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The requirement for missile and air defence

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EXECUTIVE SUMMARY

- There is a growing recognition that Britain's air and missile defences need improvement given the development and proliferation of missile threats, not least from Russia's Northern Fleet.
- However, there is a lack of clarity on what the United Kingdom's (UK) requirements should be.
- The push towards Integrated Air and Missile Defences (IAMD) should come alongside efforts to put opponents on the back foot. Efforts to improve the UK's ability to go after launch platforms reduces the number of missiles IAMD will have to contend with.
- UK IAMD should be tailored towards the most significant dangers and prioritise the most important infrastructure to defend, and be flexible enough to adapt to changes in the threat picture.

> *Our geography makes the threats facing the UK different from those facing many of our allies. Solutions preferred by some will therefore not necessarily be suitable for us. However, our geography should not and does not make us complacent.*[1]
>
> **Maria Eagle MP**, Minister of State for Defence Procurement and Industry

The United Kingdom (UK), informed by its experience of V1 and V2 attacks at the end of the Second World War, was awake to the missile threat during the Cold War. But the post-Cold War era saw missile defence take a backseat in national security requirements.

Events in recent years, such as videos of Iran's ballistic missile bombardment of Israel in October 2024 and images of destroyed Ukrainian buildings in the aftermath of Russian strikes, have captured public awareness. This has led to an array of articles calling for an 'Iron Dome' for Britain.[2] However, the Iron Dome is the name of one element (designed to intercept short-range rockets) of Israel's wider missile defences, often erroneously used to describe the whole system of systems.[3]

Missile defences represent a diverse, and expensive, set of capabilities. With many options available to His Majesty's (HM) Government, this Primer aims to explain Integrated Air and Missile Defence (IAMD). Building on the growing consensus in the UK about the need for improved missile defences, this piece – through the lens of IAMD – will provide a threat-based assessment of what factors HM Government should consider as it looks to bolster British missile and air defences.

What is Integrated Air and Missile Defence?

Air defence has been around since aircraft were first adopted for military use. Interceptor aircraft, anti-aircraft guns and the first radar systems were the early iterations of this. Jet aircraft and the advent of missile technology heralded a similar technological leap in defences, the most significant of which was the creation of Surface-to-Air Missiles (SAMs). Air and missile defences today are recognisable with the systems developed during the Cold War, so what is it that makes IAMD different?

[1] 'UK Air and Missile Defences – Volume 757: debated on Wednesday 27 November 2024', Hansard, 27/11/2024, https://hansard.parliament.uk/ (checked: 11/03/2025).
[2] Joe Barnes and James Crisp, 'UK "needs an Iron Dome" after wake-up call of Iranian attack on Israel', *The Telegraph*, 15/04/2024, https://www.telegraph.co.uk (checked: 11/03/2025).
[3] 'IMDO- Israel Missile Defence Organisation', Ministry of Defence (Israel), no date, https://english.mod.gov.il/ (checked: 11/03/2025).

The key word is 'Integrated'. The idea behind IAMD is to bring all the disparate elements of air and missile defences together through a command-and-control (C2) network which can see the complete picture, and has the ability to pass data between any sensor to any system for interception. To function as intended, a true IAMD network requires closely networked arrays of sensors, soft kill measures (which defeat threats by interfering with guidance or concealing targets), and hard kill measures (which destroy targets) to evaluate and eliminate threats rapidly and efficiently – ranging from cheap and numerous drones at one end to small numbers of exquisite missiles at the other.[4] This is known as Threat Evaluation and Weapon Assignment (TEWA).

Towards the end of the Cold War, the UK had developed a layered network designed to deal with a potential Soviet attack. The system was very siloed and was far from perfect, but it provided good protection within reasonable costs.[5] However, with the end of the Cold War, the peer Soviet threat was gone, and likely adversaries (rogue states or non-state actors) lacked meaningful missile capabilities. Coupled with the desire to reduce defence investment to cash in on the 'peace dividend', the protection of the British Isles from missile threats took a firm backseat, as did the protection of deployed British forces. However, not all allies made the same decisions and some – particularly the United States (US) – continued to invest heavily in missile defences.

