A Critical Enabler for Power Projection
Options for a UK Missile Defence Capability in an Age of Escalation Control

Sidharth Kaushal
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188 years of independent thinking on defence and security

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Contents

Executive Summary v

Introduction 1
Methodology 5

I. The Threat Environment 7
   ‘Doses of Pain’ for Escalation Control: The Coercive Role of Missiles in Limited Conflicts 7
   Actor Types 18
   Central Features of the Threat Environment 25

II. A Brief Introduction to the Technical Aspects of Missile Defence 29
   An Introduction to Missile Technology 29
   Missile Defences 32

III. Strategic and Operational Imperatives for Missile Defence 39
   Missile Defence and the UK’s Grand Strategy 40
   An Operational Framework for the UK 49

Conclusions 59

About the Author 61
Executive Summary

THE REFERENCE IN the 2015 Strategic Defence and Security Review (SDSR 15) to building a ballistic missile defence (BMD) radar and exploring the utility of the Type 45 destroyer in a missile defence role raises old questions regarding whether the UK should have a national missile defence capability and what form this should take. While the Ministry of Defence’s existing approach to missile defence has been characterised by an emphasis on enhancing the coverage and efficiency of NATO’s missile defence systems, but for the most part eschewing a national missile defence capability, reflected in SDSR 15, this approach may no longer be in step with the emerging strategic and operational environment.

The key trend driving this is the changing concept of operations, driven in turn largely by new technical capabilities, that drives adversary use of missiles. The template for a missile strike through the 1990s and 2000s was that missiles would be used for strategies of civilian punishment. Punishment strategies seek to deter a conflict or coerce concessions by exacting massive civilian costs on an opponent. While the possession of this capacity in the form of weapons of mass destruction-carrying missiles by a rogue state was problematic, it was assumed that this outcome could be pre-empted at the political level by robust non-proliferation policies. Robust great power arsenals, by contrast, could only be deterred by the prospect of nuclear retaliation. However, modern threats take the form of what Thomas Schelling dubbed ‘risk manipulation’ – threats that leave an opponent with something to lose. Coercion in the context of risk manipulation involves using force in limited doses against critical targets – causing pain but holding the bulk of one’s destructive capacity in reserve to deter retaliation. The purpose of such attacks is to deliver doses of pain meant to bring an opponent to reconsider a given political aim rather than to do so much damage that they feel compelled to retaliate.

2. For a discussion of this issue, see Jeremy Stocker, Britain and Ballistic Missile Defence 1942–2002 (London: Frank Cass, 2004), pp. 169–75. UK discussions at the time focused largely on nuclear and biological payloads being used against cities while conventional ballistic missiles were discounted insofar as they were deemed an inefficient way of producing mass casualties. This mirrors the conversation in the US which has, until recently, assumed that the rationale for BMD would be an ‘undeterrable’ actor that was willing to engage in a nuclear punishment strategy despite the risk of retaliation in kind. The canonical scenario always involved the somewhat unlikely assumption of an undeterrable actor using a punishment strategy, see Andrew Futter, ‘Trident Replacement and UK Nuclear Deterrence: Requirements in an Uncertain Future’, RUSI Journal (Vol. 160, No. 5, 2015), p. 67.
While the strategy is not new, it is gaining new currency among both regional rogue states and peer competitors armed with increasingly accurate conventional precision strike, and in the case of the latter, low-yield nuclear options as a means of keeping the West at arm’s length from their regions with limited shows of force. As such, then, conventional strikes against civilian targets with ballistic missiles or, in extremis, nuclear strikes against a single civilian or military target make sense within this rubric. The adoption of this framework for coercion by peer competitors such as Russia calls the credibility of the UK’s current deterrent posture into question if the threats to be countered are too limited to warrant nuclear retaliation. The assumption that missile defence and nuclear deterrence serve overlapping roles no longer holds in an era of limited conventional and nuclear coercion – rather, they are likely to address threats at different levels of the escalation ladder.

In higher-intensity operations at the theatre level, the range accuracy and variety of threats is growing. Ballistic missiles are joined by air-breathing threats as well as UAVs in integrated multi-domain salvos. While NATO does have a tactical BMD system, this system was developed to meet a more limited stovepiped threat. Moreover, given that not all of these threats, which can loosely be grouped under the rubric of anti-access area denial (A2AD), will be in the Euro-Atlantic area, access to NATO members’ missile defences at the tactical level is not assured.

This paper argues that missile defences, far from being a diversion from power projection capabilities, are a critical enabler. Without the capacity to defend against limited calibrated coercive salvos at the strategic level and to effect theatre entry either jointly or independently in the face of A2AD, the UK will not be able to act as a globally engaged power. Current capabilities are not sufficient to achieve both these tasks. It is thus time for the UK to end its historical ambivalence towards missile defence and invest in limited national missile defence capabilities.
Introduction

In its 2015 Strategic Defence and Security Review (SDSR 15), the Ministry of Defence restated its commitment to NATO missile defence, reigniting the longstanding debate over whether the UK’s commitment to the area of missile defence is sufficient. As things stand, the current government has effectively continued the UK’s relatively ambivalent approach of not pursuing missile defence as a national capability but contributing to multilateral coordination on the issue. The SDSR 15 included commitments to expand multilateral cooperation with NATO partners in the area of joint missile defence by building a UK ground-based radar and exploring the possibility of using the Royal Navy’s Type 45 destroyers in a missile defence role. Historically, the UK has had little incentive to invest in a missile defence capability independent of alliances. Against superpowers such as the USSR, it was assumed by successive governments in both the UK and across the West that no amount of missile defence would be sufficient while it was assumed that access to weapons of mass destruction (WMD) by regional ‘rogue states’ should be pre-empted by a combination of diplomatic and military tools as opposed to countered with missile defences which, though considered as a distant possibility, were viewed as less preferable than prevention and, if that failed, deterrence. The continuous at-sea deterrent has thus constituted the UK’s primary means of deterring WMD launches against the homeland by

4. An example of this Cold War consensus was the statement on defence estimates for 1980 which held that ‘over the last two decades the effort devoted to the air defence of Great Britain has been sharply reduced. This derives from strategic concepts which reasoned that we could not realistically hope to defend ourselves against a strategic nuclear missile strike’, Ministry of Defence, Statement on the Defence Estimates 1980, Vol 1, CMND 7826-1, p. 34. This scepticism was broadly shared across Europe and, its brief dalliance with the Strategic Defense Initiative aside, in the US, see, for example, Jeremy Stocker, Britain and Ballistic Missile Defence 1942–2002 (London: Frank Cass, 2004); for a discussion of the belief that counter-proliferation and arms control, along with deterrence by punishment, should be Britain’s primary bulwarks against rogue state missiles, see Ministry of Defence, Delivering Security in a Changing World: Future Capabilities, Cm 6041-I (London: The Stationery Office, July 2004), p. 9, which concedes the possibility that missile defence could be pursued at some point but stresses the importance of counter-proliferation and other preventative measures as primary bulwarks of defence and
existing nuclear states, while counter-proliferation has been the primary means by which the
UK has tried to ensure that so-called ‘rogue states’ do not join this club. The UK’s counter-
proliferation strategy has included arms control agreements, multilateral non-proliferation
treaties, export controls, and cooperative threat reduction. The UK has also taken active steps,
in conjunction with Allies, to, for example, monitor and disrupt proliferation networks of state
and non-state actors and to intercept illicit shipments related to proliferation. Finally, the UK
has historically not ruled out the use of force in extremis alongside Allies and within the limits
afforded by international law to pre-empt or reverse WMD acquisition by states deemed as
threats – with the 2003 war in Iraq a case in point. The capacity to intercept missiles did not
fit within this framework. The UK has, however, hosted an early-warning radar at Fylingdales
since the 1960s, which serves as an important component of the US’s Ground-Based Midcourse
Defense (GMD) system, as well as being an early-warning system for the UK.
Moreover, it
has been a major contributor to NATO’s ballistic missile defence (BMD) network, to which it
contributes around 10% of the overall costs. This network was envisioned to protect NATO’s
troops from tactical ballistic missiles in out-of-area deployments, and had its role extended
to territorial defence against threats from outside the Euro-Atlantic area (with Iran being the
primary threat at which missile defence has thus far been aimed).

Several of the assumptions that undergird this historical policy might be questioned, however.
The first is the assumption that the threat from peer competitors such as Russia will take the
form of a full-scale nuclear assault that cannot be defended against and must be deterred. As
a report from the parliamentary defence committee on the Modernising Defence Programme
highlighted, there is a growing recognition of the threat from what might be dubbed

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5. The continuous at-sea deterrent is a commitment to maintain a missile-armed nuclear submarine
(SSBN) on patrol at all times – a policy that has been maintained since the 1960s to ensure
that the UK will always have the ability to retaliate against nuclear use after a first strike, given
that even large superpower arsenals cannot target submarines on patrol with a high degree of
certainty, see Malcolm Chalmers, ‘Continuous At-Sea Deterrence: Costs and Alternatives’, RUSI
6. John Simpson and Jez Littlewood, ‘Reducing the Chemical, Biological, Radiological and Nuclear
Weapons Threat: The Role of Counter-Proliferation, Arms Control and Disarmament’, in Paul
17 April 2019.
'sub-strategic strikes'. Rather than an all-or-nothing threat to the homeland, a peer state might opt for limited coercive strikes with conventionally armed cruise and ballistic missiles so as to hamper the UK's freedom of action by targeting either critical infrastructure for political effect, or military bases and ports within the UK.

Alternatively, a coercive strike using a low-yield nuclear warhead targeted at a military installation or single high-value target within the UK might be contemplated. This would leave the UK with a missing step in its escalation ladder – full-scale nuclear retaliation, against an adversary with a substantial strategic nuclear arsenal of its own, would be suicidal and disproportionate to the damage exacted by the adversary (proportionality here being a concern not for normative reasons but because substantial damage needs to be done to compel a state's policymakers to contemplate national suicide). The increasing risk that an opponent might try to face it with such a ‘suicide or surrender’ dilemma in the form of low-yield nuclear use against its forces or against its allies has also been cited in the US as a basis for re-evaluating aspects of the US nuclear posture to emphasise low-yield retaliatory options. During the Cold War, the idea of limited nuclear options was also floated as a means of coercing the Soviets to stop a conventional advance into Western Europe by then US Secretary of Defense James Schlesinger – leaving the Soviets with a choice between de-escalation or a full-scale nuclear exchange, for which the Soviet arsenal and targeting options were primed. As such, there is some historical and contemporary evidence that strategic nuclear arsenals such as the UK’s CASD (continuous at-sea deterrent) may not be viewed as credible by an adversary contemplating limited nuclear salvos or conventional strikes against critical assets. On the other hand, such a coercive salvo would, by necessity, be limited and credible missile defence against it would be possible – irrespective of the size of an opponent’s arsenal in aggregate given that only a portion if it would be used. As such, the assumption that the CASD can deter the full spectrum of peer competitor threats to the homeland is open to contention.

Second, rogue states and non-state actors do not have to acquire WMDs to threaten the UK and UK overseas territories (UKOTs). As the Houthis have demonstrated in Yemen, relatively weak actors can use short- and medium-range ballistic missiles to good effect against local targets. In Yemen this has been cities, but ports and other infrastructure upon which the UK’s ability to respond to a regional contingency depends may also be viable targets. This poses a particular threat to sovereign bases such as Cyprus and Bahrain, both from rogue states such as Syria and Iran and from peer competitors such as Russia with missiles in these states. The tactical missile threat is not altogether new; for example, Saddam Hussein’s forces used Scud missiles in attacks

on the barracks housing US forces in Saudi Arabia in 1991.\textsuperscript{14} NATO does possess the ability to counter tactical missile threats to fielded forces through the Active Layered Theatre Ballistic Missile Defence (ALTBMD) framework, but the assets that comprise this system are nationally owned.\textsuperscript{15} While pre-existing arrangements regarding the transfer of assets and command and control (C2) in wartime and the control of Allied assets from the US’s Germany-based Rammstein Air Base in peacetime do exist, the transfer of assets to NATO command for an integrated air and missile defence (IAMD) campaign requires a consensus by the North Atlantic Council (NAC) regarding whether a Joint Force Air Component (JFAC) can be stood up to direct a campaign and ensure that relevant air and missile defence assets can be moved into the combat theatre.\textsuperscript{16} Given that opponents such as Russia plan on fighting and concluding wars on their periphery precisely before such a consensus can crystallise (and intend to use coercive threats, including the use of missiles against critical infrastructure, to delay this consensus), the ability for the Alliance to adroitly provide its members with theatre air and missile defence in a limited war is questionable.\textsuperscript{17} This is even more acute in out-of-area deployments for which there is no Article 5 requirement.\textsuperscript{18}

If the UK intends to reinforce NATO deterrence by acting as a first responder moving ahead of the Alliance as a whole – the rationale provided for its leadership of organisations such as the Joint Expeditionary Force (JEF) and the creation of rapid response forces\textsuperscript{19} – then it needs some organic defence for its forces against air-breathing and ballistic threats. The UK’s Type 45 destroyers could, subject to acquiring a BMD capability, provide this capability in larger numbers, but as things currently stand they cannot perform all the tasks that may be required of them. Moreover, at the tactical level the threat to fielded forces and bases is becoming more complex as increasingly accurate cruise and ballistic missiles are joined by swarms of UAVs and large volumes of cheap rocket fire in coordinated salvos.

\begin{itemize}
\item \textsuperscript{15} Ida Nygaard and Una Hakvåg, \textit{Why Russia Opposes a NATO Missile Defence in Europe – A Survey of Common Explanations}, Norwegian Defence Research Establishment (FFI), 3 January 2013, p. 5.
\item \textsuperscript{16} Christopher Harper, Tony Lawrence and Sven Saakov, \textit{Air Defence of the Baltic States} (Tallinn: International Centre for Defence and Security [ICDS], 2018).
\item \textsuperscript{17} Billy Fabian et al., ‘Strengthening the Defense of NATO’s Eastern Frontier’, Center for Strategic and Budgetary Assessment (CSBA), 2019, p. 2.
\item \textsuperscript{18} Under Article 5 an attack on a NATO member in either Europe or North America is viewed as an attack on the Alliance writ large, with Alliance partners obligated to take action, see NATO, ‘Collective Defence – Article 5’, last updated 12 June 2018, \texttt{<https://www.nato.int/cps/en/natohq/topics_110496.htm>}, accessed 24 April 2019.
\end{itemize}
In response to these developments, the US looks to be shifting its own posture on missile defence to missile defeat – an integrative concept involving both offensive and defensive operations aimed at defeating large enemy salvos at the theatre level rather than limited strategic launches. The recent Missile Defense Review, which fits neatly with the US’s 2018 National Security Strategy’s emphasis on great power competition, seems to portend that, as far as the US is concerned, an exclusively rogue state-focused force structure and posture has come to an end. The review explicitly identifies the theatre-level anti-access arsenals of peer competitors such as Russia and China as a threat to be defeated as opposed to deterred and commits to the defence of the US homeland against cruise-missile as well as ballistic-missile strikes – demonstrating a concern with the sort of limited conventional strike by a peer competitor such as Russia that was discussed earlier.

