukraine*, 29 December 2023, https://newsukraine.rbc.ua/news/nuclear-warfighter-key-characteristics-of-1703868824.html, accessed 22 October 2026; *Airforce Technology*, 'Tu-95 Bear Strategic Intercontinental Bomber', 20 September 2007, https://www.airforce-technology.com/projects/tu95bear/, accessed 22 October 2026.
37. Kaushal and Black, 'The Atlantic Bastion', p. 5.

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There are several reasons for this.

1. Surface-based radars can, all else being equal, draw substantially more power than airborne sensors and can therefore support greater detection ranges – particularly against targets above the radar horizon.
2. Early detection – and, where possible, early engagement – is especially valuable against high-altitude, high-speed weapons, because terminal engagement windows contract rapidly. This is particularly important for weapons whose trajectories require them to climb to altitude before accelerating or beginning their terminal descent. Some of the logic that underpins ballistic missile defence therefore also applies to the fastest high-altitude cruise and quasi-ballistic threats.
3. As launch platforms will probably remain an important bottleneck, the ability to track and, where feasible, engage platforms such as bombers in a wider area than is currently possible may have disproportionate operational and deterrent value. Even where the launch platform remains well beyond the task group's own engagement range – as may be the case for bombers launching land-attack cruise missiles – long-range maritime sensing can still contribute to the wider joint effort to detect, classify and track it.

Taken together, these considerations suggest that future specialised uncrewed ships should feature high-powered and longer-range radars. This will be distinct from the sensor architecture optimised primarily for local task group defence, as was the case with the Type 45's Type 1045 (SAMPSON) and long-range Radar 1046 radar. In the future, the emphasis should be on long-range effectors capable of exploiting the tracks such sensors generate, even if this implies cost and thus more limited magazine depth. Reach, rather than mass, should be the driving criteria in the High North. As the following chapter argues, fleet disaggregation can directly contribute to this objective. Its principal value, however, should not be understood simply as a means of generating additional hull numbers or mass. Rather, disaggregation creates the opportunity to specialise platforms for functions that are difficult to combine efficiently within a single combatant.

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Principles for the Conception of Atlantic Shield

This chapter focuses on the principles that should inform the way the Atlantic Shield concept is conceived, based on the theatre air defence function against a smaller but highly capable adversary target set.

Specialisation as a Means of Generating Reach

There are two ways in which the potential of uncrewed systems could be exploited. The first would be to minimise, where possible, both vessel and system integration complexity to generate mass. This approach would use a larger number of radars and launchers fielded to create a more resilient architecture that could sustain losses. In theory, it could also allow the geometry of the battlespace to be changed by making it possible to employ at least some interceptor-carrying vessels deeper within the adversary's weapons engagement zone which, in turn, could reduce the range of the interceptors used – lending itself to cost effectiveness and thus magazine depth.[38] Cheaper vessels could also be employed in forward positions, as passive receivers drawing returns from emitters of opportunity. This would extend the effective range of emitting platforms and would also contribute to the creation of a multistatic sensor network, which could prove useful for the tracking of objects built for very low observability (such as some UCAVs). For example, forward sensor nodes operating in passive mode could contribute to modes of tracking such as through passive coherent location.

The second way of addressing the question is that the ability of designers to build a vessel exclusively around a radar is the critical contribution that a single-purpose

38. Author interviews with Navy Develop, online, 23 July 2026.

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vessel can make to a wider radar picture. This answer points to an emphasis on leveraging this opportunity, even if this implies additional cost and thus less mass. A single-purpose vessel can dedicate most of its available space and power output to two functions: propulsion and supporting a radar. This is in contrast to a destroyer which must also allocate space and power generation to crew habitation, VLS systems and combat management, among other things. A single-purpose vessel's additional space can, in principle, accommodate larger radar apertures and higher power output (enabling detection and tracking at longer ranges), and do so at a lower cost than fitting the same systems to a multi-mission ship.

The evidence from other parts of the maritime domain suggests, moreover, that specialised sensor vessels capable of wide area search can be considerably less expensive than multifunctional capabilities. Take, for example, the US Navy's T-AGOS ASW vessels, which cost roughly half the price of an ASW frigate and generate far wider coverage.[39]

There are some advantages to having greater mass and thus more coverage, especially against sea-skimming threats whereby any individual vessel's detection range will be limited by the radar horizon (although airborne assets can still provide early warning). However, when weighing the trade-off between mass and specialisation in a context dominated by faster, higher-altitude threats, power and thus (all else being equal) range are of considerably greater value with respect to both the design of radar ships and the selection of interceptors. This is a function of several factors. The ability to engage some launch platforms at greater distances – for example, bombers carrying anti-ship missiles – carries disproportionate value for both deterrence and operations, since the adversary has a limited number of bombers. Against high-speed missiles, layering and thus the ability to engage at longer ranges is almost always the most effective solution, and is typically also the most cost effective, driving both sensor design and interceptor choices.[40] This is because the limited time between the creation of a fire control solution and impact at short ranges compels the ripple firing of interceptors, meaning that even considerably cheaper, shorter-ranged interceptors are expended at rates that offset any cost savings.[41]

Single-purpose sensor vessels can be sized around their sensors from the outset, with characteristics such as power generation, tonnage and hull form determined by the sensor. These vessels provide area sensor coverage against higher-altitude targets at a lower price point than a comparable guided-missile destroyer (DDG). The limiting factor on a DDG such as the Type 45 is not necessarily power, since the vessel generates