The missile threat is the most stark it has been since the end of the Cold War. As was the case in the Cold War, any UK approach to missile and air defence must take into consideration ways to do so cost-effectively, bearing in mind the limits of defence budgets (even if further uplifts in investment come), and, more importantly, the opportunity costs of investing in IAMD over other areas of defence. Any British approach to IAMD should be tailored to the most significant threats, and flexible enough to adapt to changes in the threat picture – whether a geographic or capability change.

The missile threat

Given the concentration of critical military infrastructure present, any threat to the Home Islands must be given priority. This is followed by protection of key overseas bases, and then by the protection of deployed British forces (who are unlikely to be fighting alone).

The most dangerous threat to the Home Islands comes from Russia's nuclear armed Inter-Continental Ballistic Missiles (ICBMs), including those launched from submarines (SLBMs). However, although the US has invested in anti-ICBM

[4] 'NATO Integrated Air and Missile Defence', NATO, 13/01/2025, https://www.nato.int/ (checked: 11/03/2025).
[5] 'Post Cold War Era', RAF Radar Museum, no date, https://www.radarmuseum.co.uk/ (checked: 11/03/2025).

capability with its Ground-based Midcourse Defence programme (GMD), the expense for a similar system for Britain is not worth the benefits. GMD is designed to intercept limited ICBM attacks from rogue states: the total cost of the programme is roughly £43 billion over 25 years, but this is for only 44 interceptor missiles.[6] Though it is worth noting the Trump administration recently announced it intends to explore options for expanding its Ballistic Missile Defences (BMD) to provide far more comprehensive protection.[7] Against a concerted Russian nuclear attack, a GMD-like system for the UK would require vast expense.[8]

What deters a Russian nuclear attack is Britain's own inventory of SLBMs. The Kremlin dare not launch a nuclear attack on the UK because it knows full well that Britain possesses the ability to launch up to 192 nuclear warheads at Russia. Somewhere in the world's seas lurk Trident missiles carried by the Royal Navy's nuclear powered ballistic missile submarines (SSBNs): the Continuous At Sea Deterrent (CASD).

Though CASD deters enemies from launching a nuclear attack on British territory, it is less clear what level of deterrence it provides against attacks below the nuclear threshold. It is not impossible that a nuclear power will come under conventional attack. Russia's nuclear arsenal has not deterred Ukraine from launching attacks deep into Russia, nor even from a large-scale ground incursion towards Kursk, and India and Pakistan have fought numerous skirmishes despite both being nuclear powers since 1998. Indeed, Britain itself found this out in 1982 when Argentina attacked the Falkland Islands. Therefore, meaningful conventional capabilities – even for nuclear armed powers – are required to bolster deterrence and provide a more credible path to nuclear escalation.

The chances of a conventional conflict between the North Atlantic Treaty Organisation (NATO) and Russia remain slim, but they have undoubtedly grown over the last few years and will remain elevated for the foreseeable future: especially as the US draws down its conventional presence in Europe to reprioritise the Indo-Pacific. How such a scenario could come about, either by accident or Russian miscalculation, is open to debate. But it is this scenario, on which UK plans for IAMD should be prioritised.

There should also be plans for defending overseas bases, either from direct attack by adversaries or by their proxies. Iran's bombardments of Israel, Houthi attacks in the Red Sea and the rapid expansion and development of the People's Republic of China's (PRC) missile arsenal are testament to growing vulnerabilities. However, Britain could survive damage to overseas bases, although the destruction

[6] 'US Ballistic Missile Defence', Congressional Research Service, 30/12/2024, https://crsreports.congress.gov/ (checked: 11/03/2025); and for the costings see 'Missile Defence: Observations on Ground-based Midcourse Defence Acquisition Challenges and Potential Contract Strategy Changes', US Government Accountability Office, https://www.gao.gov/ (checked: 11/03/2025).
[7] 'The Iron Dome for America', The White House, 27/01/2025, https://www.whitehouse.gov/ (checked: 11/03/2025).
[8] 'Russia's Nuclear Weapons', Congressional Research Service, 22/01/2025, https://crsreports.congress.gov/ (checked: 11/03/2025).

of key military infrastructure and production sites at home would render its military inoperable beyond what was available in stockpiles.