The salient point that this paper makes is that credible missile defence against limited salvos is a prerequisite to power projection as opposed to an alternative. Much in the way that a credible nuclear deterrent has been a prerequisite to global activity without the fear of nuclear blackmail, the ability to counter threats to the homeland that fall below the level of what could reasonably trigger the nuclear threshold and to ensure theatre access for one’s forces are now the foundation on which a forward posture is built. Missile defence, then, is not competing with other priorities but is a critical enabler with regard to meeting these priorities. Moreover, in the face of limited calibrated coercive threats, the second longstanding objection to missile defences in UK debates – their liability to being overwhelmed – no longer holds. If, then, the UK wishes to play the forward-postured role it envisions for itself, some form of limited national missile defence capability will be vital. To be sure, such a capability would need to be interoperable with Allied assets in NATO and capable of sharing information, but it would be nationally owned.

Methodology

This paper uses a qualitative research methodology to answer the following research questions:

- What are the key changes in the UK’s operational and strategic environment with regard to the use of both ballistic and air-breathing missiles?
- How do these threats vary by actor type and region?
- How well suited are existing NATO arrangements for coping with these threats?
- What possible operational frameworks for missile defence exist and how might they be nested within the UK’s national security strategy?

This paper relies on a variety of sources including official policy statements, strategy documents and the substantial amount of secondary literature that has been produced on both the technical and strategic aspects of missile defence. Existing literature served to scope both potential scenarios for missile use and the technical capabilities available to both attackers and defenders at present. Policy documents largely served the purpose of situating these missile/anti-missile interactions within the context of wider national purpose.

Additionally, the paper draws on the results of RUSI-led scenario-based wargaming exercises involving a number of policymakers which served to illuminate the particular challenges that political authorities might face when coping with an environment in which missiles have evolved from a discrete military threat to a flexible tool that can be deployed in a litany of escalatory steps, not all of which unambiguously constitute an act of war. The threat to use missiles, for example, might more neatly fit into the category of coercive diplomacy rather than war. Moreover, conventional missile salvos, though highly disruptive, will likely not be viewed in the same terms as nuclear use. Even in the nuclear domain, the division of an arsenal into low- and high-yield payloads offers an adversary a number of escalatory steps which leave an opponent that bases its deterrent posture on the threat of massive nuclear use with a poor suite of countermoves. The purpose of these exercises was to gauge the degree to which policymakers felt that they had proportionate retaliatory responses in circumstances where an adversary (the RUSI team in this case) attempted a risk-manipulation strategy and the degree to which their decision-making changed when they possessed credible defences against limited coercive salvos. The challenges posed by limited conventional strikes on the homeland and UKOTs were clear in these exercises – a point that has informed this paper.
I. The Threat Environment

‘Doses of Pain’ for Escalation Control: The Coercive Role of Missiles in Limited Conflicts

DURING THE COLD War, the primary emphasis of deterrence was global in scope and geared to maintaining a general balance of terror between the Warsaw Pact and the West. This involved actors with an essential symmetry of interests – the stakes for both the Soviets and the West if they lost a war for Western Europe were substantial and possibly existential. As such, the risk of nuclear escalation, coupled with the credible second-strike capabilities of both parties, rendered deterrence stable. By contrast, the 21st century is likely to be dominated by limited, local wars in which an asymmetry of interest exists between Western states intervening from outside a given region and their opponents, whether peer competitors or regional powers. This asymmetry of interest can be leveraged by the more committed actor to good effect inasmuch as one has to inflict less damage to either deter a less than totally committed opponent from entering a regional conflict or to compel its withdrawal. Certainly, this calculus is not totally novel – the Viet Cong’s strategy during the Vietnam War was predicated on the assumption that the materially more capable but less committed US could be compelled to withdraw from Vietnam by mounting casualties. Closer to our own time, terrorist groups such as Al-Qa’ida rationalised terrorist attacks in the West by arguing that targeting the civilians of the ‘far enemy’ (the West) would cause it to cease its support to the ‘near enemy’ (hostile

24. Most prospective opponents, whether they are peer competitors or regional powers, have a limited capacity for extra regional power projection (other than missile strikes in some cases), but in many cases enjoy a substantial local advantage over locally deployed Western forces. Given that the loci of conflict, for example China over Taiwan or the Baltic states with regard to Russia, are adjacent to competitor states and involve stakes that are not existential for intervening Western powers, an asymmetry of will as well as locally available capabilities is likely to emerge. States such as Russia and China may view interests in their own regions as being worth the sacrifice in a way that is not necessarily matched in Western Europe or North America, NATO commitments notwithstanding. See, for example, former House Speaker Newt Gingrich’s assertion that Estonia is ‘[a] suburb of St Petersburg’ that is not worth risking a war over, Reena Flores, ‘Newt Gingrich: NATO Countries “Ought to Worry” About US Commitment’, CBS This Morning, 21 July 2016; see also Department of Defense, ‘Joint Operations’, Joint Publication 3-0, 17 January 2017, p. V-2 where it is suggested that Western forces need a, currently absent, means to counter limited local wars of aggression. The risk of damage to the homeland will, this author argues, embolden political actors who view these local wars for less than existential ends as not worth fighting over.

local regimes that Al-Qa’ida sought to supplant) because Western publics would not support foreign policy commitments that put themselves at risk to achieve less than existential ends.\textsuperscript{26}

However, the actors leveraging this asymmetry of interest are no longer solely weak states and non-state actors. The basic calculus of leveraging an asymmetry of interest has now been adopted by both regional states and near-peer competitors with robust nuclear arsenals. In this context, it is germane to reassess certain core assumptions regarding the use of missiles by an adversary. It has been a guiding assumption of UK debates over missile defence that the use of an opponent’s strategic missile arsenal would involve it carrying WMDs and would represent the highest step of the escalation ladder in wartime and would by extension represent a provocation that would cross the UK’s own nuclear threshold. As such, it has been reasoned, the CASD amounts to a credible means of insulating the homeland from such strikes.\textsuperscript{27}

In the context of a local war in which a regional power or peer competitor wishes to either preclude Western involvement or cause it to terminate short of achieving its objectives, the use of missiles to carry out large-scale nuclear strikes makes little sense – instead, an opponent’s core objective is to develop options for the limited use of missiles which would leave the UK to grapple with the ‘suicide or surrender’ dilemma – either backing down under the threat or actual use of coercive pressure or enacting its own nuclear deterrent. An example of such an escalation control strategy would be Pakistan’s use of tactical nuclear missiles to deter significant Indian conventional retaliation against what India regards as Pakistan-sponsored terrorist attacks. Pakistani leaders have since the 1990s opted for a policy of gradual escalation against Indian forces, logistical nodes and bases using low-yield weapons, calculating that in a scenario where tactical nuclear weapons were used against its forces, India, with its minimum deterrent posture, would have been faced with precisely such a dilemma.\textsuperscript{28} The creation of an intermediate step between the highest levels of escalation and conventional warfare allows Pakistan to deter the use of Indian conventional forces on a large scale and thus frees its hand with regard to low-level provocations over which, it calculates, India would not risk unacceptable escalation. Similarly, the Russian concept of strategic deterrence includes the limited use of both strategic non-nuclear weapons (for example, long-range precision strikes by cruise or ballistic missiles) and limited nuclear use against an adversary intervening on Russia’s periphery to deter outside intervention in a local conflict involving Russia or to compel its cessation. Strategic non-nuclear weapons represent the first step in the escalation ladder, while limited nuclear weapons serve

\textsuperscript{26} A useful discussion of how actors can leverage asymmetries of commitment is provided by Robert Pape, \textit{Dying to Win: The Strategic Logic of Suicide Terrorism} (New York, NY: Penguin, 2006). While the idea that weak actors can leverage asymmetries of interest is discussed in the context of terrorism, the principle, if not the tactics, applies across contexts.

\textsuperscript{27} Stocker, \textit{Britain and Ballistic Missile Defence 1942–2002}, pp. 66, 179. Notably, this assumption was briefly re-evaluated with regard to small-scale chemical weapons use in the early 2000s, although pre-empting the acquisition of long-range capabilities was eventually chosen as a policy choice against the rogue states that, it was assumed, would pose this threat.

to both deter an opponent from responding in kind and to escalate further should conventional strikes not have the desired effect. The underlying assumption behind this posture is that limited coercive threats will be effective against an adversary that has limited stakes in a conflict and lacks commensurate retaliatory options because it has focused exclusively on deterring full-scale strikes.29

If this is indeed the case, then the utility of strategic missiles is not in their ability to deliver catastrophic damage to an opponent’s society, but rather to do sufficient damage to convince an adversary whose public and political class may already be ambivalent about the wisdom of a military commitment that the game is not worth the candle. As such, limited strikes using conventionally armed ballistic and cruise missiles make eminently good sense in this context insofar as they do enough damage to an opponent to demonstrate the costs of further involvement in a regional conflict, but not so much damage that they back an opponent’s leadership into a corner from which it must escalate. An opponent might avoid doing direct damage altogether, instead highlighting the threat that their missile arsenal poses by publicly putting their arsenals on alert or carrying out demonstrative strikes near an adversary’s territorial waters. Or, in extremis, an opponent backed into a corner because, for example, they are losing a war at the conventional level, might opt for a limited nuclear strike using a low-yield weapon against selected high-value targets such as a military base in the UK. An actor with a robust nuclear arsenal and limited strike options can contemplate limited nuclear use against an adversary which lacks such options because the only retaliatory threat that can be made (full-scale retaliation) would bring a response in kind and is thus not viable.

The threat of limited nuclear use is not totally new. For example, during the 1970s then US Secretary of Defense James Schlesinger pushed for the development of limited nuclear options partly because he feared the Soviets would use their nuclear forces in this way against select targets, leaving the US with a choice between ‘suicide or surrender’.30 However, in a regional contest between actors with an asymmetry of interest, the threat of limited nuclear use, even if it is a bluff, gains a new currency as a tool to further weaken the resolve of an actor that potentially is already less committed to the outcome than oneself. Moreover, the increasing accuracy of conventional strike may make nuclear use only part of a repertoire of limited options.

Contemporary Russian thinking seems particularly attuned to the value of what Russian authors dub ‘non-nuclear strategic weapons’.31 Figures including President Vladimir Putin himself


have contended that conventionally armed long-range precision weapons can achieve effects comparable to nuclear weapons but with fewer political ramifications and escalatory risks. Russian doctrine views conventional counter-value capability as a tool that is critical at every stage of a competition that may lead to war. In the peacetime build-up to conflict or in local conflicts against small countries on Russia’s periphery along the lines of those that have occurred in Georgia and Ukraine, these capabilities help to shape the contours of the war by deterring distant powers from intervening in a local ally’s defence – effectively localising the conflict. Coercive threats, publicised deployments of strategic assets and other means of signalling may serve to underscore this threat to Western European publics. Should conflict occur and regional powers become involved (escalating the conflict from a local to a regional conflict, in Russia’s parlance), Russian sources suggest the use of strategic non-nuclear weapons to inflict ‘doses of pain’ on select adversaries. The notion of a dose of pain implies a certain confidence on the part of Russian planners that they can select targets and calibrate damage in such a way as to remind an opponent of the costs of further involvement in a conflict without doing so much damage that it is politically unfeasible for an opponent not to escalate. Russian authors suggest firing limited salvos against select critical infrastructure near urban nodes or, in some cases, strikes on urban centres themselves with long-range conventional strike capabilities.

Limited nuclear options based on low-yield warheads represent the next step in the escalation ladder and a means of ensuring that an opponent does not respond to a conventional salvo in kind. While the primary role of these weapons is tacit coercion rather than actual use, limited nuclear use may be considered an escalatory option in extremis. Given that Russia envisions that the use of both conventional and limited nuclear precision strike is to deter or coerce extra-regional adversaries looking to involve themselves in a conflict on its periphery, large European states such as the UK, France and Germany may well be the target of either the threat or actual limited use of ‘doses of pain’. Alternatively, conventional precision-strike capabilities could be used against ports, airfields and C2 nodes as part of an anti-access strategy to delay or disrupt UK deployment in the Baltics as part of a wider effort to insulate the Baltic states from their allies. In the absence of credible missile defences against such limited salvos, the UK has a limited set of responses. Against conventional salvos, the UK could choose to respond in kind, but this would not resolve the underlying strategic issue – that the prospect of damage to civilian infrastructure would delay and potentially deter the deployment of UK forces to the Baltics to meet their Alliance obligations.


33. For a useful overview of Russian doctrinal literature and the idea of calibrated doses of pain, see Johnson, ‘Russia’s Conventional Precision Strike Capabilities, Regional Crises, and Nuclear Thresholds’, pp. 20–25.
Deterrence by punishment might allow a response here but would still allow Russia to shape the pre-conflict strategic environment. Additionally, in a limited series of tit-for-tat conventional exchanges the UK would likely be at a disadvantage against an adversary with IAMC capabilities of its own, and in the absence of IAMC may sustain more damage than it inflicts. As for limited nuclear use, while it is likely that this threat would be faced only in extremis, it would face the UK with the suicide or surrender dilemma discussed above. Lacking an option for limited nuclear use of its own, the UK could not easily mount a proportionate response to such an attack on its soil. Massive retaliation, the UK’s current option, risks a response in kind and is a less than credible threat against limited nuclear use, as the India–Pakistan example illustrates.

Nuclear capabilities, by contrast, play a tacit shaping role in both the build-up to a conflict and conflict itself. In peacetime, signalling the willingness to use nuclear forces under certain circumstances is viewed as a means of shaping the environment. This is especially true as these circumstances are defined in intentionally ambiguous terms, thereby increasing the uncertainty facing opponents. Once a local conflict breaks out, nuclear weapons continue their shaping role through what Dave Johnson calls ‘aggressive sanctuarization’ – extending the nuclear umbrella over newly seized territories and raising the risk that evicting Russian forces may cross Russia’s nuclear threshold.