39. Austal, 'Austal USA Awarded Contract Valued up to US$3.195 Billion for up to Seven T-AGOS Surveillance Ships for the United States Navy', press release, 19 May 2023, https://www.austal.com/media-releases/austal-usa-awarded-contract-valued-us3195-billion-seven-t-agos-surveillance-ships, accessed 22 October 2026.
40. Eric Larson and Glenn Kent, *A New Methodology for Assessing Multilayer Missile Defense Options* (Santa Monica, CA: RAND, 1994), pp. 30–40.
41. *Ibid.*

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sufficient power to run a radar with a far higher output than the SAMPSON. However, longer-range radar such as the US SPY-6, to use a notional example, consume space and weight. For example, incorporating the SPY-6 radar on the *Arleigh Burke*-class Flight III added 400 tons of structural weight to the DDG across the radar and its supporting systems (such as cooling systems).[42] While the radar is relatively small compared with the overall size of a vessel, on a crewed system with existing installed systems this erodes thin-weight margins (as the SPY-6 programme manager noted in 2016).[43] The requirement to allocate space competes directly with crew support, allocation of space for combat information centre suites, VLS and close-in protection; this is not the case on a dedicated sensor vessel. Consequently, even in vessels notionally designed around radar, the systems and their supporting components are not allocated an especially large amount of weight or space. As an illustrative example, consider that propulsion and radar make up roughly 6% of a Type 45's weight, with the remainder taken up by other systems.[44] Consequently, a far greater portion of a vessel's weight-carrying capacity can be allocated to a more powerful radar on a single-purpose vessel.

Top-weight, on the other hand, represents a constraint which becomes more problematic on smaller vessels comparable to the proposed 100-m Type 94. A vessel built around its radar can be purpose-built to offset this. For example, a wider beam increases waterplane inertia and thus metacentric height. Spare space lower in the hull can house ballast to lower a vessel's centre of gravity. Both of these enable stabilisation. In addition, if one is optimising for high-altitude targets, mast height can (to some extent) be sacrificed. This is because additional height buys only marginal detection advantages against sea-skimming targets, while higher-altitude targets can be tracked with a lower-height mast.[45] Moreover, in the event of a Type 45 life extension, another vector for engaging sea-skimming systems exists.

Even so, the proposed approach, and its attendant requirement for top-weight and space, would probably exhaust the physical limits of a 100-m vessel. This would be compounded if the vessel also sometimes needed to keep pace with an aircraft carrier at 25 knots, as task group functions would not disappear even if theatre defence became the driving function. Illustratively, this would require 20 MW for a 4,000-ton

42. Otto Kreisher, 'Arleigh Burke Program Manager: Flight III Production "On Track"', *USNI News*, 22 February 2019, https://news.usni.org/2019/02/22/arleigh-burke-program-manager-flight-iii-production-on-track, accessed 22 October 2026.
43. Megan Eckstein, 'Navy, Industry Working Through DDG-51 Flight III Detail Design; Draft RFP for Ship Construction Released', *USNI News*, 12 November 2015, https://news.usni.org/2015/11/12/navy-industry-working-through-ddg-51-flight-iii-detail-design-draft-rfp-for-ship-construction-released, accessed 22 October 2026.
44. The weight of SAMPSON was derived from Carlos Ochoa Grau, *Ship Design Data Book* (London: UCL, 2011). The weights of the Type 45 induction motors, Wartsila engines and WR-21 gas turbines were derived from Grau, *Ship Design Data Book*, p. 120. See also Peter Czerniewski, 'The Type 45 Destroyer: Present and Future Capability', *Journal of Naval Engineering* (Vol. 40, No. 2, June 2002), p. 192.
45. Radar horizons can be calculated using the formula against a sea-skimming target. An additional 10 m of height only marginally changes the radar horizon.

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vessel. Powerplants which are proportionately larger relative to the vessel could abet this, as could integrated electrical propulsion. However, a requirement for both speed and power would probably drive an attendant requirement for space and vessel size. As such, rather than the navy specifying vessel length, a better approach to the design of the Type 94 would be to allow the desired radar to dictate the size and dimensions of the Type 94 USV (uncrewed surface vehicle).

One might object that the proposed approach would necessarily move the price point of a sensor vessel and would probably introduce both increased system complexity and reduced formation level mass. This is partly the case, and the proposed approach trades the optimisation of the vessel in terms of its sensor for additional cost as an acceptable choice in the specific context of the High North. Nonetheless, the absence of crewing requirements would still represent an organisational advantage, given recruitment and retention issues. Moreover, in the absence of life support and VLS, a Type 94 would still probably be considerably less expensive than a similarly equipped destroyer (even if it is not cheap). Although not a perfect analogue, the initial $445-million cost of a T-AGOS ship could provide a rough sense of the price of a single-purpose sensor vessel built around the requirement for detection.[46]

Another factor is worth considering. While vessel size is typically a proxy for cost and complexity, this is only because larger vessels carry a larger number of different complex systems on which the decision to accept additional size is typically made. Size is not, in itself, always a linear predictor for cost when a vessel is single purpose.[47] Illustratively, the cost differential between the US Navy's *Ticonderoga*- and *Arleigh Burke*-classes was minimal when both vessels were introduced, despite the former being both 10% longer and 20% heavier,[48] because their combat systems are largely identical. The wider air defence system, including the missile barge, could see its costs driven down by efforts to economise on the cost of the Type 91. A vessel designed purely to act as a missile carrier could cost roughly $250 million (based on the anticipated cost of the US Navy LUSV [large uncrewed surface vehicle] and the Australian large optionally crewed vessel).[49]

Additionally, against targets such as air-launched supersonic cruise missiles and hypersonics, it may be a false economy to compromise on range to have more sensors.