To threaten the Home Islands, Russia possesses an impressive array of conventional strike weapons ranging from cruise missiles to various short and medium range ballistic missiles (SRBMs and MRBMs respectively).

At the time of writing, Russia possesses limited (conventionally armed) land-based ballistic missiles capable of reaching the British Isles, although the recent development of the Oreshnik MRBM shows that this will change in time.[9] Russia does possess a number of air-launched ballistic and cruise missiles which could hit the UK should Russian aircraft get close enough, but this is unlikely given the air power NATO members possess (bolstered in terms of geography and capability by the fact Sweden and Finland have now joined the alliance). The missile threat which Britain must focus any potential IAMD to defeat is that presented by Russia's Northern Fleet.

The missile potential of Russia's Northern Fleet

The Northern Fleet is a long way from the relative threat it posed to NATO forces during the height of the Cold War. The collapse of the Soviet Union, followed by more than a decade of economic and political turmoil in Russia, reduced this force to a husk of its former self. But it is in the process of modernisation (see: Box 1). The fact that Russia's Northern Fleet is far smaller than it was during the Cold War should be little consolation; NATO navies went through a similar process of reduction. At the end of the Cold War, the US Navy possessed 97 frigates (warships focused on Anti-Submarine Warfare or ASW), but today it possesses none.[10] The Royal Navy had at its command 38 frigates in 1990, compared to just eight today.[11]

Box 1: Russia's Yasen class nuclear powered attack submarine (SSN)

The Yasen class represents a new era for the Russian submarine fleet, being the first post-Soviet designed SSN to enter service. The Yasen class brings with it a slew of new technologies and systems which make it the most stealthy and lethal submarine at the Kremlin's disposal.The first boat, Severodvinsk, entered service in 2014 and

[9] Maxim Starchak, 'Russia's Hypersonic Missile Attack on Ukraine Was an Attempt at Blackmail', *Carnegie Politika*, 29/11/2024, https://carnegieendowment.org/ (checked: 11/03/2025).
[10] Richard Sharpe (ed.), *Jane's Fighting Ships 1990-91* (Coulsdon: Janes Information Group, 1990).
[11] *Ibid.*

four further boats have since become active.[12] It is estimated the Russians plan to commission at least 12 boats, most of which will see service in the Northern Fleet.[13]

Details about the Yasen class:[14]

- **Size:** Submerged displacement of around 12,000 tonnes, about 50% larger than the Royal Navy's Astute class submarines, this large size is in part to accommodate a new and large sonar as well as increased missile firepower.
- **Firepower:** In addition to the torpedoes they carry, each Yasen class submarine has eight quad launcher Vertical Launch System (VLS) tubes capable of firing up to 32 missiles of either the SS-N-26 Strobile (Oniks), SS-N-30A Sagaris (Kalibr)/SS-N-27 Sizzler (Klub), or the SS-N-33 (Zircon) type: see Box 2 below for details

Image credit: The nuclear submarine Kazan has arrived at a permanent base in the Northern Fleet, Ministry of Defence (Russia), Creative Commons Attribution 4.0 International.

The total missile firepower of the Northern Fleet's 26 submarines and 11 major surface combatants comes to over 800 missiles, around 720 from submarines and 80 from surface ships.[15] This number represents the maximum number of land attack capable missiles Russian submarines and surface ships could carry – launched either from tubes, canisters, or VLS. However, the entire Northern Fleet would not be able to put to sea simultaneously and, the greater the threat from NATO naval forces, the more likely it is that anti-ship missiles or torpedoes will be carried in place of land attack weapons. Most navies work on the basis that three hulls are needed to generate one for active duty. In a conflict, maintenance schedules would be expedited, but it is difficult to say, *in extremis*, precisely how much availability the Russians could generate. Box 2 below outlines which types of missiles are available to the Northern Fleet, which any UK IAMD system would have to contend with.[16]