Finally, should a conventional war be going badly for Moscow, nuclear weapons can be used in the form of limited tactical and strategic strikes as part of Russia’s attempts to ‘escalate to de-escalate’ – doing enough damage to an adversary to signal the tremendous risks of further conflict. While it seems that conventional strike capabilities are the preferred means by which doses of pain are to be delivered to an intervening state, the possibility of limited nuclear use is also considered a feasible option. When they become operational, de facto intermediate-range ballistic missiles such as the air-launched Kinzhal and the RS-26 Rubezh would serve the role of bolstering this posture, given that they would allow Russia a nuclear strike option that could be credibly differentiated from full-scale ICBM use by an adversary alliance and would put some Alliance members (in Western Europe) at greater risk than others across the Atlantic – acting as a political wedge by decoupling the security of Alliance partners. Given that the RS-26 has been tested at ranges of 2,000 km and can hold 150 kilotonnes (kt) of warheads, which can be used with limited fallout against a non-hardened target such as an airfield (assuming detonation at a sufficient altitude), its use in lieu of an ICBM would signal limited intent. Given that the RS-24, on which the RS-26 is based, almost certainly has a low-yield nuclear option, it is also likely that the RS26 will have both low-yield and nuclear

35. Johnson, ‘Russia’s Conventional Precision Strike Capabilities, Regional Crises, and Nuclear Thresholds’, p. 45.
This is also true of the Kinzhal air-launched ballistic missile which can only carry either conventional or low-yield payloads and any potential medium-range ballistic missile (MRBM)/IRBM options that may be added to the Iskander system, allowing Russia to deliver both conventional and low-yield nuclear strikes (but not high-yield payloads) across Europe. Having limited strike options that can be credibly differentiated from a strategic arsenal by an adversary is critical to being able to threaten limited war credibly – inasmuch as an opponent must be convinced that there is a viable plan for conventional/limited nuclear use that can be distinguished from a full-scale assault and that does not involve mutual suicide. IRBMs and air-launched ballistic missiles provide a suite of launch options which can be clearly differentiated from a full-scale strike by target states. They thus decrease the risk that a limited strike will be confused for a full-scale attack. This in turn makes the threat of limited nuclear use more feasible than otherwise might be the case. It is for this reason that the placement of Soviet SS-20 IRBMs in eastern Europe during the Cold War was seen as destabilising. However, Russia can produce a limited number of new IRBMs – around 20 a year by some estimates. As such, the number of ballistic missiles available for limited strike options will be relatively small and subject to interception.

Figures 1 and 2 illustrate Russia’s understanding of calibrated escalation and the role of a long-range strike.

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**Figure 1: Russia’s Understanding of the Role of Non-Military Methods in Deciding Inter-State Conflicts**

<table>
<thead>
<tr>
<th>Military Means</th>
<th>Non-Military Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio of military and non-military means: 4:1</td>
<td>Formation of coalition and alliances</td>
</tr>
<tr>
<td>Strategic deployment</td>
<td>Search for means to regulate the conflict</td>
</tr>
<tr>
<td>Conduct of military operations</td>
<td>Implementation of a complex of measures to reduce tension in relations</td>
</tr>
<tr>
<td>Information confrontation</td>
<td>Switch economy to military footing</td>
</tr>
<tr>
<td>Operations by opposition forces</td>
<td>Economic sanctions</td>
</tr>
<tr>
<td>Conflict</td>
<td>Economic blockade</td>
</tr>
<tr>
<td>Financial pressure</td>
<td></td>
</tr>
<tr>
<td>Economic blockade</td>
<td></td>
</tr>
<tr>
<td>Formation of political opposition</td>
<td></td>
</tr>
<tr>
<td>Ratios of military and non-military means: 4:1</td>
<td></td>
</tr>
<tr>
<td>Military means of strategic deterrence</td>
<td></td>
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<tr>
<td>Strategic deployment</td>
<td></td>
</tr>
<tr>
<td>Conduct of military operations</td>
<td></td>
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<tr>
<td>Peacekeeping operations</td>
<td></td>
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</tbody>
</table>

*Source: Johnson, ‘Russia’s Conventional Precision Strike Capabilities, Regional Crises, and Nuclear Thresholds’, p. 19.*
Figure 2: Russia’s Strategic Deterrence Mechanism

Mechanism of Strategic Deterrence
A complex of inter-connected political, diplomatic, military, economic, informational and other means, aimed at preventing or lowering the threat of destructive actions by an aggressor state (collation of states)

Non-Military (Non-Forceful) Means
Political, diplomatic, economic, cultural and other measures taken with the aim of averting aggression

Military (Forceful) Means
Measures connected with use of means for the conduct of war exploited considering the actual potential for tradition or non-traditional weapons

Type of event implemented
- Political-diplomatic
- Economic
- Informational-psychological
- Informational-technical
- Legal
- Humanitarian
- Spiritual

Phase of Deterrence
- General purpose forces
- General electro-magnetic energy weapons
- Long-range conventional precision weapons
- Conventionally armed ICBM and SLBM
- Non-strategic nuclear weapons
- Strategic nuclear weapons
- Strategic weapon set

Informational-Command and Defensive Means and Systems
- Command, control, communications and intelligence
- Missile attack warning system
- Space surveillance system
- Air, missile and space defence

Existing concepts for nuclear deterrence are not credible against these sorts of limited coercive strikes – particularly if they involve the use of low-yield nuclear weapons. While the UK has historically relied on its nuclear deterrent to deter missile threats against the homeland, the assumption underpinning this began during the Cold War – that any threat against the homeland would be a full-scale nuclear salvo that would justify a full-scale nuclear response. As such, the UK has maintained an assured retaliatory capability in the form of a CASD. Under this system, at least one UK ballistic missile submarine (SSBN) is on patrol at any given time. The Trident D-5 missiles on these submarines can currently carry up to eight W76 re-entry vehicles with a 100-kt yield warhead. In practical terms, a single trident carries a payload sufficient to destroy much of an opponent’s urban population and the cumulative effect of firing all 16 trident warheads carried on a Vanguard-class submarine would be national devastation.40

The trident, then, is a tool with which to effect a full-scale nuclear response. While threatening such a response could deter a full-scale Soviet first strike against the UK during the Cold War, it is less likely that the threat of a full-scale nuclear response can be credibly made to deter a limited conventional strike against the homeland, particularly if the adversary in question has a substantial nuclear arsenal of its own. Moreover, the historic assumption that missile threats would be WMD threats means that little thought has been given to responding to conventionally armed salvos. Of course, one might argue that options for the sub-strategic use of UK’s Trident nuclear programme might obviate this risk, but this too involves complications – most notably the fact that an opponent with a poor early-warning system cannot easily distinguish a low-yield Trident submarine-launched ballistic missile (SLBM) launch from a full-scale nuclear salvo, given that the UK only fields one missile for both.41 As such, a limited use of Trident risks being misconstrued as a full-scale strike and responded to in kind, and is thus as politically difficult to enact as a full-scale strategic use.

Developing other sub-strategic nuclear options, such as nuclear-capable submarine-launched cruise missiles (SLCMs) or IRBMs, might be more feasible but also politically fraught given the controversies that surround intermediate nuclear forces. Conventional retaliation in kind, particularly against a conventional strike, is easier to contemplate, but involves two complications. First, this would mean targeting the Russian homeland – which Russia has deemed a potential basis for nuclear first use.42 Russia, moreover, has the low-yield nuclear options and associated delivery mechanisms to make the first use threat credible. The substantial Russian arsenal of

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42. Russia’s 2014 Military Doctrine defines both nuclear use and conventional strikes against the Russian homeland as a basis for nuclear first use. While it does stipulate that conventional strikes must threaten critical infrastructure, it would appear that Russian authors delineate infrastructure as being critical on the basis of a broad set of criteria, including damage to national prestige. See Johnson, ‘Russia’s Conventional Precision Strike Capabilities, Regional Crises, and Nuclear Thresholds’, pp. 53, 87.
low-yield nuclear weapons, coupled with the existence of IRBMs such as the RS-26 and the Kinzhal, and cruise missiles that can be clearly differentiated from Russia’s ICBM arsenal, makes it possible, albeit risky, to launch a limited first strike without it being confused for a full-scale salvo by an opponent. The existence of intermediate-range weapons with dialable yield warheads which can carry differing payloads makes it possible to communicate limited intent more credibly – given that warheads for delivering low- and high-yield weapons are not identical. Of course, given that missiles such as the RS-26 can carry high-yield warheads, there is a risk of erroneous attribution but, given that the UK lacks a launch on early-warning policy, the discrimination problem is less of an onus on Russia. Given that the UK, unlike Russia, will not launch a warhead before target damage assessment, the risk of a limited salvo being misidentified as a full-scale strike is lower for Russia. By contrast, because Russia’s likely launch on early-warning posture implies launching as soon as a strike is identified, the risks of a limited response being confused for a full-scale strike are larger. Second, even if the UK did retaliate against Russia, although it has the long-range strike to do this with Tomahawk Land Attack Missiles, for example, Russia has a substantially more developed integrated air defence system (IADS) – meaning that, should this evolve into a reprisal conventional missile exchange along the lines of the Iran–Iraq War, the country without any credible IAMD is at greater risk. Perhaps most importantly, however, retaliatory threats do not really obviate the strategic deterrence function identified by Russian authors in Figures 1 and 2 – even if the UK can retaliate after the damage of a limited first strike, the risk of having to incur this strike in the first place will hamper policymakers’ freedom of action. Deterrence by punishment, then, is important but not sufficient.

Against an opponent that is not a peer competitor, such as a regional rogue state, the UK could use retaliatory strikes to deter a WMD strike against the homeland or UKOTs. However, relatively weak states looking to use nuclear and other WMD capabilities to offset conventional weakness often tend to devolve control over these assets to make what would otherwise be a non-credible threat credible. An example of this is Pakistan’s decision to devolve operational control of its tactical nuclear arsenal as a means of reinforcing its deterrent posture regarding India.43 This does mean, however, that weak states with WMDs sometimes (though not always) have weak central C2 and a greater risk of losing control over events as commanders exercise decision-making power.44 However, retaliation against conventional attacks on military targets such as sovereign bases may not serve a deterrent purpose, insofar as such strikes would be carried out by an actor already at war with the UK and expecting retaliation.

At the theatre level, the issue of being sealed out of conflicts where the UK has a strategic stake is likely to be reinforced by increasingly capable anti-access area denial (A2AD) capabilities, of which both ballistic and air-breathing missiles are a major part. Cruise and ballistic missiles pose an increasingly credible threat, particularly when used in conjunction with one another, to the bases, ports and airfields needed for power projection. Moreover, anti-ship ballistic missiles (ASBMs) such as China’s DF-21D and anti-ship cruise missiles (ASCMs) such as the

44. Ibid., p. 21.
Russian KH-35U and the Zircon could hold the ships that comprise a carrier strike group at risk at significant distances from the theatre of operations.\textsuperscript{45} Threats to carrier groups and the infrastructure that underpins power projection are not necessarily new. The Soviet Union’s naval doctrine during the late Cold War, for example, relied heavily on air- and ground-launched missiles to keep NATO at bay.\textsuperscript{46} However, both technology and strategic shifts have combined to render the threat more salient. In terms of technology, tools such as ASBMs hold carrier strike groups at risk at distances from which land-based missile batteries could not operate. The increasing accuracy of short-range ballistic missiles (SRBMs) also portends an improved likelihood of successfully shutting down a regional base or airfield. Air-breathing threats have also become more lethal with the introduction of missiles such as the Zircon which is capable of operating at hypersonic speeds.\textsuperscript{47} Perhaps more salient, however, is the aforementioned shift in the strategic environment. In a conflict that is less than existential, the number of assets one has to strike to compel an external power to accept a fait accompli is lower than would have been the case in the Cold War when the US Navy’s outer air-battle concept and the forward maritime strategy in which it was nested assumed that NATO would accept heavy naval losses to break down the USSR’s anti-access system in what would have amounted to a total war.\textsuperscript{48} As such, A2AD systems need to inflict less damage in a limited regional war to achieve their intended effect than they would have if the Cold War had become hot.

In effect, then, the UK faces two major threats. The first is the threat of limited strikes against the homeland by cruise or ballistic missiles as a means of either deterring it from acting in its desired role in a regional conflict or constraining the effective use of its forces. The second is the theatre-level threat posed to its fielded forces by precision-strike assets. The thread that binds both threat types together is the idea of localised or limited conflict, whether in the grey zone or otherwise. Adversaries operating in this manner have use for missile arsenals both as a tacit coercive threat before direct hostilities with the UK commence and as a means of applying calibrated ‘doses of pain’ to fielded forces and civilians, should conflict involve the UK. Critically, then, there should be a limited expectation of the use of missiles at the strategic level, even by adversaries with substantial arsenals – their objective being to coerce the UK, not to overwhelm it. This poses both problems and opportunities. On the one hand, deterrence by nuclear punishment is less than credible as a deterrent against such limited shows of force. That being said, the traditional objection to missile defence – that it is simply not credible in the event of a massed attack by a great power – is less sound in the event that any expected salvo

\textsuperscript{47} Mark Gunzinger and Bryan Clark, ‘Winning the Salvo Competition: Rebalancing America’s Air and Missile Defences’, CSBA, 2016, pp. 11–12.
is likely to be limited. The possession of limited IAMD capabilities against such threats, then, is no longer strategically unnecessary.

**Actor Types**

**Peer Competitors**

The challenge posed by peer and near-peer competitors is driven by the fact that powerful states such as China and Russia are not competing globally but, for now at least, in or near their own backyards. They thus recognise that they can leverage what they perceive to be an asymmetry of commitment through Thomas Schelling’s risk manipulation approach. Peer competitors such as China and Russia have invested in a suite of counterforce and countervalue missile capabilities designed for the same purpose as rogue state arsenals – namely effecting escalation control and, by extension, enabling localised challenges to a regional security architecture. At the theatre level, the creation of A2AD ‘bubbles’ in Eastern Europe and the Asia-Pacific by a combination of cruise and ballistic missiles in conjunction with other capabilities poses serious risks to Western credibility in these regions. On the one hand, these capabilities raise the possibility that by the time fielded forces can be effectively deployed to a regional flashpoint, the status quo will be irrevocably altered. On the other hand, the implicit risks posed by these capabilities to expeditionary forces once deployed effectively alter the thresholds of provocation at which policymakers would consider deploying troops at all, enabling low-level challenges to the status quo. As the pattern of island-building in the South China Sea and the Russian annexation of Crimea and its intervention in Donbas illustrates, the capacity to hold opposing forces at bay with either the use or implicit threat of anti-access capabilities allows gradual alterations of the status quo at relatively low levels of risk.