46. Austal, 'Austal USA Awarded Contract Valued up to US$3.195 Billion for up to Seven T-AGOS Surveillance Ships for the United States Navy', press release, 19 May 2023, https://www.austal.com/media-releases/ austal-usa-awarded-contract-valued-us3195-billion-seven-t-agos-surveillance-ships, accessed 22 October 2026.
47. Mark V Arena et al., *Why Has the Cost of Navy Ships Risen? A Macroscopic Examination of the Trends in U.S. Naval Ship Costs over the Past Several Decades* (Santa Monica, CA: RAND, 2006), p. 6.
48. Commander, Naval Surface Force Atlantic, 'Cruisers – CG', https://www.surflant.usff.navy.mil/Organization/Operational-Forces/Cruisers/Ticonderoga-Class-Cruiser-CG-Info-Page/, accessed 22 October 2026; Alva Bowen and Ronald O'Rourke, 'DDG-51 and the Future Surface Navy', *Proceedings* (Vol. 111, No. 5, May 1985). https://www.usni.org/magazines/proceedings/1985/may/ddg-51-and-future-surface-navy, accessed 22 October 2026.
49. *Maritime Executive*, 'Australia Plans to Buy Unmanned Warships', 19 February 2024, https://maritime-executive.com/index.php/article/australia-plans-to-buy-unmanned-warships, accessed 22 October 2026.

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To provide depth against high-speed threats, sensor vessels with less power and interceptor vessels with shorter-ranged interceptors would probably have to be pushed closer to an opponent and thus within the engagement envelopes of other air threats. The attrition rates of destroyer pickets against kamikazes during the Second World War illustrates the risks of pushing vessels closer to an opponent, away from the main formation.[50] Notional additional mass may, then, quickly dissipate (because additional mass is offset by additional attrition against vessels which, although less expensive than crewed assets, will not be cheap).[51] Clustering around a task group, by contrast, would limit engagement times for less powerful sensors and for less capable effectors. Moreover, concentrating individually cheap vessels into an expensive and geographically clustered formation runs against the logic of distribution and resilience, which justifies a focus on many cheaper vessels. By contrast, longer-range sensors, although also high-value targets, can be more effective from positions closer to a task group and can provide depth without a requirement to operate closer to an opponent.

Several features of the operating environment place a floor under the cost of any vessel in this role. The sea states of the High North (often up to sea state 6 – a very rough sea) impose demands on hull form and structure. A requirement to keep pace with a carrier group – should force protection be among the vessel's functions – adds to size and power. In a context where electromagnetic pulse effects are plausible, hardening will add cost again, and the assurance of communications across a distributed force will become correspondingly harder. A vessel capable of operating and surviving in this environment is therefore already expensive. Against that baseline, marginal savings sought through reduced size represent a false economy.

The nuclear dimension also shapes where interception should occur. A short-range intercept of a nuclear-armed missile may still expose a formation to fallout, generating decontamination requirements that will slow operational tempo. An airburst detonation (explosion of a nuclear device in the air or atmosphere above a target), moreover, would leave less time for shorter-range interception. This provides a further incentive to engage at the greatest distance the architecture allows.

Certainly, even a high-power radar is constrained by factors such as the radar horizon against low flying objects, against which airborne sources of ISR such as the E-7 AWACs would be critical. Still, many of the threat platforms and effectors – and especially high-speed targets – that will probably be encountered will fly at a high altitude for much of their entire trajectories.

50. Trent Hone, 'Countering the Kamikaze', *Naval History* (Vol. 34, No. 5, October 2020), pp. 28–35.
51. Based on the cost of US Navy large uncrewed surface vehicles. See *Combat Tech*, 'LUSV, MUSV, and Orca: Inside the Navy's $3 Billion Gamble on Crewless Warships', 16 September 2025, https://www.combattech.net/navy-unmanned-vessels-lusv-musv-orca-budget-crisis-2025/, accessed 22 October 2026.

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Consequently, cost reductions and scale might most effectively be sought within the missile barge, whereas the value of disaggregation as it relates to the sensor vessel should be viewed as flowing from its specialisation. Relatedly, to capitalise on the detection advantages provided by long-range sensors, the system should have longer-ranged effectors than are currently fielded – which would dictate the balance between allocating VLS capacity to future blocks of the Aster-30 and the common anti-air modular missile.

Adding Complexity to Targeting the Adversary

While this paper has so far focused on the vessel types announced by the Royal Navy as part of its air defence solution, a wider range of USVs is being considered under the hybrid fleet concept. This means that the planned force model could be used as a nucleus for a range of other, simpler vessels which could contribute to the IAMD battle by complicating adversary targeting.