[12] Alex Pape (ed.), *Jane's Fighting Ships 2023-24* (London: Jane's Information Group, 2023).
[13] Christine Casemiro, 'Russia's Nuclear-Powered Attack Submarine "Arkhangelsk" Joins Navy', *The Defence Post*, https://thedefensepost.com/ 06/01/2025, (checked: 11/03/2025).
[14] H I Sutton, 'Yasen Class: Russia's most potent submarines', *Covert Shores*, 13/10/2018, http://www.hisutton.com/ (checked: 11/03/2025).
[15] Alex Pape (ed.), *Jane's Fighting Ships 2023-24* (London: Jane's Information Group, 2023).
[16] 'Today's Missile Threat: Russia', Missile Defence Advocacy Alliance, No date, https://missiledefenseadvocacy.org/ (checked: 11/03/2025).

Box 2: Missiles in service with the Northern Fleet

NATO designation (Russian name)	Type	Range	Notes
SS-N-21 Sampson (Relief)	Cruise Missile	2,400km	Submarine launched variant of the S-10 Granit
SS-N-27 Sizzler (Klub)	Anti-Ship Cruise Missile	300km	Capable of land attack
SS-N-30A Sagaris (Kalibr)	Cruise Missile	2,500km	
SS-N-22 Sunburn (Moskit)	Anti-Ship Cruise Missile	120km	Capable of supersonic speeds and land attack. Primarily designed for stand-off defence of Russian waters
SS-N-12 Sandbox (Bazalt)	Anti-Ship Cruise Missile	550km	Capable of land attack
SS-N-19 Shipwreck (Granit)	Anti-Ship Cruise Missile	625km	Capable of land attack
SS-N-26 Strobile (Oniks)	Anti-Ship Cruise Missile	300km	Capable of land attack
SS-N-33 (Zircon)	Anti-Ship Cruise Missile	500 to 750km*	Capable of land attack. Russia has made dubious claims that the Zircon is a hypersonic weapon capable of reaching speeds of Mach 9. Evidence from its use in Ukraine suggests Zircon may be

			capable of reaching Mach 5+ using a long shallow dive.[17]

*Range is estimated at 500km when using a low-level flight path and up to 750km when using a semi-ballistic flight path.

For the foreseeable future, the cruise missile threat from Russia's Northern Fleet will remain the most pressing concern, but this is not the entire picture. Two additional factors need to be considered, one in the short-term and one in the long-term.

The additional short-term factor to consider is the vulnerability of UK military forces and bases overseas. Here, the threat from ballistic missiles greatly increases, especially from Iran and the PRC. To name just a few examples, the Sovereign Bases on Cyprus, the Joint Logistics Support Base at Duqm and the base on the British Indian Ocean Territory (Diego Garcia), are vulnerable.

In the long-term, consideration must be given to the fact that the missile capabilities of adversaries will continue to develop. Adversaries such as the PRC, Russia and Iran are investing a lot of effort into developing their missile arsenals, particularly ballistic missiles and hypersonics: as ranges increase, the British Isles will increasingly come under potential threat. Over time, there will be a growing need for the UK to develop its BMD and counter-hypersonics capabilities (such as long-range radar and BMD/hypersonic capable missile interceptors), which remain very limited. Box 3 provides a brief overview of how missile defences contribute towards deterring the UK's adversaries.

Box 3: Missile defence and deterrence

In essence, there are two types of deterrence: deterrence by denial (maintaining the military capability to deny an adversary the ability to pursue undesired goals without incurring unacceptably high costs) and deterrence by punishment (maintaining the military capability, and demonstrating the will, to punish undesired actions by an adversary).[18] Missile and air defence contribute to deterrence in a number of ways:

- Maintaining military capability is vital to both forms of deterrence. Missile defences protect the key military infrastructure, production

[17] William Freer, 'Britain's hypersonic challenge: Strategic opportunities and risks', Council on Geostrategy, 10/09/2024, https://www.geostrategy.org.uk/ (checked: 11/03/2025).
[18] William Freer and James Rogers, 'Deterrence and British strategy', *Britain's World*, 15/08/2024, https://www.britainsworld.org.uk/(checked: 11/03/2025).

sites, and forces needed to conduct military operations and to sustain and reconstitute military power.
- Missile defence increases the costs for an adversary in launching an attack, contributing to denial strategies. The more capable missile defences are, the more missiles an adversary needs to launch a successful strike. However, there is an open debate as to the cost-effectiveness of offence versus defence and what balance is the right balance.