Beyond the tactical level, Russia views its long-range precision-strike capabilities as a tool with which to manage escalation at all levels of conflict – deterring rivals from acting before the kinetic phase of operations through coercive threats and using conventional and nuclear strike capabilities to shape its action after overt conflict begins. Russia’s arsenal, which is comprised of roughly 1,500 strategic nuclear warheads and 4,500 nuclear-capable ballistic missiles, coupled with a range of conventional ballistic missiles and dual-use cruise missiles, such as the Kalibr

52. Billy Fabian et al., ‘Strengthening the Defense of NATO’s Eastern Frontier’, CBSA, 2019, pp. 7–13; on the effect of China’s A2AD as a tacit enabler of grey-zone aggression, see Clark et al., ‘Restoring American Seapower’, pp. 9–16.
series, dwarfs almost any missile arsenal on the planet in size and sophistication.\textsuperscript{53} Offensive missiles such as the Iskander and Kalibr pose substantial risks to NATO forces attempting to reinforce outposts such as the Baltics in a regional contingency, while longer-range ballistic missiles confer upon Russia the capacity for limited escalations against the homelands of Western European states, including the UK.\textsuperscript{54} Indeed, the emergence of missiles such as the Kalibr and its export variant, the Klub, has led some observers, such as Vice Admiral James Winnefeld of the US Navy, to suggest that homeland defence against cruise missiles had now emerged as a priority co-equal with BMD.\textsuperscript{55} Currently, Russia possesses a number of long-range precision-strike assets with which it can target the UK. Air-launched cruise missiles such as the KH-55 launched from bombers such as the Tu-160 MI/M2 and Tu-95 MSM are joined by sea-launched Kalibr variants that can strike targets in the UK from the Baltic Sea and ground-launched cruise missiles such as the SSC-8. Additionally, ballistic threats such as the Kinzhal air-launched ballistic missile and the RS-26 can deliver precision strikes against the UK from intermediate ranges.\textsuperscript{56}

By contrast, China has emphasised an arsenal of conventional cruise and ballistic missiles such as the DF-21D ‘carrier killer’, conventional SRBMs and IRBMs such as the DF-15 and DF-26, which will likely target bases, and a litany of ASCMs such as the YJ-18. Effectively, China places a greater premium on area denial than punishment, whereas Russia’s approach mixes both strategies.\textsuperscript{57}

For both states, missiles are nested within a wider strategy of effectively rendering Western military superiority irrelevant by either making it politically unusable or operationally impeding its deployment. To be sure, differences exist in the approaches taken to escalation control by different peer competitors – China’s nuclear doctrine still adheres to the concept of ‘no first use’ and has no equivalent to the Russian notion of escalatory de-escalation at the nuclear level. That said, several Chinese doctrinal documents have explored the idea of making an example of a particular high-value military vessel in a regional crisis to demonstrate resolve. A limited salvo on a UK vessel attempting a freedom of navigation operation might well be an appealing way to achieve this end.\textsuperscript{58}

\begin{itemize}
\item \textsuperscript{54} Kathleen Hicks et al., \textit{Evaluating Future U.S. Army Force Posture in Europe: Phase II Report} (Washington, DC: Center for Strategic and International Studies [CSIS], 2016), p. 36.
\item \textsuperscript{56} Defense Intelligence Ballistic Missile Analysis Committee, ‘2017 Ballistic and Cruise Missile Threat’, National Air and Space Intelligence Center, 2017.
\item \textsuperscript{57} Anthony Cordesman, ‘The PLA Rocket Force: Evolving Beyond the Second Artillery Corps (SAC) and Nuclear Dimension’, CSIS, 2016, pp. 29–37.
\end{itemize}
Traditional missile defence, with its emphasis on hit-to-kill interceptors, would be of limited use against a full-blown missile salvo from a near-peer competitor. However, given that both Russian and Chinese doctrines call for the use of limited salvos involving small numbers of missiles as a means of signalling credibility or imposing costs on an opposing party without triggering a full-scale conflict, nationally owned missile defences could well protect fielded forces and urban populations in the UK from this sort of attack. Additionally, national missile defences can be allotted to provide added resilience to particularly critical infrastructure or vital urban centres. For example, Taiwan has achieved a substantial strategic effect by deploying a modest force of 16 Patriot batteries against roughly 1,500 Chinese SRBMs on the principle of point defence – prioritising the defence of particularly high-value targets rather than trying to defeat a salvo entirely.59 While this is not exactly what this paper proposes, it does illustrate that even against large enemy salvos a national missile defence capability for the UK could be useful under some circumstances.

Regional Rogue States

For the purposes of this paper, a regional rogue state is defined as a state with credible capacity to act as a spoiler in its region, but which lacks and is unlikely to possess the ability to project power out of it. This definition poses some challenges – for example, Russia has limited power-projection capabilities outside its immediate periphery but is classified as a peer competitor by documents such as the Missile Defense Review. However, the term remains the most useful basis to categorise states such as Iran and North Korea which, though divergent in many ways, pose a similar type of threat insofar as their power is strictly bounded to their immediate environs and will remain so for the foreseeable future. The characteristics of such actors, sometimes grouped under the rubric of rogue states, are a modicum of stability (however authoritarian the government that underwrites it) and a moderate capacity for resource extraction in the form of taxes and the organisation of industry for military purposes.

While not as sophisticated as the arsenals of peer competitor states, rogue state missile arsenals typically include a reasonably robust mix of SRBM, MRBM and, in some cases, IRBM capabilities. An archetypal example of a rogue state threat would be Iran, which maintains a robust if crude arsenal of ballistic and cruise missiles. Iran’s ballistic missile arsenal, which includes ASBMs such as the Khalij Fars (Persian Gulf) infrared-seeking ASBM and Soumar cruise missiles, confers upon the Islamic Republic the capacity to attempt a blockade of the Strait of Hormuz, through which pass an estimated third of the world’s oil supplies.60 While Iran for the most part lacks the sophisticated A2AD capabilities of the UK’s more capable competitors such as Russia, the capacity of even a moderately sized cruise and ASBM capability to do substantial damage to a locally deployed force and effectively close off a regional sea to shipping was illustrated by

59. Michael Lostumbo et al., Air Defense Options for Taiwan (Santa Monica, CA: RAND Corporation, 2016), pp. 10–19. The Patriot is a long-range air-defence system capable of point defence (that is, defence of its immediate environs) against some ballistic missile threats.

the US Army’s Millennium exercises in which Lieutenant General Paul Van Riper, in his capacity as the red team commander, used an arsenal roughly the size of Iran’s to sink a US carrier and 10 cruisers.61 Crucially, Van Riper achieved this by acting pre-emptively and quickly, before a preponderant but slow to act adversary could mobilise. This risk will be even more pronounced in a NATO context where the deployment of assets such as the ALTBMD system out of area in an expeditionary role will likely require a political consensus regarding the allocation of nationally owned assets in a non-Article 5 context. While the ALTBMD and NATO Integrated Air Defence System (NATINADS) and related C2 arrangements already exist, assets committed to these systems are under national control. Currently, only the European Phased Adaptive Approach (EPAA) sites at Redzikowo, Poland and Devesulu, Romania are under permanent NATO control. While the Allied air command at Rammstein can cue these assets for territorial defence, standing up a JFAC capable of tasking these assets as part of an overall campaign plan or moving them into theatre for a campaign requires the NAC to invoke Article 5 and then to make the decision to stand up a JFAC — a process which may take up to a week. For out-of-area deployments in regions such as the Persian Gulf, the invocation of Article 5 is unlikely, meaning that while individual states may choose to commit resources, NATO as a whole will not be available.62

In addition to anti-ship capabilities, Iran possesses an ever-growing range of ballistic missiles which could be targeted at fixed facilities and civilian populations. SRBMs such as the Fateh-110 and Shahab-1 (a derivative of the Russian Scud) have the capacity to target the port and critical infrastructure nodes upon which a Western response to a regional crisis might depend.63 This would be salient for the UK given that the Royal Navy’s port facilities in Bahrain would constitute an obvious target for these missiles in a conflict scenario. Additionally, the Shahab and Fateh series can be used to target an opponent’s civilian infrastructure in a regional contingency. The threat of civilian punishment might be an appealing means for Iran to convince local actors to deny necessary facilities to a Western force. Conventional warheads possess a limited capacity for damage but, if an actor’s commitment to a cause is already limited, the level of damage that can be done may be sufficient to compel their withdrawal from a coalition. Additionally, the damage done by conventional warheads can be disproportionate to their payloads if select critical national infrastructure is targeted. For example, in a regional war in the Gulf, an Iranian salvo shutting down Riyadh’s single desalination plant or Bahrain’s two ports at Sitra and Manama would have consequences disproportionate to the power of the warheads themselves.

Beyond this, Iran has demonstrated an interest in the development of the Shahab-6, a long-range ballistic missile which would place most European cities at risk. While the development

of this missile, thought to be a derivative of the North Korean Taepodong-2, has been stalled as part of the regime’s concessions to European powers, an increasing degree of uncertainty over the future of the Joint Comprehensive Plan of Action (JCPOA) may well see the regime remove its clerical taboo on the development of long-range missiles – rendering the emergence of an Iranian long-range counter-city capability a possibility.64

While the conventional payloads carried by a non-nuclear IRBM may have a relatively trivial effect in comparison to missiles tipped with WMDs, the capacity to impose civilian costs on a democracy may make even a conventional countervalue strike an appealing option for a relatively weak state. This is particularly true given the disproportionate cascading effects that even a limited conventional strike – if conducted with highly accurate missiles – can have within a large interconnected metropolis. For example, the 9/11 attacks are remembered largely for the damage done to the twin towers of the World Trade Center, but what is often ignored is the catastrophic second order effects the attacks nearly produced. Shortly after the attacks, the electrical grid in the surrounding area shut down, causing the pumps that keep the Hudson River from flooding the New York subway to shut down and compelling emergency services to rush a generator-operated emergency pump train to the site to pump out an amount of water 27 times the volume of Shea Stadium. While it is difficult to estimate the casualties had this ad hoc response to an occurrence for which emergency services had not planned failed to materialise, they are likely to have been substantially higher than the day’s actual toll. Elsewhere, the uncertainty caused by the attacks saw financial markets briefly panic, forcing then Chairman of the Federal Reserve Alan Greenspan to take emergency action to preclude a recession.65 Effectively, then, it does not take much to produce a so-called ‘butterfly effect’ in a complex interconnected society, raising the coercive value of conventional missiles to a level comparable, if not identical, to that of WMDs. While this has much less certainty of effect than the use of WMDs, it does not need to produce certain effects if the objective is to deter intervention-only and to face Western policymakers with a realistic risk that complicates their decision-making. The risk posed by conventional missiles is particularly acute for nations with fragile national infrastructures. By way of an example, Riyadh currently relies almost entirely on a single desalination plant at Al Jubail to supply it with water.66 The loss of this plant to a ballistic missile raid could have unpredictable effects for regime stability. As such, it is not only democracies that need to worry about the cascading effects that missile strikes on critical infrastructure can produce.

A shorter-range threat is posed by Syria, which operates an arsenal of Russian-made bastion coastal defence missiles and SRBMs capable of targeting facilities such as the Akrotiri Royal Air

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Force base in Cyprus, along with regionally deployed forces. Syria’s pre-war arsenal consisted of Scud-C and -D SRBMs capable of carrying both conventional warheads and, in extremis, chemical or biological payloads.\(^6^7\) While it is difficult to imagine the regime choosing to deploy what remains of these forces against Western targets in a scenario short of a threat to its own survival, there remains the possibility that it might misconceive the significance of a limited strike or action against it and by extension initiate a risky strike against fielded Western forces to deny them regional access. Indeed, the tendency of leaders to embrace catastrophic explanations of an opponent’s actions and, by extension, engage in strategic overreaction, is a consistent fixture of international politics.\(^6^8\)

Another regional power with a substantial missile capability is North Korea, which has now obtained, through its Hwasong-15 ICBM, the capacity to hit most Western targets with a nuclear-armed ballistic missile. In addition, the North Korean regime employs a moderately sophisticated anti-access capability based on imported and reverse-engineered versions of the Russian KH-35 ASCM and Chinese CSS-C-2 Silkworm ASCM.\(^6^9\) Much of North Korea’s arsenal is aimed at regional adversaries such as Japan and the US. That said, the stated policy aim of a higher profile in East Asia as a contributor to regional order embeds the UK in regional dynamics to a degree that it has not been for decades – meaning that it may well find itself the target of a regional rogue state.\(^7^0\)

Effectively, then, the threat posed by rogue state missile arsenals is strategically identical to the approach of peer competitors but less sophisticated at the technical level. Missiles serve to raise the risks of Western activity in regional theatres to levels that exceed the value of the often-non-existent aims being pursued. These often-unsophisticated arsenals have questionable operational use, but the mere risk they pose to fielded forces is enough to achieve a deterrent purpose. While the C4ISR capabilities needed to target mobile forces may be beyond more unsophisticated states targeting logistical nodes, C2 centres and other fixed assets upon which fielded forces depend may well be within their capacity – a point illustrated by the successful Iraqi scud attack on US Army barracks in Saudi Arabia in 1991.\(^7^1\) Moreover, as examples such as the Egyptian Styx raid on an Israeli destroyer during the Six-Day War and Hizbullah’s attack on the Israeli corvette INS Hanit show, targeting mobile assets is not entirely

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impossible even for weak actors (Egypt, of course, was not a weak actor but the missile boat it fielded to fire the Styx was a very cheap one).  

While rogue states lack the diversified nuclear arsenals to target military facilities in the homeland with low-yield nuclear weapons, the possession of capabilities that can target civilian centres raises the risks of a regional intervention enormously for both regional and extra-regional great powers and, concomitantly, creates the strategic space for rogue states to engage in relatively risk-free challenges to the regional order. Even though these arsenals serve a deterrent purpose, this is not synonymous with defensive intent. Incidents such as the North Korean sinking of the South Korean vessel Cheonan in 2009 and the subsequent shelling of the South Korean Yeonpyeong Islands by North Korean artillery illustrate the central threat posed by rogue state counter-value capabilities, of which missiles are an important component – namely their capacity to provide rogue states with escalation control. Rogue state missile arsenals’ threat to civilians precludes conventional conflict at the higher levels of warfare in which weak states are at their most vulnerable by posing opponents an unacceptable escalatory risk. They thus enable low-risk provocations such as localised attacks, support for insurgents and other challenges to global order.

Rogue states can also act as launch platforms for more powerful allies – which the positioning of missiles in Syria by Russia and Iran highlights. From a position in Syria, Russian forces can menace the entire Eastern Mediterranean. They can also extend the reach of their own missile arsenals by providing local actors with ballistic missile capabilities. This allows them to both take advantage of the geographical position of a well-situated proxy and to potentially use ballistic missiles as a grey-zone coercive tool as, for example, Iran has regarding Saudi Arabia through the Houthis.

Non-State Actors

In addition to state-based missile arsenals, the last two decades have seen a number of non-state actors obtain cruise and ballistic missile capabilities, often as a result of their role as proxies for rogue states. Examples include Hizbullah, which deployed Iranian-made missiles in

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75. A proxy is defined as an actor who engages in a conflict on behalf of a third party that wishes to avoid direct and visible engagement, see Andrew Mumford, *Proxy Warfare* (Cambridge: Polity Press, 2013). On Iran’s use of proxies, such as the Houthis, see Hook, ‘The Iranian Regime’s Transfer of Arms to Proxy Groups and Ongoing Missile Development’.  
both an anti-shipping role and as a tool for civilian punishment during its 2006 war with Israel, successfully damaging the Israeli corvette INS Hanit with what is likely to have been a Chinese C-802 missile imported from Iran and imposing shutdowns on Israel’s northern cities with rocket and missile barrages. The forced evacuation of thousands of civilians from northern cities played a role in convincing President Ehud Olmert’s government to initiate an offensive on Hizbullah’s terms on ground that the group had prepared extensively. Effectively, Hizbullah recognised that even minimally effective attacks would allow it to dictate the tempo of the campaign and the level of escalation at which it fought.  

More recently, the Houthi insurgency in Yemen has deployed Burkan SRBMs (assumed to be a derivative of the Scud) against targets in Saudi Arabia, such as the Al-Muzahimiyah airbase outside Riyadh. Additionally, the Houthis have attempted to target US Navy vessels with an ASCM that was likely a C-800. The insurgents have also targeted the Saudi-led coalitions’ vessels and infrastructure using a range of Iranian exports such as the Zelzal-3, an SRBM with a 200-km range. Regional powers may see support for insurgents as a low-risk way of both expanding their influence and testing their own missile arsenals and may, as a result, be willing to share weapons with insurgents.