At the moment, much of the emphasis of maritime electronic warfare (EW) is aimed at defeating missile seekers and building the local threat picture. Russian maritime targeting depends on a sequence. Wide-area ELINT (electronic intelligence) provides the initial cue, which is then used to direct sensors with much narrower fields of view – for example, radar satellites and maritime patrol aircraft – onto a confined search area. Decoy emissions degrade that first step, and by extension, limit the utility of the narrow-field sensors that depend on it. While EW against missiles themselves would probably be best placed on crewed assets within a task group, EW emitters require separation to draw ISR away from a task group. These emitters would benefit from dedicated vessels which, if they carried nothing but an emitter, need not be especially expensive. For example, the unit cost of the US Navy's medium USV, which carries a weight comparable to most EW systems, is about $40 million.[52] A vessel with more endurance and sea-state durability would cost more, but the point is that unlike, for example, a sensor vessel, a vessel intended to haul a single payload (which is less complex than an integral radar) can be procured for little cost.

History provides indicators of how decoy vessels could be used. During the Cold War, the US Navy's CSGs were increasingly held at-risk by Soviet naval aviation and by SSGNs, which (it was assumed) would launch nuclear weapons at them (not least since the carrier air wings themselves carried atomic payloads). Avoiding detection and thus engagement entirely was deemed unviable. This drove the *Haystack* exercises, begun in 1956, which tested tactical deception, dispersion and anti-submarine / air defence concepts, and the *Uptide* series of ASW and tactical

52. Mallory Shelbourne, '3 Louisiana Shipyards to Build 30 Drone Ships in $1.2B Navy MUSV Deal', *USNI News*, 29 September 2026, https://news.usni.org/2026/09/29/3-louisiana-shipyards-to-build-30-drone-ships-in-navy-musv-deal, accessed 22 October 2026.

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experiments carried out from 1969 to 1972.[53] Both involved vessels clinging to littoral clutter where possible, the use of EMCON (emission control) and electronic deception to draw ELINT aircraft and the use of acoustic decoys in the latter series of experiments.

The exercises were a mixed success – the aircraft carriers survived long enough to conduct strikes, despite being eventually detected and engaged by the red force. Operating near littoral clutter confused adversary targeting but also made it harder for destroyers to operate once detected due to clutter. Additionally, communication under EMCON imposed relatively self-explanatory challenges.[54]

Even so, the exercises did demonstrate the promise of deception against an opponent reliant on ELINT for its early intelligence sweeps. Of note were several instances in which the aggressor force's ELINT aircraft were drawn into positions from which they could be engaged by the creation of false positives.[55]

Russia remains reliant on ELINT satellites such as the PION-NKS for the early detection of vessels at sea, along with maritime patrol aircraft such as the IL-38N, and ELINT aircraft like the IL-20. In the future, larger and longer-endurance UCAVs could also probably play an important role, although early evidence on naval UAV regiments suggests a focus on shorter-ranged systems, such as the Forpost, is more relevant to coastal defence.[56] Beyond Russia's coastal defence zone (out to 500 km), ELINT will probably be a primary means of gathering less granular data over wide areas to cue other assets, such as aircraft.

Given the limited number of platforms for sweeps, the loss of relatively scarce platforms (such as Backfires) or ISR assets (such as maritime patrol aircraft) can have a considerable impact on the opening stages of a conflict. A requirement for more careful surveillance and route planning to offset the impact of uncertainty can affect a conflict's opening stages, too, and the need for this could rob Russia of valuable time in the initial period of a war.

53. Robert G Angevine, 'Hiding in Plain Sight – The US Navy and Dispersed Operations under EMCON, 1956–1972', *Naval War College Review* (Vol. 64, No. 2, Spring 2011), pp. 81–99.
54. *Ibid.*
55. *Ibid.*, p. 82.
56. Kaushal et al., *The Balance of Power between Russia and NATO in the Arctic and High North*, pp. 30–40; Sam Cranny-Evans, 'The Future of Drones in the Russian Armed Forces', *RUSI Defence Systems*, 7 July 2025, https://www.rusi.org/explore-our-research/publications/rusi-defence-systems/future-drones-russian-armed-forces, accessed 22 October 2026.

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Uncrewed systems can enable deception to be conducted in ways that were not as easily contemplated with crewed assets. This is the case for several reasons.

1. Decoy vessels can be distributed more widely. Under current conditions, decoy emissions to draw attention would require the distribution of ships that also had other functions. These functions could, for example, include destroyers which had an air defence role; this would impose trade-offs on the defending force.[57] These trade-offs would be less apparent with single-purpose uncrewed emitters.
2. Crewed assets – even when commanders had considerable risk appetites – could not be used purely as decoys to draw fire.
3. Uncrewed systems can enable a more risk-acceptant emissions policy. Currently, the policy that dictates when and how vessels emit is one of the more complex choices facing a task group commander. Expendable emitters that do not give away the fleet could change this.

It is worth noting that operating EW emitters would require less power than, for example, sensors and would not necessarily require larger uncrewed systems. Russia's Murmansk-BN consumes 400 KW of power, for example.[58] Platforms with a dedicated EW function, such as radar picket vessels, could dedicate a proportionately larger amount of their output to EW.

Single-function uncrewed systems could be used as dedicated EW vessels to affect the tempo of Russian attacks as well as to draw both long-range aviation and missile-carrying platforms in ways that expose them to being engaged. Currently, most maritime electronic decoying is non-persistent, with decoys such as the rocket-propelled Nulka[59] or towed decoys deployed offboard from crewed ships under attack to target missile seekers.