Towards a British solution

Due to a number of factors (including geographic), British needs are specific and any developments in IAMD should be tailored to these. Any approach to IAMD should aim to maximise strategic advantage. Using the definition put forward by the Council on Geostrategy, this means efforts which catalyse national resources by either **extending** strategic reach, **amplifying** strategic efforts, **accelerating** strategic success, or **multiplying** strategic impact.[19]

The first and most important point to make is that IAMD does not operate in a vacuum. It works in tandem with other capabilities. Attempts to invest in IAMD capability, coverage, and missile stocks, which could reliably intercept 100% of anything fired at the UK, would require enormous expense.

To even the odds, any requirement for IAMD must also consider how the UK can reduce the number of missiles it may have to contend with: going after the 'archers' in addition to intercepting the 'arrows'. Russia follows a 'bastion' approach whereby it seeks to protect its SSBNs in the Barents Sea. If there is minimal threat to this bastion, Russian assets are free to conduct operations elsewhere. The UK, alongside NATO allies, should **extend** its strategic reach by replacing the old focus on the Greenland-Iceland-UK (GIUK) gap with a more forward focus on the Svalbard-Tromsø gap. Putting greater pressure on Russia's bastion puts the Northern Fleet on the back foot. To **amplify** the ability to attack the 'archers', a number of options present themselves:

- Improve situational awareness: Maritime and aerospace domain awareness in the High North to detect and track Russian submarines and missile launches is vital. Any work should be closely coordinated with allies with similar interests (namely the US, Canada and Norway) to **multiply** efforts. In addition

[19] Gabriel Elefteriu, William Freer and James Rogers, 'What is strategic advantage?', Council on Geostrategy, 23/11/2023, https://www.geostrategy.org.uk/ (checked: 11/03/2025).

to returning the E-7 Wedgetail order to the original five intended (which was cut to three), new technologies, including airborne, surface and underwater drones, and Artificial Intelligence, should be further explored: recent reports centred around a British 'Bastion Atlantic' concept show this is already under consideration.[20]

- Improve ASW capability: Alongside improving detection capabilities, the ability to destroy submarines once detected is vital. The Royal Navy is down to just eight operational Type 23 frigates, and the Royal Air Force (RAF) only has nine P-8 Poseidon maritime patrol aircraft. Over the longer-term, increasing the number of frigates (and therefore the number of ASW helicopters/drones in service) beyond the planned eight Type 26 and five Type 31 frigates would be beneficial. Beyond increasing hull numbers, further – and **accelerated** – exploration of next generation ASW weapons is needed, including missile delivered torpedoes and the ability for the Royal Navy's aircraft carriers to operate ASW drones.

- Improve Suppression and Destruction of Enemy Air Defence (S/DEAD) capabilities: In addition to the threat to the Home Islands, British forces deployed in Europe could come under attack by Russian missiles and drones. DEAD is a capability gap for European NATO: improving UK DEAD capabilities, to allow NATO forces to go more effectively after the 'archers', should therefore be pursued. Focusing nascent UK hypersonic missile requirements on the DEAD mission could be one avenue to explore; this process could be **accelerated** by co-producing existing designs in Britain.[21]

All the above will come with costs, but the investment in improving the ability to destroy enemy launch platforms will significantly reduce the level of investment needed in IAMD to more manageable levels and pressure adversaries to invest more heavily in their own defences. This means that the primary function of any missile defences in the UK should be to protect against any 'leakers' (missiles which make it through the first layers of defences). The following points should feature prominently in any UK IAMD requirement:

- Integrated C2: To create an efficient IAMD system, a truly integrated C2 network, with the ability to evaluate threats and defeat them as efficiently as possible, is needed. IAMD C2 must bring together information from a range of sensors across the different services, as well as share and receive information from allies. An open architecture (albeit one which still

[20] Richard Scott, 'UK sets out Project CABOT ambition to deploy autonomous ASW screen in the North Atlantic', *Naval News*, 18/02/2025, https://www.navalnews.com/ (checked: 11/03/2025).
[21] William Freer, 'Britain's hypersonic challenge: Strategic opportunities and risks', Council on Geostrategy, 10/09/2024, https://www.geostrategy.org.uk/ (checked: 11/03/2025).

maintains security) to any such system is vital in order to 'plug in' with allies, with the various systems used across the British Armed Forces, and to adapt to future developments.