While insurgents typically lack the long-range capacity to target cities in Europe, this could change. For example, state failure in a state such as Algeria (which currently operates Russian Iskander missiles) could place capabilities in the hands of an insurgent group such as Al-Qa’ida in the Islamic Maghreb, which would be sufficient to target Gibraltar. At present, though, this threat is not imminent and ranks behind the arsenals of peer states and rogue states in terms of both severity and likelihood. It is, however, worth citing as something that may conceivably become salient over the long term.

Central Features of the Threat Environment

The threat environment with regard to missile threats, then, has evolved in key ways. The critical factor is that the ability of well-calibrated missile threats to complicate decision-making and protract response times makes countering them a key factor in the early stages of a crisis response.

- Ballistic missiles both in an area denial and countervalue capacity serve as a tool of escalation control, precluding Western forces from engaging in high-tempo, high-intensity combat at a level of escalation in which they are dominant and instead allowing the opposition to dictate the tempo of campaigns.


The most likely threats facing fielded forces, fixed military assets and cities are limited ‘demonstrative’ salvos aimed at shocking target governments into negotiating an end to the conflict.

By contrast, the capacity to deliver overwhelming nuclear salvos of the type seen in a general war seems absent or at least de-emphasised in the planning of both peer competitor and lower-level adversaries. In the event that war does occur, technological developments appear to be incentivising deep operational missile strikes along the length of an opponent’s territory, targeting both civilian and military infrastructure. The emphasis of these strikes is not necessarily to kill civilians but to impose temporary operational and political paralysis on a society for long enough for a revisionist state to accomplish its goals.

The existing European missile posture is sufficient to cope with some of these threats, for example a countervalue launch by a rogue state such as Iran, but is insufficient to contend with a near-peer state at any level of escalation due largely to the internal restrictions placed upon it for policy reasons. Currently, the backbone of Europe’s territorial defence against missile threats is provided by the EPAA. The EPAA, which constitutes the US’s major contribution to NATO’s missile defence shield, was put in place by US President Barack Obama’s administration in 2009 as an alternative to the placement of GMD in Europe as envisioned by President George W Bush’s administration in 2007. The programme progressed in three phases:

- Phase I: The deployment of Aegis destroyers, homeported in Rota, Spain, to BMD patrols in the Eastern Mediterranean and the deployment of an AN/TPY-2 X-Band radar to Kurecik, Turkey.
- Phase II: Building an Aegis Ashore site in Deveselu, Romania.
- Phase III: Building an Aegis Ashore site in Redzikowo, Poland.

A cancelled fourth phase would have seen the deployment of the SM-3 Block IIB interceptor capable of ICBM intercepts to Poland. The architecture of this system is entirely aimed at Iran with the forward-based Turkish X-band providing early-warning and tracking data to effectors both afloat and ashore in the event of an Iranian launch. It is likely that the EPAA does in fact provide sufficient coverage against this threat.

However, the placement of Aegis sites at Redzikowo in Poland and Deveselu in Romania and the restrictions placed on the interceptor types and numbers at these sites precludes their...

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80. Ibid., p. xi.
effective use against either limited or large-scale launches from Russia – a decision made in the hope of mitigating Russian qualms over BMD in Europe.\textsuperscript{82} Moreover, theatre-level missile salvos in regions beyond Europe are beyond the remit of the EPAA. While the ALTBMD and NATO Integrated Air and Missile Defence System (NATINAMDS) frameworks can provide this capacity, subject to the availability of nationally controlled assets, this is subject to the delays discussed earlier. Perhaps most important, however, is the inability of the existing NATO framework to cope with the increasing complexity and integration of missile defence, as well as the pace of events. Missile salvos are likely to comprise an amalgam of cruise- and ballistic-missile threats, augmented by unmanned aerial swarms. The emerging battlespace is one in which the distinction between tactical attacks on the front and strategic attacks in an opponent’s rear is eroding. This sort of scenario exceeds the remit of Alliance-wide planning which envisions both a clear distinction between war and peace and a build-up to hostilities that allows for an Alliance-wide response to be coordinated.

\textsuperscript{82} Sankaran, ‘The United States’ European Phased Adaptive Approach Missile Defense System’.
II. A Brief Introduction to the Technical Aspects of Missile Defence

An Introduction to Missile Technology

A BRIEF PRIMER ON the types of missile threats the UK might face and some of their basic technical details would be germane here to develop an outline of the mix of capabilities the UK might need to alleviate this complex threat. The critical issue is that a mix of missiles with differing trajectories, payloads and ranges requires a comparable suite of responses. Moreover, some types of threat are more prominent in some regions – a fact that should inform the UK’s regional investments.

Two types of missile predominate in the current strategic environment – ballistic and cruise. The distinction between the two is that whereas a cruise missile conforms to a low-flying trajectory within the Earth’s atmosphere for the entire duration of its journey, a ballistic missile follows a standard parabolic trajectory, with its initial thrust typically (but not always) carrying it either beyond or to the edge of the Earth’s atmosphere before it enters its midcourse, proceeding along a trajectory that conforms to the Earth’s orbit before beginning its descent above its intended target. A caveat to this, however, is that nascent technology in the field of hypersonic glide vehicles might enable warheads carried on ballistic missiles to move along non-parabolic trajectories within the Earth’s upper atmosphere at speeds of up to Mach 8, hitherto deemed technologically unfeasible.83

At present, both China and Russia claim to have developed the capacity to field hypersonic glide vehicles in the next few years, which would severely compromise the viability of conventional missile defences.84 This is compounded by the fact that, if such missiles are exported to smaller powers, rogue state limited launches are likely to become much more viable. Independent research into hypersonic vehicles by countries such as Iran, which built its first hypersonic wind tunnel in 2014, suggests that this technology may not be the sole preserve of great powers.85 Most existing missile defences, however, are built to counter the more conventional ballistic missiles that currently dominate actors’ arsenals.

84. Ibid.
As mentioned above, the trajectory of a ballistic missile is divided into three phases: a boost phase, during which it ascends; a midcourse phase, in which it cruises towards its target; and a terminal phase, in which the warhead begins its descent. Depending on the sophistication of the party firing the missile, the missile may be equipped with multiple independently targetable re-entry vehicles (MIRVs) – that is, capable of splitting into multiple independently targetable warheads upon re-entry into the Earth’s atmosphere. Typically, ballistic missiles are grouped by range, as illustrated in Table 1.

### Table 1: Missile Types and Characteristics

<table>
<thead>
<tr>
<th>Type</th>
<th>Range (km)</th>
<th>Flight Time to Limit of Radius/Speed (Minutes)</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRBM</td>
<td>100–1,000</td>
<td>3–9</td>
<td>Fateh-110, Scud B, Iskander</td>
</tr>
<tr>
<td>MRBM</td>
<td>1,000–3,000</td>
<td>9–19</td>
<td>DF-21</td>
</tr>
<tr>
<td>IRBM</td>
<td>3,000–5,500</td>
<td>19–26</td>
<td>DF-26</td>
</tr>
<tr>
<td>ICBM</td>
<td>5,500+</td>
<td>26+</td>
<td>SS-X-30 ‘Satan’</td>
</tr>
<tr>
<td>Land attack cruise</td>
<td>300–1,500</td>
<td>60+</td>
<td>Kalibr 3M-14</td>
</tr>
<tr>
<td>ASCM</td>
<td>100–600</td>
<td>10</td>
<td>3M22 Zircon</td>
</tr>
</tbody>
</table>


It is worth noting here that a missile’s range is not necessarily a fixed variable, since range can be enhanced by altering the size of its payload. For example, a US Trident missile carrying its full payload of eight warheads can travel 8,000 km but can traverse 11,000 km if carrying a payload of four warheads.\(^{86}\) Alternatively, a ballistic missile’s range can be shortened by firing it on either a lofted or a depressed trajectory – the former involves firing the missile to a higher maximum altitude and the latter to a lower one.

The velocity of a ballistic missile is a function of the ratio between its total mass and the mass of propellant it contains and is captured by the equation:

\[
V = V^* \ln\left(\frac{M_S + M_P}{M_S}\right)
\]

Where \(V\) is the final velocity of the missile at burnout, \(V^*\) is the velocity at which fuel is expelled from the missile’s boosters and \(M_S\) and \(M_P\) are, respectively, the mass of fuel in the missile and the mass of the missile itself. As such, the determinant of a missile’s speed is the ratio of the mass of the fuel it contains to the overall mass of the missile. Typically, a missile’s velocity is increased by dividing its fuel between multiple boosters that are activated at multiple stages. A multi-stage rocket carries the same total amount of fuel as a single-stage one of a similar size.

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but, due to its boosters being activated separately, produces a greater overall velocity. As such, there is a direct correlation between a missile’s speed and range.

By contrast, air-breathing cruise missiles do not have warheads which separate from their boosters. They travel significantly more slowly than most ballistic missiles, but skim along less predictable low-flying trajectories by not conforming to a standard parabolic arc. A caveat here is that hypersonic cruise missiles such as the Russian Zircon ASCM can approximate Mach 6 speeds comparable to SRBMs. Cruise missiles remain within the Earth’s atmosphere during their flight, often changing altitude over the course of their journey and starting their final approach flying as low as possible to evade radar by hugging the terrain. Instead of being grouped by range, then, cruise missiles are grouped by their intended target. Land attack and anti-ship cruise missiles, the two broad categories found commonly, differ in their targeting systems and payload. While most cruise missiles operate within a short range of several hundred kilometres, exceptions to this rule exist, such as the Russian Kalibr KH-101/102 air-launched cruise missile and the Kalibr 3M-54 ASCM, which operate within a 2,000-km range.

The speeds and typical trajectories of different types of missiles are shown in Table 2. Typically, cruise missiles, SRBMs and, in some cases, MRBMs do not leave the Earth’s atmosphere (70 km above the surface), while IRBMs and ICBMs always do. This, combined with the greater speeds of longer-range missiles, means that different types of interceptor are needed to counter each threat.

Table 2: Missile Trajectories

<table>
<thead>
<tr>
<th>Type</th>
<th>Burn Time (Seconds)</th>
<th>Burnout Altitude (km)</th>
<th>Apogee (km)</th>
<th>Burnout Speed (km/s)</th>
<th>Burnout Angle (Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRBM</td>
<td>62–80</td>
<td>25–35</td>
<td>85–120</td>
<td>1.6–2.0</td>
<td>41–43</td>
</tr>
<tr>
<td>MRBM</td>
<td>100–170</td>
<td>50–140</td>
<td>250–500</td>
<td>3.0–4.0</td>
<td>39–41</td>
</tr>
<tr>
<td>IRBM</td>
<td>140–250</td>
<td>100–300</td>
<td>700–1,200</td>
<td>4.5–5.5</td>
<td>33–38</td>
</tr>
<tr>
<td>ICBM</td>
<td>250</td>
<td>330</td>
<td>1,200</td>
<td>5.4–7</td>
<td>33</td>
</tr>
<tr>
<td>Cruise missiles</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>0.2–5</td>
<td></td>
</tr>
</tbody>
</table>


An additional, albeit nascent, threat is emerging in the form of hypersonic glide vehicles. While straight-line hypersonic weapons do presently exist (Russia’s anti-ship Zircon, for example), these vehicles represent a first in terms of their capacity to manoeuvre at hypersonic speeds. Their emergence represents another reason why passive and active missile defence must be combined with conventional counterforce, insofar as the only means for negating them is by destroying them left of launch.

87. Spier et al., *Hypersonic Missile Nonproliferation*, pp. 8–11.
As is apparent, then, the UK faces a mix of missile threats that differ in terms of their speeds and trajectories. This makes traditional separations between air and missile defence difficult given that sophisticated adversaries can mix salvos of different missiles. For example, ballistic missiles can be used to destroy air-defence radars which cannot track them and vice-versa, enabling subsequent salvos. This compound threat environment requires some form of integration between air and missile defences, which rely on different types of radars and interceptors and a robust mix of capabilities to combat multi-tier threats. The next section discusses the components that would collectively comprise such a capability.

**Missile Defences**

Existing missile defences are comprised of three components: sensors; command systems; and interceptors. Defences against both ballistic and cruise missiles rely on a radar system to track their target before firing an interceptor that makes contact with the missile before it reaches its destination. BMDs are usually networked with a satellite which detects a launch through its heat signature and informs relevant systems of its occurrence, after which the radar tracks the target along its trajectory before an interceptor is fired. The radar systems upon which both anti-cruise and anti-BMD systems depend are often dual use. For example, the AN/SPY-1 radar system upon which the US Navy’s BMD-capable ships depend is also capable of tracking cruise missiles. The US Navy’s AN/SPY-6 radar will fulfil both roles simultaneously.88 Similarly, the Sampson radar mounted on the Royal Navy’s Type 45 destroyers is capable of simultaneously tracking both ballistic and cruise missiles.

In addition to their hard-kill capabilities in the form of interceptors, missile defence systems such as Aegis, which conducts upper- and lower-tier missile defence on vessels such as the US Arleigh Burke-class destroyer and currently plays a BMD role in Europe (albeit in its ground-based variant Aegis Ashore), also come equipped with a series of electronic countermeasures that were seen in action when the US destroyer USS Mason deployed the decoys and chaff that are part of its Aegis system to foil a cruise missile attack by the Houthi insurgents in Yemen.89 As time goes on, the integration of hard- and soft-kill capabilities, such

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89. Soft-kill methods, such as decoys and chaff, are a means of misdirecting a missile’s targeting system rather than destroying it, as a hard-kill interceptor might. Decoys are usually infra-red-emitting objects deployed to attract the infra-red seekers on warheads, while chaff is comprised of radar-absorbent fibres that prevents a radar-emitting seeker from finding its target. Other soft-kill methods are the use of lasers to damage the targeting system on a missile. See, for example, Edward Maso, ‘Our Aircraft Carriers are Not Sitting Ducks’, *Forbes*, 4 August 2014, <https://www.forbes.com/sites/realspin/2014/08/04/our-aircraft-carriers-are-not-sitting-ducks/#4a0f33565095>, accessed 22 April 2019; on the attack on the USS Mason, see Sam LaGrone, ‘USS Mason Fired 3 Missiles to Defend From Yemen Cruise Missiles Attack’, *USNI News*, 11 October 2016, <https://news.usni.org/2016/10/11/uss-mason-fired-3-missiles-to-defend-from-yemen-cruise-missiles-attack>, accessed 22 April 2019.
as electronic and cyber measures, will become essential for effective missile defences. As the US Joint Chiefs of Staff Joint Integrated Air and Missile Defense: Vision 2020 notes, it is no longer sufficient to conceptualise missile defence purely in terms of passive defences against missiles once they are launched. Rather, the aspiration is that deterrence, interception ‘left of launch’ in the form of strikes against launchers, cyber and electronic warfare, active defence and passive defence will be integrated to provide a defender with both flexibility and strategic depth.