There is qualified, historical evidence that – at least with respect to task group defence – soft-kill solutions can predominate, albeit with notable exceptions such as the Falklands War. Between the 1967 sinking of the Israeli vessel *Eilat* in the Six-Day War – the first use of an anti-ship cruise missile (ASCM) – and in the late 20th Century, the majority of ASCM defeats were achieved by soft-kill methods.[60] This data is partly skewed, as a large part of the dataset is derived from fighting between Israel and its neighbours in which neither side possessed air defence destroyers or credible hard-kill solutions. More recent fighting in the Red Sea against the Houthis, as part of Operation *Prosperity Guardian* (2023–25), has changed this balance somewhat – with the

57. Angevine, 'Hiding in Plain Sight – The US Navy and Dispersed Operations under EMCON, 1956–1972', p. 83.
58. Thomas Withington, 'Murmurs of Murmansk', *Armada International*, 4 September 2024, https://www.armadainternational.com/2024/09/murmansk-electronic-warfare-system-iran/, accessed 6 October 2026.
59. BAE Systems, 'Nulka Active Missile Decoy', https://www.baesystems.com/en/product/nulka, accessed 12 November 2026.
60. John C Schulte, 'An Analysis of the Historical Effectiveness of Anti-Ship Cruise Missiles in Littoral Warfare', thesis, Naval Postgraduate School, September 1994, https://calhoun.nps.edu/entities/publication/fa49adf3-5a8e-4e5e-8aca-5aad228317ab, accessed 22 October 2026.

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expenditure of roughly 220 interceptors by coalition naval forces for both self-protection and the defence of civilian shipping.[61]

However, more recent data also illustrates the relative importance of denying an opponent scouting opportunities as compared with generating additional magazine depth. The average expenditure rate of interceptors per incoming missile in the Red Sea was two interceptors per incoming missile.[62] Since the majority of the missiles employed in the Red Sea were subsonic ASCMs rather than supersonic short-range Asef anti-ship ballistic missiles, a target set which was comprised largely of supersonic or hypersonic missiles would probably compel a greater level of expenditure. Therefore, if an opponent achieves multiple scouting and thus engagement opportunities, the impact of more magazine depth is real but marginal. A ratio of three interceptors to each incoming target – assuming higher expenditure against supersonic targets – would mean that even a considerable increase in magazine depth would not necessarily offset the scale of interceptor expenditure. For example, the loadout of an *Oscar II*-class SSGN (comprising 72 missiles) would, in theory, be able to absorb the interceptor capacity of a force with double the VLS capacity of the two Type 45 destroyers that would normally accompany an aircraft carrier at the same rate of expenditure.[63] More magazine depth through both offboard VLS and quad-packing only partly resolves the problem if an opponent gets multiple scouting opportunities and multiple effectors are allocated to any target. Depth of detection – and thus optimising a shot doctrine – remains the most viable means of conserving magazine capacity.

Since the details of both interceptor probability of kill (Pk) and the probable success rates of EW are highly classified, there is no accurate way in which the specifics of engagements can be modelled. However, using a Monte Carlo simulation run by the author, in which an engagement was simulated 1,000 times with combat dynamics (based on a variant of Wayne P Hughes Jr's salvo combat models[64]), with varying values for both interceptor single-shot probabilities of kill (SSPk) and EW effects, potential crossover points can be identified. Crossover points signify the juncture at which the utility of greater magazine depth outweighs the utility of decoying. Both the red and blue forces in this simulation are highly stylised – the red force comprising 30 bombers and two SSGNs and the blue force comprising an aircraft carrier and any mix of either missile barges, radar vessels or decoy vessels. The baseline scouting likelihood over a period of seven days is roughly two successful scouting events. This is a proxy measurement based on modelling of China's anti-access network in Asia a decade ago

61. Alison Bath, 'Navy Fired More than 200 Missiles to Fight off Red Sea Shipping Attacks, Admiral Says', *Stars and Stripes*, 16 January 2025, https://www.stripes.com/branches/navy/2025-01-16/houthis-navy-red-sea-missiles-drones-16500246.html, accessed 22 October 2026.
62. *Ibid*.
63. Each Type 45 has 48 Sylver VLS.
64. See Wayne P Hughes Jr and Robert P Girrier, *Fleet Tactics and Naval Operations,* Third Edition (Annapolis, MD: Naval Institute Press, 2018), pp. 263–70.

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(which is a rough analogue for Russia), but the possibility of variance either due to disruption or improved ISR is modelled.[65]

The key finding is that both magazine depth and decoys add value by different mechanisms. Magazine depth enables a 'greedy' shot doctrine – more interceptors to each target, which increases the overall Pk, while decoys deliver greatest value by complicating scouting and subsequent targeting. Unlike Hughes' original model, the prospect of detection leading to targeting is treated as a variable rather than a fixed outcome. This variable outcome is a function of decoy effectiveness, which also has an impact on missile Pk. Across most values, the independent effect of marginal improvements in decoy effectiveness outperforms additional magazine depth and thus Pk. Notably, this would change in a longer war. In Ukraine, for example, software on both drones and EW systems must be updated on six-week cycles to keep up with adversary adaptation.[66] However, in a theatre such as the High North, short war assumptions which may not hold elsewhere in Europe may be valid.

Table 2: The Impact of Decoying Compared with Other Factors

Driver	Probability range / value distribution	Probability (carrier mission kill)
Scouting success	0.1–0.9	20–86%
Decoy success	0.0–0.8	81–44%
Interceptor Pk	0.3–0.9	68–49%
Magazine depth / fire control shot ceiling	2–6	65–57%

Source: Author generated.