- Improved coverage: Although the missile threat is reduced by offensive capabilities, the UK still lacks sufficient numbers of SAM batteries to cover its most vital military infrastructure. Several more batteries (four SkySabre batteries are currently in service but there is a lack of transparency as to the number of fire launchers) are needed to complement quick reaction fighter aircraft to defend sites in the UK adequately, as well as bases and forces deployed overseas. Innovative solutions for improving coverage should be looked into, such as the possibility of using the Mk70 (the containerised land-based version of the Mk41 VLS which the Royal Navy will soon be operating); which can launch a wide variety of missiles.

  In addition to this, in 2015, the UK committed to investing in improved BMD radar to enhance the coverage and effectiveness of NATO BMD. In 2021, this plan was delayed until 2029, although given the threat posed by Russia's development of MRBMs – as shown by deployment of the Orseshnik – this programme should be expedited.[22]

- Deeper stocks: The air war in Ukraine has proven that NATO IAMD is effective but struggles with the production rate of interceptor missiles. Deeper missile stockpiles are urgently needed, with the added benefit that larger orders reduce unit costs and multi-year contracts maintain the workforce and supply chains.

- More layers of interceptor systems: In addition to deeper stocks, the UK should consider which systems it may require now which it does not possess, and those it may need in the future. Two immediate priorities should be on improving VSHORAD (Very Short-Range Air Defence) capability for the British Army to defend against the rapidly growing drone threat – for example mobile 20-40mm gun systems similar to the Gepard which has proved so effective in Ukraine – and in improving BMD capability.

  Given that Royal Navy warships will need BMD capability anyway (due to the proliferation of anti-ship ballistic missiles), it may be wise to focus BMD capabilities in surface ships to avoid duplication; though in an ideal world, ground-based BMD would also be acquired. Japan has taken this approach with a solely naval based BMD capability. Warships can fulfil other tasks when a BMD presence is not required and presumably several will always be around the British Isles at any given time (either active or close to readiness). BMD upgrades for the Type 45 class destroyer should be

[22] Richard Scott, 'UK defers Lewis BMD radar plan', *Janes*, 01/03/2022, https://www.janes.com/ (checked: 11/03/2025).

accelerated, and the number of Type 83 class destroyers planned should go beyond a like-for-like replacement and place a strong emphasis on BMD capability (building on the potential offered by the Royal Navy adopting the Mk41 VLS).

- Other measures: a wide-ranging review into how the UK can better prepare itself to survive a missile salvo should be undertaken. Relatively low cost solutions can significantly **amplify** survivability such as hardening shelters at RAF airfields, practicing dispersed flying operations, introducing decoys, or spreading key defence industrial production across more sites are just some of the potential examples.

Conclusion

Britain's geography gives it distinct advantages, but the missile threat is growing. Despite some putting forward the view that a comprehensive IAMD system offering total geographic and threat coverage is needed, such an approach would require a vastly increased investment in defence to achieve; investment which could be spent more effectively if it materialised.[23] What is required to deliver strategic advantage is an improved air and missile defence capability centred on the efficiency offered by IAMD, tailored towards the most significant threats and prioritising the most important infrastructure to defend. Key military infrastructure in the UK, vital to Britain's ability to sustain its military force, is currently too vulnerable and should be the first priority, followed by the protection of overseas bases (crucial to projecting power), and then by the protection of deployed British forces (which will likely be able to call on allied IAMD). Decisions to improve UK IAMD should also come alongside actions to incur costs on adversaries and to decrease the threat from launch platforms.

[23] Joe Barnes and James Crisp, 'UK "needs an Iron Dome" after wake-up call of Iranian attack on Israel', *The Telegraph*, 15/04/2024, https://www.telegraph.co.uk/ (checked: 11/03/2025).

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