**Missile Defence Sensors and Command Systems**

**Sensors**

The core of any missile defence capability is its sensor suite, which serves the role of identifying a launch, tracking the target and discriminating between the target and non-threatening objects (including the decoys and chaff that more sophisticated missiles can deploy). This information is relayed to a command post, either ashore or afloat, where it is processed by the BMD system’s C2 capability. The type of sensors used to identify and track a target play a substantial role in delineating the scope of a missile defence system’s mission.

Once a launch has been identified by a satellite, a missile defence system typically relies on radar to provide tracking and discrimination. A radar’s bandwidth – the frequency of the waves it emits – is inversely proportional to its resolution but directly proportionate to the width of the area it covers. Thus, higher-frequency X-Band radar offers greater levels of target discrimination but operates along narrower lines of sight, whereas lower-frequency S-Band, L-Band and ultra-high frequency radars offer less granularity but can cover larger areas with less power – meaning that, all things being equal in terms of power sources, they have longer ranges. Against ICBMs which move at considerable speed and separate from their boosters outside the Earth’s atmosphere, defenders must deploy a combination of early-warning radars and radar with the resolution to discriminate between the warhead and its boosters, as well as any countermeasures it might deploy.

Next-generation air- and missile-defence radar, such as the AN/SPY-6 and the Sampson radar, with which the Type 45 destroyer is equipped, also offers users the opportunity to simultaneously scan and locate multiple tracks – allowing them to identify both ballistic and air-breathing threats simultaneously.

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Finally, space-based sensors can offer continuous tracking of a ballistic missile from boost phase through midcourse and, potentially, enable boost phase interception if combined with either space-based interceptors or targeted energy weapons.\(^92\)

**Battle Management Systems: The ‘Brain’ of Missile Defence**

The integration of multiple streams of information into a single image of the battlefield on which managers will base their decisions depends, in the final instance, on the software of a missile defence system – its ‘brain’. The C2 functions of a missile defence system typically include: tasking sensors; calculating target trajectories; discriminating targets from clutter; and allotting targets to interceptors.\(^93\)

A quick expedient with which the UK could integrate its existing capabilities with a missile defence role is to augment the C2 systems of ships such as the Type 45 with software such as BMD-Flex which would enable them to communicate with other Allied assets. Assuming that the UK wishes to engender interoperability with NATO partners in a missile defence role without creating a specialised national missile defence capability, building on steps already taken in this direction would be germane.\(^94\)

Alternatively, if it does opt for a national IAMD capability, the UK will need a system capable of tasking multiple sensors and shooters within and potentially outside the UK. The UK could opt to rely on off-the-shelf battle-management systems (such as the C2 battle-management [C2BMC] system used by the US Aegis platforms ashore and afloat). Upgrades to existing battle-management systems such as the Multi-Level Integrated Command, Control and Communications Air Defence system developed for the Sky Sabre by Rafael might be a plausible option – not least because the software used is shared with Israel’s Iron Dome system which


is already linked with upper-tier defences in the form of David’s Sling.\(^\text{95}\) Alternatively, the UK could develop a battle-management system from the ground up, but this would entail costs and time delays.

**Missile Defence Interceptors**

The interceptors needed to counter cruise and ballistic missile defences differ substantially, insofar as they aim to target missiles at different altitudes.\(^\text{96}\) That said, certain launchers, such as the MK 41 VLS (vertical launcher system) of the Aegis system, can carry a mixed load of interceptors aimed at targeting both types of threat. Additionally, emerging technologies such as the Aegis SM-6 interceptor will be usable against both air-breathing and ballistic missiles. It is worth mentioning that the UK already possesses some means of cruise missile defence, such as the Sky Sabre anti-air system and the Aster missile series.\(^\text{97}\)

Ballistic missile interceptors are divided into categories based on the phase of the missile’s trajectory that they aim to make contact in.

- **Midcourse phase interceptors** target missiles at their highest altitude during the middle of their trajectory.
- **Terminal phase interceptors**, such as the PAC-3, target SRBMs as they begin their descent towards their target. Given the difficulties inherent in targeting missiles at this stage in their trajectory (SRBMs achieve Mach 6 speeds at this point and can spend less than 60 seconds in their terminal phase), terminal phase interceptors are typically employed as a defensive tool of last resort in conjunction with other interceptors.

Missile interceptors can be subdivided into two categories – exoatmospheric interceptors that target incoming missiles midcourse, and endoatmospheric interceptors, such as the US PAC-3 and the Aster 30, that typically play a dual role as both a defence against cruise missiles and a terminal phase defence against ballistic missiles. Missile defence interceptors vary in terms of both their speed and maximum altitude. As such, they correspond to threats that differ along the same lines – slower, low-altitude interceptors such as those of the PAC-3 system can target commensurately slow and low-flying targets such as cruise missiles and SRBMs, for example. A layered missile defence relies on exoatmospheric interceptors to intercept long-range missiles midcourse, while exo- to endoatmospheric terminal phase defences, such as Terminal

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High-Altitude Area Defence (THAAD), provide area defence against intermediate-range targets and endoatmospheric interceptors such as the PAC-3 provide point defence against SRBMs at specific sites.

Like the missiles they target, missile defence interceptors can be subdivided according to their speed, the altitude at which they operate and their range. The mix of interceptors typically fielded is summarised in Table 3.

Table 3: Missile Defence Interceptors

<table>
<thead>
<tr>
<th>Interceptor</th>
<th>Speed (km/s)</th>
<th>Maximum Range (km)</th>
<th>Maximum Altitude (km)</th>
<th>Missile Type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exoatmospheric</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GBI Block I/IIA/IIB</td>
<td>7.2</td>
<td>3,300</td>
<td>2,000</td>
<td>ICBM</td>
</tr>
<tr>
<td>SM3 Block IB</td>
<td>3</td>
<td>700</td>
<td>600</td>
<td>SRBM MRBM</td>
</tr>
<tr>
<td>SM3 Block IA</td>
<td>3</td>
<td>700</td>
<td>600</td>
<td>SRBM MRBM</td>
</tr>
<tr>
<td>SM3 Block IIA</td>
<td>4.5</td>
<td>2,500</td>
<td>1,450</td>
<td>IRBM MRBM Limited ICBM</td>
</tr>
<tr>
<td>SM3 Block IIB (conceptual stage)</td>
<td>5.5</td>
<td>2,500</td>
<td>1,450</td>
<td>ICBM</td>
</tr>
<tr>
<td><strong>Exo-/Endoatmospheric</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>THAAD</td>
<td>2.8</td>
<td>200</td>
<td>40</td>
<td>IRBM SRBM</td>
</tr>
<tr>
<td><strong>Endoatmospheric</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aster 30 SAMP/T</td>
<td>1.54</td>
<td>100</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>SM6</td>
<td>1.2</td>
<td>500</td>
<td>33</td>
<td>Cruise missiles Terminal phase BMD intercepts Anti-ship role</td>
</tr>
<tr>
<td>PAC-3</td>
<td>1.36</td>
<td>15–45</td>
<td>25</td>
<td>Cruise missiles Theatre ballistic missiles Terminal phase BMD</td>
</tr>
</tbody>
</table>

*Source: The author, 2019.*

The differing speeds, trajectories and uses of the various ballistic and air-breathing missiles currently proliferating necessitate a diverse mix of interceptors to counter them. Additionally, the emergence of disruptive technology such as the hypersonic glide vehicle will likely complicate the task of missile interception further – with the likely outcome being that traditional hard-kill methods will have to be mixed with soft-kill tools such as directed energy weapons and attempts to stop missiles left of launch by destroying them on the ground. At the moment,
however, missile–anti-missile interactions will be captured by the competition between the missiles and interceptors listed above.

In future conflicts, the UK will likely find itself countering a combination of cruise- and ballistic-missile threats (along with a range of other tools in the air, electronic and cyber spectrums) as the battlefield in which its forces operate becomes increasingly complex and congested. Simultaneously, ballistic and cruise missiles pose a strategic threat in the form of attacks on vital civilian infrastructure. Ballistic missiles comprise the bulk of the latter threat, but cruise missiles launched from submarines can augment the countervalue capacity provided to a nation by its ballistic missile arsenal. This is particularly true in the case of Russia, which has worked to render its submarine-launched Kalibr missiles capable of carrying both conventional and nuclear payloads.98

*Soft-Kill Methods*

In addition to interceptors, robust missile defences are increasingly deploying a raft of non-kinetic soft-kill instruments that aim to disable a missile threat in its boost phase or reduce its probability of striking its target without making physical contact. Existing soft-kill methods vary depending on whether they are being deployed aboard a ship or as part of a shore-based defence system. Ship-based missile defence systems can deploy decoys or chaff to complicate the targeting of an incoming missile salvo. For example, the MK 41 VLS deploys Nulka decoy canisters as part of its load.99

Second, systems dependent on kinetic kill vehicles can be augmented with tools such as directed energy weapons which can destroy the guidance system on a manoeuvring missile. These weapons have the advantage of being able to cover a wide surface area at speed, which is of importance given the potentially revolutionary ramifications of hypersonic glide vehicles travelling at Mach 6 speeds. At present, targeted energy weapons can only be used in a terminal phase role, given that they are limited to the line of sight of the platform firing them. That said, the possibility that they may be mounted on UAVs as part of a boost phase intercept system has been floated by figures such as former US Missile Defense Agency director James D Syring.100

Additionally, cyber attacks, targeted energy weapons and electromagnetic pulse-carrying warheads can all disrupt the sensors and computers that constitute an opponent’s kill chain.

These tools would comprise part of a nation’s left of launch capabilities and, given their non-kinetic nature, could allow for pre-emption at a tolerable level of escalation.

At this juncture, soft-kill methods are likely to be more useful against threats such as ASBMs at the theatre level, inasmuch as the ability to disrupt the targeting and homing systems of a ballistic missile aiming at a fixed target is of limited use. As former head of the US Joint Chiefs of Staff Martin Dempsey noted in Vision 2020, missile defence systems will increasingly have to evolve to play a role in a multidimensional battlespace, integrating both kinetic and non-kinetic means within operational concepts that mix offense and defence.101

III. Strategic and Operational Imperatives for Missile Defence

If the UK does move beyond its present position of exclusively relying on and contributing to NATO as well as developing limited maritime capabilities in the form of the Type 45, then the sort of missile defence system that it seeks, and the operational concepts that underpin it, will depend largely upon the role that missile defences are expected to play within the context of the country’s overall security posture. On the one hand, missile defence could be understood within the context of the National Security Capability Review’s stated objective of improving national resilience, particularly that of critical infrastructure. However, it is also worth considering the position of former Labour Secretary of State for Defence George Robertson who, when discussing the prospect of a national missile defence system, opined that it risked creating a ‘Maginot mentality’ within the UK. He questioned whether a ‘fortress mentality [is] the best way to address the problem at the political level’. However, implicit in Robertson’s statement, made in the strategic context of the late 1990s, was the assumption that relatively weak regional actors with nascent missile arsenals were the primary threat to the homeland – and by extension that a forward posture aimed at precluding such threats, either by denying adversaries access to key technologies or destroying their capacity to threaten the homeland at its source, was viable. In an environment in which peer competitors with large existing arsenals are a key threat, and in which regional states such as Iran and North Korea have increasingly robust missile arsenals, a purely forward-postured defence policy is no longer viable. Given that recent policy statements in the SDSR 15 by the UK government have emphasised the importance of increasing the UK’s influence within multilateral frameworks (both within and outside a NATO context), this would necessitate a rather different set of operational concepts and deployment patterns. Moreover, given that the purpose of missile arsenals is to curtail a forward posture both at the tactical level (A2AD) and the strategic level, the dichotomy is a false one. Missile defence is not a Maginot line but a springboard on which a forward posture depends.

As the following sections illustrate, the key components of the UK’s grand strategy of global engagement necessitate a more expansive and ambitious missile defence posture than has been considered at present. The rather narrow focus on NATO missile defence obscures the ways in which such an architecture could reinforce key components of the UK’s grand strategy.

Missile Defence and the UK’s Grand Strategy

A state’s grand strategy is its theory of how it might create security for itself, a relatively coherent ends–means–ways chain that sets the context for lower-level decisions regarding its military doctrine and policies about matters such as force structure. Each individual government can and has altered the contours of the UK’s foreign and security policy, it has retained a number of persistent features that have been restated by the present government’s policy. Central among these features are:

- Acting as a ‘networked power’ with a pivotal, if not usually preponderant influence in multiple regional alliance networks. Network centrality is a recurring motif of post-Second World War UK foreign policy, whether in the form of Winston Churchill’s idea that the UK, even if it was no longer a superpower, should be a leading actor in what he described as the three circles that comprised the free world, or Tony Blair’s concept of the UK as a pivotal power. The guiding understanding here is that the UK could generate influence by acting as a public goods provider of sorts, using its diplomatic connections, embeddedness in global institutions and other relative strengths to be an indispensable member of as many networks as possible. The military component of this strategy involves acting as what might in contemporary NATO parlance be dubbed a ‘framework state’ – providing niche rapidly deployable military capabilities and developing the interoperability and C2 structures required for multinational military cooperation. The UK’s role in the JEF is a case in point – it is likely to provide the bulk of the organisation’s rapid deployment forces from its standing readiness pools and is working to organise a framework for multinational intervention in a wide variety of contingencies in the Baltic. Being the central node in this military–technical network is one pillar of a wider push for political network centrality – hence the idea that the JEF is international by design. Crucially, this organisation cannot substitute for NATO but can supplement it by providing rapid reaction capabilities and interoperability with non-NATO states. The UK, in this framework, is a central power even though it is not a preponderant Alliance member like the US.

- Maintaining the special relationship with the US and acting as a primary European contributor to NATO. The special relationship, and the notion that the UK would be a primary military partner for the US both in Europe and, to a degree, outside it is, in some ways, a natural outgrowth of the pivotal power framework. The UK is not a militarily preponderant power but, as one of the largest military spenders in NATO and one of its most capable actors aside from the US, it is indispensable to at least two of Churchill’s

108. The special relationship is a foreign policy concept that assumes that the UK will be the US’s partner of choice within Europe and will exercise more influence over US decision-making than most US allies.
three circles. Thus, for example, former UK Prime Minister Harold Macmillan rationalised
the possession of nuclear weapons in terms of building credibility with the US as an
Alliance partner uniquely capable of pulling its weight independently and thus achieving
a privileged say in strategic decision-making – ‘interdependence with independence’, as
Macmillan’s slogan had it. Closer to our own time, the UK has attempted to be the
partner of choice within NATO for the US in a variety of contingencies both within and
outside Europe – with recent contingencies in the Balkans and Middle East standing out as
examples. This idea also animates the ‘framework state’ concept underpinning the JEF.

- Maintaining the strategic depth that the UK has enjoyed historically, both because of its
  insular geographical position and, in more recent history, because it is ensconced within
  a liberal transatlantic ‘zone of peace’. By virtue of its insular geography, the fact that
  it is separated from potentially hostile states by a glacis of allies and the scope of its
  alliances, the UK enjoys greater room for manoeuvre than would a state facing nearby
  hazards alone.