Note: The Monte Carlo simulation was created through Python coding software, using code generated with AI support (Claude model), based on Wayne P Hughes Jr's salvo combat model, Wayne P Hughes Jr and Robert P Girrier, *Fleet Tactics and Naval Operations,* Third Edition (Annapolis, MD: Naval Institute Press, 2018), pp. 263–70. The author's variant departs from Hughes' original model in several areas, such as including the impact of collapsing engagement windows, but maintains its core structure. Each row varies one driver across the stated range while the others are held at their baseline values, which are non-zero. Although highly stylised models have significant limitations, they can serve as a baseline for more granular work.

At the level of theatre IAMD (as opposed to task group defence), decoys can potentially exercise an indirect effect on Russia's tempo of air activity. The more emitters Russian planners must account for, the more effort they must commit to surveillance, identification and route mapping. In past and ongoing conflicts, even intermittent losses to unidentified surface-to-air missile (SAM) systems have forced costly and time-consuming adaptations. In Kosovo, for example, the threat of Serbian SAMs led to the

65. Eric Heginbotham et al., *The U.S.-China Military Scorecard: Forces, Geography, and the Evolving Balance of Power, 1996–2017* (Santa Monica, CA: RAND, 2015), pp. 60–80.
66. Sidharth Kaushal, Justin Bronk and Jack Watling, 'Pathways Towards Multi-Domain Integration for UK Robotic and Autonomous Systems', *RUSI Occasional Papers* (October 2023), https://www.rusi.org/explore-our-research/publications/occasional-papers/pathways-towards-multi-domain-integration-uk-robotic-and-autonomous-systems, accessed 22 October 2026.

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imposition of minimum operating altitudes, which reduced the effectiveness of Allied air power against Serbian ground forces.[67] Similarly, in Ukraine, the SAM threat has compelled Russia to precede missile strikes with ELINT soaks by IL-20s and more recently use Shaheds as pathfinders to enable effective route mapping for cruise missiles. If an opponent believes the initial period of conflict is critical (as Russia does), a multiplication of the targets it must classify represents a challenge: not because it lacks the ability to sift relevant targets from decoys, but because the time spent doing so represents a disruption to early campaign planning.

Certainly, there will be times when it is easy for Russia's force to sift the signal from the noise. For example, when a high-powered radar emits, it will announce both its own presence and that of nearby ships. However, since radar are not always emitting – and when they do, they are not always operating at peak power (which is a function of radar policy and task group commander judgement) – there will be many instances when sifting the signal from the noise will not be straightforward. This is a resolvable problem for Russia, but adds time to an alreaey time-constrained process.

Missile Barges as a Shaping Tool

Since the Type 91 has both an offensive and a defensive role, it can play an important role in shaping the allocation of Russian assets. As noted in previous papers examining the Atlantic Series, statements by Russian senior officers, including Chief of the General Staff Valery Gerasimov and Nikolai Yevmenov, former commander-in-chief of the Russian navy, indicate a disproportionate interest in suppressing sea-launched cruise missiles, given the strategic threat the latter are deemed to pose.[68] The way in which the Type 91 barges are distributed can thus shape the way in which assets, such as bombers equipped with air-launched cruise missiles, are allocated and therefore set the conditions for counteracting steps to be taken. Rather than hunting for Russian assets over a wide area, the disposition of missile barges can be used to draw some missile-carrying platforms to preprepared terrain. The way in which the Soviets planned to use the *Kiev*-class carrier during the Cold War is a useful analogy here. Since it was understood that Western doctrine would prioritise the destruction of aircraft carriers, the Soviets planned to use the carriers as bait to draw in Western capabilities and narrow the search boxes for Russian submarines and aircraft.

67. Benjamin S Lambeth, *NATO's Air War for Kosovo: A Strategic and Operational Assessment* (Santa Monica, CA: RAND, 2001), pp. 100–20.
68. N A Yevmenov, « Основные тенденции угроз Российской Федерации, исходящих из океанического направления » ['Main Trends in Threats to the Russian Federation Emerging from the Oceanic Direction'], *Военная мысль* (Vol. 19, 2023), pp. 19–25.

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Risk Mitigation

The model outlined in the previous chapter has opportunities, but there are also risks worth considering that are associated with a disaggregated fleet (particularly of the kind for which this paper advocates). The model of Atlantic Shield discussed in this paper embraces higher system complexity with respect to sensor vessels, which potentially compounds inherent first-of-a-kind risks. While the author believes this to be operationally justifiable, this risk must be hedged against. In addition, any disaggregated air defence solution will face certain general risks with respect to network assurance. This chapter discusses risk mitigation with respect to both the concept as a whole and the specific version supported by the paper.

Datalinks and Command-and-Control Assurance

Command-and-control assurance will probably be a major consideration with any disaggregated force, especially if there is a requirement for data to be passed with low latency between nodes such as the CCV, the Type 94 and the Type 91.

It is possible to maintain low-latency communications, albeit with a requirement for line-of-sight communications, which drives a clustering of the force. This is compounded by the number of handovers which must be performed within a network between a radar and a command ship, and a command ship and a missile barge. Each adds small margins to an engagement. Although this may seem insignificant, these margins may have to be compensated for through the ability of an interceptor to seek and engage a target (determined by its seeker sweep-width and kinematic performance).[69] High-granularity seekers, such as Ka-band seekers – which are optimal against some targets, such as ballistic missiles – typically have narrow apertures due to their high frequencies. Other modes of engagement, such as semi-active radar homing or the use of less granular seekers with a wider sweep width, are suboptimal against high-speed targets such as ballistic missiles. The impact of Russian EW in the High North, which includes long-range complexes such as the Murmansk-BN, further complicates the latency challenge.[70]

One way to minimise the impact of this challenge would be to offset the temporal lag caused by handovers through fully automatic engagement modes. Time lost at one step of the process could be regained at the next. Many destroyers have a fully autonomous mode, and as the experience of recent conflict has shown, civilian aircraft rapidly stop

69. Warren J Boord and John B Hoffman, *Air and Missile Defense Systems Engineering* (Boca Raton, FL: CRC Press, 2016), p. 171.
70. On the Murmansk-BN, see Withington, 'Murmurs of Murmansk'.

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flying in a contested area.[71] Furthermore, there is comparatively little civilian air activity in the High North at any given time, so this would not differ from the way existing destroyers have (but only rarely use) fully autonomous modes of operation.[72]

Low-latency communication also probably imposes a requirement for proximity. However, the most important contribution of disaggregation need not, necessarily, be physical distribution. A cluster of vessels would represent a high-value but also robustly defended target, if the specialisation of the vessels' sensors expands their effective defended area against probable threat types.

The problem of latency is not uniform and is largely driven by the highest-speed threats. Against other threat types, such as subsonic and supersonic cruise missiles, there may indeed be options to better exploit data held across the wider IAMD architecture. For example, while broadcasting in Link 16 may be an unacceptable risk for aircraft within an adversary's weapons engagement zone, this may be considerably less problematic for aircraft in the Norwegian Sea, operating at some distance from the ground-based IADS on the Kola Peninsula. As shown by tests at the White Sands Test Facility, in which Patriot batteries were able to engage based on tracks from an F-35, publish–subscribe models can enable the translation of data across formats in ways that makes the sharing of tracks easier.[73] Hosting the processing power to enable this might be the most important role of the CCV, although this could also be held at the Maritime Operations Centre.

Maintenance and Sustainment

The larger the number of vessels, the greater their requirement for support – ranging from refuelling at sea to the maintenance of subcomponents. One potential weakness of the high-power, high-range model which this paper proposes is that it has the potential to exacerbate this challenge.

However, a hybrid force design will not necessarily radically change requirements for solid stores, many of which sustain crews. There are, moreover, solutions at the level of force design and structure which can mitigate this challenge. Moreover, the concept of employment which flows from the problem set described in previous chapters also provides some mitigations.

71. See, for example, ITIJ, 'International Travel Health and Insurance Journal. Airlines Extend Middle East Flight Suspensions Amid Renewed Attacks on Saudi Arabia', 13 November 2026, https://www.itij.com/latest/news/airlines-extend-middle-east-flight-suspensions-amid-renewed-attacks-saudi-arabia, accessed 13 November 2026.
72. David B Larter, 'The Drift: NavyCon Edition', *Defense News*, 23 July 2020, https://www.defensenews.com/naval/the-drift/2020/07/23/the-drift-navycon-edition/, accessed 22 October 2026.
73. Sidharth Kaushal and Jack Watling, 'Requirements for the Command and Control of the UK's Ground-Based Air Defence', *RUSI Occasional Papers* (April 2024), p. 82, https://www.rusi.org/explore-our-research/publications/occasional-papers/requirements-command-and-control-uks-ground-based-air-defence, accessed 22 October 2026.

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First, consider that the hybrid fleet will operate as part of an Alliance framework. As a conflict progresses, DDGs and air defence assets from a number of Allied states will probably flow north as part of NATO's Regional Plan Northwest. Russia might enjoy specific advantages in the early stages of the transition from crisis to conflict, before the weight of Allied maritime power has been mobilised. The Royal Navy might be required to fill regional gaps alongside Scandinavian partners and other Allies during this period, possibly as part of a Joint Expeditionary Force framework. If the task is to provide a blunting capability in the early stages of a conflict, this bounds the requirement for a hybrid air defence capability; air defence needs to endure for long enough for other assets to be flowed into the theatre from across the Alliance. Some missions, such as the defence of a CSG, will probably be standing requirements; however, since the Royal Navy is working to incorporate Allies into the operation of the CSG – as seen during recent Operation *Highmast* – some erosion of the initially deployed capability could be offset by Allies as a campaign progresses.[74]

Second, the requirement for sustainment could be reduced by a pulse model of force deployment, which would see the hybrid fleet treated as an Article 5 capability, while other platforms (such as the Type 31) would be used in more regular deployments. This could see vessels retained in port and surged in a crisis for the early stages of the transition from crisis to conflict. This is corroborated by evidence from the use of crewed ships, where deployments beyond scheduled maintenance windows have often driven considerably higher maintenance requirements. Conversely, vessels retained at readiness and surged in a crisis can have major maintenance issues resolved on a pre-deployment basis, in a manner which delays (without eliminating) demands for maintenance.[75] The operation of uncrewed systems by partner states would also seem to validate this. Since the US Navy has demonstrated 30 days of operation without human intervention with its 90-m LUSV, a surge model could be consistent with a low maintenance and sustainment demand if it is assumed that the force is effectively a first-battle capability which will be relieved by Allied crewed assets.