It has been historically understood by British policymakers since the early Cold War that to
achieve these three grand strategic ends the UK would require the ability to deter attacks on its
homeland that might otherwise be used to constrain its freedom of action. As the nuclear threat
made by Soviet Union leader Nikita Krushchev during the Suez Crisis showed, the threat of
missile attacks against the homeland represented a potent means to constrain the UK’s freedom
of action – and one that was partially responsible, along with the US involvement it catalysed,
for the failure of the Suez campaign. It has typically been assumed, at least with regard to
missile threats, that threats to the homeland could be deterred by an independent nuclear
arsenal. Indeed, the need to deter a threat such as former Soviet Premier Nikita Khrushchev’s
over the Suez, in light of the fact that the US could not with certainty be counted on to trade
Washington for London, was a core rationale for a strategic deterrent capable of massive nuclear
retaliation. This is a valid strategy in the event that a missile strike against the homeland is
either a salvo of WMD-capable missiles fired by a peer competitor, which would necessitate
a nuclear response, or a limited rogue state WMD launch. However, against a limited strike
against the homeland or UKOTs using either conventionally armed missiles or low-yield nuclear
weapons, the credibility of this posture comes into question. If the limited nuclear strike was
carried out by a peer competitor, the UK would have to either respond by using its nuclear
arsenal – knowing full well that this would bring retaliation in kind – or back down. It is not clear
that a threat to incur mutual suicide to avenge a limited loss is credible. Indeed, the dangers of

111. Ibid., pp. 2–6.
such a posture are being presently noted even in the US, with its much larger arsenal. As former US Secretary of Defense Ashton Carter noted:

> It’s a sobering fact that the most likely use of nuclear weapons is not the massive nuclear exchange of the classic Cold War-type, but rather the unwise resort to smaller but still unprecedentedly terrible attacks, for example, by Russia or North Korea to try to coerce a conventionally superior opponent to back off or abandon an ally during a crisis.\(^\text{114}\)

This sentiment was echoed by his successor, James Mattis, who argued that the US needed to introduce flexibility into its nuclear repertoire to better deter limited nuclear and conventional countervalue threats.\(^\text{115}\) It might be argued that the sub-strategic nuclear option on the Trident SLBMs offers this flexibility, but this is questionable. An adversary has no way of distinguishing a sub-strategic SLBM launch from a strategic one and has strong incentives to assume that if one is spotted late in its trajectory, it is a strategic strike. If this is the case, then a sub-strategic launch will likely incur exactly the same response as a strategic one – raising the question of whether a policymaker would incur these risks any more readily than they would incur the risks of a full-scale launch.

Against rogue states, nuclear retaliation could serve as a deterrent against nuclear and chemical, biological, radiological, and nuclear strikes against the homeland, but this is less certain than is often assumed. States that use nuclear threats as part of what MIT’s Vipin Narang dubs an asymmetrical escalation strategy (that is, deterring conventional action by the threat of nuclear first use) have to take steps to make this threat credible.\(^\text{116}\) Often, this involves efforts to visibly hamper their own decision-makers’ freedom of action – for example, by devolving control of elements of the nuclear arsenal to the military, as Pakistan has. Visibly ‘cutting one’s own barks before the game of chicken’, as Thomas Schelling’s colourful analogy has it, has obvious value to a weaker power that is threatening mutual suicide.\(^\text{117}\) It also means that, in certain circumstances, a rogue state’s leadership may not be able to control the flow of events even if it really is deterred by the UK’s nuclear arsenal. Additionally, the threat of conventional strikes against either the homeland or UKOTs might be considered – although the UK can retaliate, the prospect of significant civilian damage or disruption to critical military infrastructure could hamper the UK’s freedom of action. As such, the ability to defend the homeland and UKOTs against limited ballistic and air-breathing salvos will be critical to achieving all three objectives. In the absence of this capacity, it is unclear that the UK can develop a credible forward-postured foreign and military policy.

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\(^{115}\) Ibid.


A forward posture requires air- and missile-defence capabilities for fielded forces. In a NATO context, this may be provided by partners. However, while ALTBMD was originally brought about to defend fielded forces against ballistic missiles during out-of-area missions, the political consensus needed to secure a NATO response to an out-of-area challenge may not materialise.\(^\text{118}\) Moreover, the lack of integration between NATO’s air- and ballistic-missile defence capabilities means that NATO’s capacity to defend fielded forces, even if a political consensus to do so exists, is questionable.\(^\text{119}\) If the UK does wish to act as a framework nation, which is a first responder holding the line while NATO mobilises, then its forward-deployed forces need to be backed by credible air and missile defences.\(^\text{120}\) Assets at sea such as the Queen Elizabeth-class aircraft carriers cannot be deployed to regional crises in an adroit manner without organic air and missile cover. Moreover, even if the assets of coalition partners are to be relied upon, a pre-existing C2 and information-sharing network will be required to allow the UK’s partners within organisations such as the JEF to work with one another and the UK. Absent this capability, it is unclear how the UK could play the framework nation role that it has carved out for itself in publications such as the UK’s SDSR 2015.\(^\text{121}\)

Finally, although this is an elective objective, the UK could expand its framework nation concept beyond Europe to regions such as the Gulf. The ability to play a role in coordinating the missile-defence capabilities of partners in regions such as the Persian Gulf could, as discussed below, be combined with non-elective aims such as the defence of UKOTs and sovereign bases without incurring substantial additional costs. While elective, these aims dovetail well with the SDSR’s stated objective of reinvigorating the UK’s relationships in regions such as the Gulf. Given the centrality of missile-based threats to security in this region, they should be considered as the military component of a strategy to serve this foreign policy aim.

To achieve the first of the strategic aims outlined above, deterring or defeating threats to the homeland that might constrain its freedom of action, the UK would need a limited IAMD capability to protect the homeland and UKOTs against limited air and missile strikes by both peer competitors and rogue states. While it might previously have been argued that defending against a Russian salvo was unfeasible, this is less true if the salvo in question is a limited combination of cruise and ballistic missiles meant to inflict a ‘dose of pain’. In the event of a

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\(^{118}\) On ALTBMDs missions, see David Taylor et al., ‘NMSG-039/TG-027 Preliminary Analysis of Tactical Data Link Representation in Extended Air Defence Simulation Federations’, NATO Modelling and Simulation Group 039/Task Group 027, p. 3.


\(^{120}\) A framework state is a state that operates within NATO to organise smaller partners to provide niche capabilities, such as rapid-response capabilities. The role of an organisation such as the JEF led by a framework state is distinct from but not separate to, that of NATO writ large and is meant to complement the work of the wider organisation. For a brief overview, see Rainer L Glatz and Martin Zapfe, ‘NATO’s Framework Nations Concept’, CSS, 1 April 2017.

contingency on its periphery, as noted earlier, it is likely that inflicting calibrated doses of pain on key states using conventional weapons or, in extremis, low-yield nuclear weapons, is a key part of Russia’s overall posture. Such a threat, which presents the UK with the challenge of a missing step in its escalation ladder, could be countered by a credible limited IAMD capability. Further afield, the SDSR 2015’s probable commitment to place a BMD radar on the UK sovereign base in Cyprus raises the question of how UKOTs should be defended.\textsuperscript{122} Although the radar in question is not necessarily a means of defending Cyprus itself, the discussion of Cyprus (within range of multiple missile threats) does highlight the fact that the UKOTs represent a vulnerability that can be exploited for coercive pressure by both rogue states and non-state actors along NATO’s southern rim. At present, a radar on Cyprus could, depending on the type chosen, serve as either an early-warning capability for NATO against missile launches from the Middle East or as a hedge against a potential Turkish demand for the withdrawal of the American AN/TPY-2 radar currently on its soil. However, a purely radar-based capability would also involve a certain replication of effort – particularly if political headwinds do not preclude Turkey from retaining the TPY-2. Rather, a missile defence system in the Eastern Mediterranean would be more useful if it could defend Cyprus itself from a missile attack and serve as a component of a missile-defence posture covering UKOTs and regional partners in the area.

In the case of defending Europe’s northern tier against Russian revanchism, the UK can fill a vacuum left by NATO’s relative neglect of missile defence against salvos in the context of a local escalation. This would be consistent with the UK’s stated aim of playing a leading role in this area of European defence, embodied in its commitment to be the leading contributor to the JEF. Playing this first responder role requires a credible and rapidly deployable missile defence capability, without which assets such as the Queen Elizabeth-class carrier cannot be safely deployed. Ship-based vertical launcher systems (VLS) such as the MK 41 VLS on Type 26 frigates or a VLS installed on the Type 45 destroyers equipped with the Aster 30 Block 2 could play a role in defending forward-deployed forces and vital logistical nodes from an anti-access threat in a region such as the Baltics. Given that access to ports and airfields and the air and missile defence of forces ashore once they land will be critical to any power projection in the Baltics, some form of air- and missile-defence capability will be vital. The Sea Viper missile aboard the Type 45 has demonstrated its ability to provide theatre air defence and could provide terminal phase defence against ASBMs. This would require the permanent rotation of roughly three to four vessels to this region at any given time, however. Given that this would involve the whole deployed Type 45 fleet, it would preclude the Type 45 playing a role in homeland defence or global carrier protection. Given that operating environments are likely to see a multitude of threats, dedicating ships to a missile defence role excludes them from any other action and represents a potential strain on the Royal Navy’s overall capacity. However, VLS systems no longer need to be deployed exclusively on specialised vessels and can be placed aboard a plethora of sea- and land-based containerised launchers which could be networked with local capabilities and cued remotely by a UK-based battle-management system – allowing substantial

\textsuperscript{122} Ibid., p. 25.
savings in terms of costs compared to specialised naval vessels such as the US’s guided missile destroyer (DDG) fleet.\textsuperscript{123}

Given the task of formations such as the JEF (consisting of both NATO and non-NATO members of the northern tier) as ‘first responders’, with the role of responding to contingencies such as hybrid-war scenarios in which events move at a pace that exceeds the capacity of NATO’s political and military structures to respond adroitly, an independent missile-defence capability that is interoperable with but distinct from the ALTBMD framework would be of immense value in limited wars in which an Alliance-wide response would be difficult to organise in time. Although the NATINAMD framework involves existing C2 arrangements, the fact that contributions are national and voluntary, coupled with the fact that standing up a joint forces air command requires a NAC consensus, means that the transfer of national assets to multinational control and the standing up of C2 structures needed for effective battle management will not be available in the early days of a Baltic contingency.

In addition, a UK missile-defence capability could in principle support the network state concept within bilateral and multilateral frameworks pertaining to European security. For example, the SDSR 2015 highlighted the UK’s bilateral cooperation with France, enshrined in the Lancaster House treaties and the creation of the Combined Joint Expeditionary Force. This bilateral framework allows substantial savings on resources and at least the prospect of pooling both resources and influence in a number of vital regions in which both powers are engaged outside a NATO context.\textsuperscript{124} The joint work carried out by the UK and France on the Principle Anti-Air Missile System built around the Aster missile illustrates both the prospects for coordination and cost saving in the realm of research and development.\textsuperscript{125}

The second region of interest with regard to a role for missile defence should be the Persian Gulf. The SDSR 2015 identified reinvigorating the UK’s role in the Persian Gulf as a second major national objective. It was within this context that the Royal Navy opened its base in Bahrain with a view to contributing to regional efforts to maintain freedom of access in vital waterways such as the Strait of Hormuz (as indicated by the deployment of a force of four mine-clearing vessels to Bahrain).\textsuperscript{126} If it is indeed the UK’s stated objective to play a central role in the Gulf and reinvigorate its historic ties with actors in the region, missile defence may well be an important component of this return to east of the Suez. HMS Jufair, now the UK’s largest naval facility outside the UK itself, will be critical both to power projection within the Gulf and as a waypoint to East Asia. Given the growing threat of Iranian cruise and ballistic missiles, access to this


\textsuperscript{125} Scott, ‘Taking Aim’, p. 9.

A missile-defence capability in the Gulf could also play a second role. Given the primacy of an Iranian cruise- and ballistic-missile threat within the defence planning of Gulf states, a Gulf Cooperation Council (GCC)-wide missile defence system has been on the cards since the 1990s. However, historic rivalries between the Gulf monarchies have precluded effective coordination, creating a ‘tragedy of the commons’ in which actors attempt to pass the buck of providing regional security and are wary of the sort of information sharing that might facilitate an integrated missile-defence system. One way of sidestepping this issue is through a hub and spoke system where countries cooperate with a regional ally that they trust more than they trust each other. The country acting as the ‘hub’ plays a primary role in collating and transmitting information between individual ‘spokes’, acting, to all effects and purposes, as an information clearing house. Given the historic role of the UK in the Persian Gulf, it could well play a role in resolving this historic dilemma as the centrepiece of a regional missile-defence system. The rationale for such a role is provided by documents such as the SDSR 2015, which point to the substantial military and economic role that the UK already plays in the Gulf as grounds for treating the region’s security as a core interest. The decision to secure a permanent facility in Bahrain and dispatch four mine-clearing vessels all point to a policy intent to play a key role in Gulf security. If this is indeed the case, assuming the role of a facilitator with regard to missile defence would allow the UK to play a critical role in the region’s security at a relatively low cost. A long-range air and missile defence radar (AMDR) in Bahrain such as the AN/SPY-6, coupled with a battle-management system capable of cueing individual states’ batteries, would lay the groundwork for a more cohesive regional missile-defence posture. To be sure, this would not resolve all the problems of integration – a shared operating concept, targeting plan and C2 structure still require a political consensus that does not exist. However, as some have pointed out, a system capable of collating and sharing information between individual states and coordinating its own interceptor fires with each state bilaterally is a minimal prerequisite, if still a poor substitute, for true theatre air and missile defence. In principle, networking such a system with national missile defence systems of each of the Gulf states would allow the information sharing needed to support a regional missile defence – albeit with each national system being

bilaterally linked to that of the UK rather than to each other. This role is presently played by the US Arleigh Burke-class destroyers in the Gulf, which can provide early-warning and tasking information to the US’s respective partners without them having to share information with one another.\textsuperscript{130} As the US fleet of Aegis ships is likely to be stretched over the coming years, however, the UK taking on this role would free up US assets to serve Alliance aims elsewhere and create the sort of network centrality that the UK covets. While the US could play this role, the fact that it is likely to become increasingly focused on the Asia–Pacific region may draw resources from its commitments in the Gulf. The UK could then play a valuable role as an Alliance partner by backfilling in this area and, additionally, further its stated aim of deepening ties in the region.

The fact that the UK has maintained a substantial diplomatic footprint in the region makes the UK well placed to play this role. Additionally, given that logistical nodes such as the facility in Bahrain will be critical to allowing the UK to project power east of the Suez, protecting these nodes against air and missile threats will be an important imperative. Centrality within a technical network is the sort of public goods provision upon which political network centrality depends – and would amount to a partial application of the framework nation concept outside NATO. Additionally, this would mesh with the US-stated aim of pivoting to Asia – insofar as the need to provide a regional missile-defence capability in the Gulf ties up US assets that might be used elsewhere.