Third, the forward sustainment of some vessels (particularly radar ships) might occur in Norwegian ports, especially in the early stages of a crisis before the risks of proximity outweigh the utility of forward sustainment. This could reduce transit times and sustainment requirements. It is difficult to move armed ships and dangerous goods across jurisdictions, and this challenge is compounded if crews must be deployed overseas for extended periods. Yet, if arrangements for refuelling can be made in Allied ports, the forward deployment of radar ships could be carried out more readily.

74. Royal Navy, 'Carrier Mission Forges Future of Anglo-Norwegian Naval Cooperation in the Atlantic', 4 November 2025, https://www.royalnavy.mod.uk/news/2025/november/04/20251104-carrier-mission-forges-future-of-anglo-norwegian-naval-cooperation-in-the-atlantic, accessed 22 October 2026.
75. Government Accountability Office (GAO), 'Force Structure: Navy Needs to Fully Evaluate Options and Provide Standard Guidance for Implementing Surface Ship Rotational Crewing', GAO-05-10, November 2004, pp. 32–40, https://www.gao.gov/products/gao-05-10, accessed 2 November 2026.

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(Some maintenance crews might have to be rotated forward to achieve this.) This would also enable a degree of peacetime distribution of the fleet, making it a less concentrated target for pre-emptive attack in known UK ports – although the use of positions closer to the threat bring their own risks. Forward sustainment of radar vessels would narrow the problem set.

System Complexity

As noted in the introduction, first-in-kind projects tend to carry disproportionate risks. And in some ways, the author's proposed model exacerbates the challenge by proposing an especially complex radar vessel.

The timetable for the delivery of a hybrid air defence solution can prove useful in this area. The Type 45 will be retired from service between the mid-2030s and 2038 and may now see its service life extended beyond this point. This allows for different components of a hybrid fleet to be delivered at different speeds.

For example, missile barges can be delivered first, being the simpler components of the fleet. These vessels can be paired with the Type 45 while it is still in service, in a model similar to those adopted by partners in the Netherlands and the US. Crucially, the experience gained with operating USVs which are similar to those being deployed in other navies might provide a stepping stone to the fielding of more complex systems, such as the Type 94. One of the most effective safeguards against the risk of first-in-kind projects is disaggregation and iteration. Accordingly, a stepping stone approach to fielding the hybrid air defence solution – parts of which are delivered in the service life of the Type 45 – would be both appropriate and in line with the Royal Navy's 'wise pivot' approach.[76] It would also allow the Royal Navy to begin the transition to capabilities (specifically, missile barges) which are not themselves first-in-kind systems, since comparable USVs are being fielded by several navies. Lessons learned could then be applied to the design of the radar ship, which will probably be the most complex component of the air defence system.

76. Ministry of Defence, 'Maritime Operating Concept (MarOpC)', 8 September 2022, last updated 2 February 2023, https://www.gov.uk/government/publications/maritime-operating-concept-maropc, accessed 24 October 2026.

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Conclusion

The adoption of a hybrid approach to air defence can have specific utility in the context of the air battle in the High North. This utility should not, however, be conflated with mass. In a theatre likely to be dominated by exquisite platforms, the key contribution which disaggregation can make to the fleet is specialisation rather than scale. Although single-purpose platforms can also lend themselves to scale, this is not their primary contribution.

Winning the battle to create a more robust sensor picture – both through the expansion of the fleet's own contribution to the wider air picture and through counter-ISR against adversary ELINT – could be the most important contribution that a focus on single-purpose platforms and specialisation can make to the IAMD battle in the High North. Within this context, the ability to build platforms around specific functions, and in particular specific sensors, could be a significant advantage.

The key recommendation of this paper is that theatre air defence, and the attendant requirement for specialisation, should drive the way the hybrid fleet is designed. This would imply the acceptance of size and (potentially) cost, particularly with respect to the sensor vessel. However, a focus on mass is suboptimal in the High North. A smaller number of vessels can exploit the potential that autonomy creates for specialisation in the High North, and these vessels can thus have a disproportionate effect. Not all specialised solutions, however, need to be expensive – electronic decoy vessels represent a cost-effective tool with which to disrupt an opponent with considerable kill-chain limitations.

Since the Royal Navy's vision is a first-of-a-kind project, an incremental approach to delivering it could help mitigate risks. This approach begins with missile barges and decoy ships – the simpler components of the architecture. Relatedly, the extension of the service life of the Type 45 can play an important role in supporting the hybrid approach to air defence. The Type 45 can provide a hedge against first-of-a-kind project risk and can also make it possible for the simpler vessels in the force (such as missile barges) to be delivered first as accompaniments to the Type 45, allowing more time to deliver the more complex components of the fleet.

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There is, overall, a robust case for a hybrid approach to the maritime contribution to air defence in the High North. A contribution to theatre air defence can have significant ramifications for both power projection and the protection of the UK homeland. To realise the potential of an approach that leverages autonomy, the correct aspects of a disaggregated fleet must be emphasised.

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About the Author

Sidharth Kaushal is a Senior Research Fellow in Seapower at RUSI. His research at RUSI covers the impact of technology on maritime doctrine in the 21st century and the role of seapower in a state's grand strategy. Sidharth has a doctorate in International Relations from the London School of Economics, where his research examined how strategic culture shapes the contours of a nation's grand strategy.

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