Third, a credible maritime missile-defence capability would contribute to the UK’s desire to play a more active role in East Asia. The UK could not provide serious coverage against a sustained attack by China. However, given that the PLA has on occasion flirted with the idea of a single salvo ‘shot across the bows’ as a credible limited response to a freedom of navigation option, the likely deployment of missile-defence interceptors such as the Aster 30 Block 2 on board vessels like the Type 45 would provide Royal Navy vessels in the region with some coverage against limited escalations.\textsuperscript{131} The other capabilities discussed would have a knock-on effect – freeing the Type 45 fleet from other missions to play this role.

Finally, with regard to resilience and strategic depth, a UK missile-defence system could provide coverage to UKOTs in scenarios that at present might exceed the capabilities of the EPAA. For example, existing NATO capabilities provide only limited coverage against SRBM launches against UKOTs such as Gibraltar from North Africa, given their overwhelming focus on states such as Iran. Additionally, the capacity to defend the homeland against limited launches from a near-peer competitor would reinforce the capacity of the UK to credibly commit to expeditionary operations.

Two possible options then exist for the UK. The first, consistent with existing policy commitments, would be to build a missile defence radar with the intention of enhancing the overall effectiveness of NATO against a limited ICBM launch. As NATO’s BMD capability already covers contingencies involving Iran, the target for such a policy would be North Korea.\textsuperscript{132} NATO currently has no ability to track a North Korean ICBM and discriminate the target from debris during its midcourse phase (which would likely be somewhere over Russia).\textsuperscript{133} In principle, a long-range radar capable of tracking and discrimination such as the Long-Range Discrimination Radar (LRDR) could, if placed in Cyprus, provide some capacity for tracking and discrimination, likely in conjunction with the US’s planned space-based sensor layer. Such a capability would enhance NATO’s ability to intercept a North Korean ICBM, assuming interceptors, such as the SM-3 block IIB, capable of ICBM intercepts, are added to the EPAA architecture. However, this is subject to several caveats. First, as noted earlier, Europe is not high on North Korea’s target list. Second, North Korea may well halt or reverse its steps towards an ICBM capability if it can reach an understanding with the US. Even if North Korea never denuclearises, it may deem the ability to threaten regional powers with IRBMs and MRBMs a sufficient deterrent and sacrifice its ICBMs as a concession to the US. Third, as noted above, NATO does not currently have the interceptors to target an ICBM even if one were developed and launched at Europe. As such, the ability to track an ICBM would only make sense should such a capability emerge – which is unlikely given that the SM-3 Block IIB missiles are viewed as destabilising the balance with Russia. As such, a standalone radar would, by itself, make little sense – against the Iranian threat it would be redundant and against North Korea it may be unnecessary.

The alternative, more expansive vision would be a national integrated air- and missile-defence capability interoperable with but distinct from NATO’s own. In order to play a meaningful role in the UK’s national security strategy, a national air- and missile-defence system would have to achieve the following aims:

- Protect the homeland against limited air and missile salvos fired by a peer competitor such as Russia designed to restrict the UK’s freedom of action. While rogue state launches against the homeland cannot be ruled out, they are, as discussed below, less likely.
- Protect UKOTs and overseas military facilities, such as HMS Jufair and Cyprus, from short- to intermediate-range rogue state and non-state actor launches. The Falkland Islands are excluded here given the paucity of Argentine missile capabilities – although if this changed this assumption would have to be revisited.
- Support the UK’s objective of acting as a framework nation through organisations such as the JEF.


Additionally, the UK could opt to extend the framework nation concept out of NATO by supporting a partial Gulf missile-defence system. This would be consistent with the stated policy aims of the SDSR 2015 but is in the final instance an elective rather than a core aim.\textsuperscript{134}

An Operational Framework for the UK

Existing Commitments and Their Limitations

As of now, the only capability to which the UK has currently committed is a ground-based BMD capability intended to enhance the coverage and efficiency of NATO’s missile-defence system which is geared at countering limited threats from outside the Euro-Atlantic area – that is, limited rogue state launches with Iran being the primary threat.\textsuperscript{135} Formal modelling indicates that the coverage provided by Aegis Ashore sites in Deveselu and Redzikowo is sufficient to protect most likely European targets, including the UK, from a hypothetical Iranian ICBM. The capabilities contained at these sites, coupled with the sea-based component of the EPAA, provide sufficient coverage to render a national-level replication of this role unnecessary.\textsuperscript{136} Thus, a potential BMD radar either in the UK or the Eastern Mediterranean would have to be geared towards improving NATO’s capacity to cope with a North Korean launch. NATO currently lacks the ability to track a North Korean ICBM travelling to Europe through its likely trajectory over Russia. The US’s early-warning radars at Fylingdales could provide early warning but not track quality data. A long-range ground-based radar in Cyprus capable of tracking and discrimination, such as the US’s LRDR, could compensate for this gap in coverage. Alternatively, a ground-based long-range X-Band radar along the lines of the US’s Sea Based X-Band radar could perform the same function. With a track and detection range of around 4,600 km, variants of these radars based in Cyprus could track a North Korean ICBM in midcourse over Russia.\textsuperscript{137}

A UK missile-defence radar in the Eastern Mediterranean would also add a layer of redundancy to NATO in the event that political events force the withdrawal of the forward-based AN/TPY-2 radar based in Turkey upon which the EPAA depends. However, it must be reiterated that limiting the scope of the UK’s missile-defence policy to an additional ground-based radar and an exploration of a BMD role for the Type 45 is of questionable value. A ground-based


\textsuperscript{136} Sankaran, ‘The United States’ European Phased Adaptive Approach Missile Defence System’.

A Critical Enabler for Power Projection

missile-defence radar would only make sense if it is assumed that North Korea retains its capacity to launch an ICBM, decides that targeting Europe will be an attractive policy choice and that NATO’s missile-defence system will come to include an anti-ICBM interceptor such as the SM-3 Block IIB. Given that all of these assumptions are at best uncertain, a UK BMD focused solely on enhancing NATO’s coverage against threats other than Iran may be insufficient.

Rather, investment in a ground-based radar to enhance NATO’s existing coverage should be coupled with a policy shift with regard to missile defence. This could be accomplished with a partially redeployable force capable of protecting the homeland and UKOTs from limited air and missile salvos and of abetting theatre air and missile defence in the face of A2AD threats. While exploring the BMD capability of the Type 45 is a step in this direction, a greater investment will be needed to enable power projection.

A Limited National Capability Distributed Defence with Mixed Forces

While threats from rogue states such as North Korea cannot be ruled out, they remain a relatively distant possibility. Although it is not inconceivable that, should the UK become more embedded in East Asian geopolitics, it may become a target for states such as North Korea, this outcome is contingent on a number of uncertain factors.

The more imminent threat is missile salvos against the homeland by peer competitors aimed at limiting the UK’s political freedom of action and theatre-level salvos by both peers and regional states against UK bases and fielded forces as part of an A2AD strategy. To this end, the UK would need the following capabilities:

- A ground-based integrated air- and missile-defence system for the homeland. Currently, the UK lacks medium- and long-range air defences other than its limited typhoon fleet and has little to no protection against intermediate-range ballistic threats.
- Short- and medium-range air defences for UKOTs such as Cyprus and sovereign bases such as Mina Salman, which are in range of a mixed rogue state/peer competitor threat, coupled with limited defences against SRBM and MRBM threats.
- A series of relatively cheap dedicated platforms capable of carrying out anti-aircraft warfare and BMD missions on the basis of tracks from sensors either afloat or ashore.
- The ability to defend fielded forces against A2AD threats – a role that can be played both by the Type 45 and the dedicated platforms discussed.

In order to meet these divergent objectives, this paper proposes an operating concept based on two distinct components. The first are relatively limited ground-based air- and missile-defence capabilities that would constitute holding forces. The purpose of a holding force would be to defend the homeland and UKOTs from limited salvos aimed at either coercing the UK’s withdrawal from a conflict or, in the case of military targets on the homeland and UKOTs, pre-empting it from taking part in a conflict as part of an anti-access strategy. The second component of the framework proposed is a surging force built around relatively cheap dedicated air- and missile-defence platforms which could be reallocated either towards the homeland, UKOTs
or carrier task forces in the event that warfighting exceeds a certain level of intensity and necessitates a more robust defence against larger salvos.

The proposed system would revolve around a backbone of ground-based sites in the UK built along the lines of Japan’s recent Aegis Ashore purchase and two more limited shore-based sites in Cyprus and Bahrain fielding radar and control but limited organic interceptors. The value of a system such as Aegis Ashore is its potential to combine air and missile defence, the potential for cooperative engagement with sensors in the air and afloat, and the potential to disperse its elements to defend a wide area. Although sites in Deveselu and Redzikowo currently field only BMD interceptors to counter ballistic missiles from the Middle East, this need not be the case for UK sites. The Aegis system on the Arleigh Burke-class destroyer already combines both air- and missile-defence roles – the MK 41 VLS on the destroyer can hold a mix of short-range Evolved Sea Sparrow Missiles (ESSMs) along with the SM-3 and will in due time field the SM-6 interceptor which plays both a long-range air defence and terminal phase BMD role. In principle, there is no reason that sites ashore cannot field the same mix of capabilities – the hardware and software to perform this function already exists afloat and states such as Japan are confident that in due time Aegis can provide a layered nationwide defence against both air and ballistic threats if equipped with a cooperative engagement capability to link it with AWACS and assets afloat. The proposed system would rely on a long-range AMDR such as the AN/SPY-6 radar which tracks both air-breathing and ballistic threats as well as the RAF’s existing air-defence radars which could be networked with an open architecture system such as the Aegis. An Aegis Ashore system based in the UK and comprised of the AN/SPY-6 radar and multiple distributed VLS with mixed loads of long- and medium-range air interceptors as well as BMD interceptors such as the SM-3 would provide a cheap and ready off-the-shelf IAMD capability for deterring or reducing the effectiveness of limited coercive salvos from Russia in conjunction with home-based Typhoons and existing short-range point defences such as the Sky Sabre. While existing Aegis sites are limited to 24 launch cells which are placed on site, this need not be the case. Assuming that it possesses a scaled-up radar capable of tracking and tasking on a larger scale such as the SPY-6 and a cooperative engagement capability, the system can potentially track far more targets and task a larger number of VLS which need not necessarily be concentrated in a narrow space.

Another option would be to emulate the Aegis model with local technology – for example, creating an ashore version of the sensors, control systems and effectors that currently sit on the Type 45. In principle, a more powerful shore-based version of the Sampson radar and effectors equipped with a combination of the Aster 30, Aster 30 Block INT and 30 Block 2 BMD could provide a shore-based IAMD capability analogous to Aegis Ashore – albeit at the cost of developing a product as opposed to buying an ‘off-the-shelf package’. Given that the C2 system of the army’s short-range air defences is based on the software from Iron Dome, the combination of Sky Sabre with something along the lines of David’s Sling might be another

138. Karako, ‘Shield of the Pacific’.

option. However, the fact that the Aegis is an ‘off-the-shelf’ product, coupled with the fact that the Aegis system is interoperable with the F-35 (which could come to play an important role in missile-defence tracking and intercept) and other NATO assets, is an advantage. Ultimately, however, any multipurpose system capable of providing layered defence – that is, cover against both air-breathing and ballistic threats – would be fit for purpose.

A UK IAMD system built around something like Aegis Ashore could be complemented with a relatively cheap fleet of interceptor-carrying cargo vessels. In the 1990s the US Navy explored the possibility of creating arsenal ships – cargo vessels with small crews dedicated entirely to holding vertical launch cells. These austere vessels, devoid of sensors, would receive tracking and cueing from other vessels or from shore-based radar and C2. Within a UK context, the option of such a vessel has been put forward as a relatively cheap means of delivering mobile IAMD. The concept vessel proposed, which could theoretically have a speed of around 25 knots, is substantially cheaper than a DDG and, given that existing propositions envision a vessel cued by an onboard radar rather than a cooperative engagement capability, the version this paper proposes would be cheaper still. Containerised launchers capable of holding a mixed load of upper- and lower-tier interceptors can effectively provide ‘layered defence in a box’ capable of either upper-tier interception or being surged to an area to provide tactical point defence. These launchers could also host dual-use missiles such as the SM-6 and offensive cruise missiles – meaning that they could enable multiple concepts of operations, from purely passive defence to participation in multi-domain fires to suppress missiles on site. Given that launchers and interceptors are less expensive than the dedicated platforms that hold them, a fleet of cheap auxiliary shooters may be one way of expanding capacity at an acceptable price. Importantly, leveraging containerisation would allow passive defence by interspersing vessels featuring containerised vertical launch cells with empty container vessels – substantially complicating an opponent’s targeting posture. Although vulnerable to anti-ship capabilities when entering theatre, the relatively innocuous nature of these vessels, visually indistinguishable from cargo ships, coupled with the fact that they could be surged in the early stages of a crisis, mitigates this risk.

In the medium term, the use of cheap single-purpose vessels could also be leveraged with respect to evolving technologies in the realms of High Pulse Repetition Frequency (HPRF) weapons, railguns and electronic warfare systems that may shift the balance of costs in favour of defenders in a salvo contest. These capabilities depend only on a reliable power source and cost significantly less than interceptors such as the ESSM and SM-6. Moreover, as the Chinese

143. Ibid.
demonstrated by mounting a railgun on an amphibious vessel, they do not need specialised craft – only vessels capable of holding a power source.\textsuperscript{144}

Given that the container vessels which would have to be converted to serve this role cost around $25–50 million and that the ship would rely entirely on off-board sensors for its engagement capability, it is estimated that the costs of procuring such a dedicated vessel could be as low as £65 million.\textsuperscript{145} Of course, this excludes life-cycle costs and the cost of the interceptors that the ship would field. If, like DDGs such as the \textit{Arleigh Burke}, the ship fielded a mix of missiles that was largely comprised of medium-range air interceptors such as the ESSM or the Sea Viper and a smaller batch of long-range air and BMD interceptors such as the SM-3 and SM-6 (which should collectively comprise around 15\% of its loadout), then a converted container fielding around 200 air and missile interceptors would cost close to £200 million.\textsuperscript{146} However, given that each ship would field far more defensive power than any given destroyer at a fraction of the cost of additional Type 45 destroyers, an initial purchase of a fleet of nine such vessels, which would allow for three to be operational at any given time, would afford the UK substantially more coverage of the two additional Type 45s that could be purchased for the same amount.\textsuperscript{147}

The system would rely on the backbone of ground-based air- and missile-defence sites to hold the line during a period of low- to mid-intensity competition, which might see coercive strikes either threatened or used to a limited degree against UK interests. During this period, the mobile component of the system could be reallocated to the relevant theatre to surge the number of interceptors on call in the event that an adversary escalates to the level of high-intensity warfighting. Based as they are on bare-bones ships without sensors, these maritime interceptors would rely entirely on tracks from either the ground-based sites or, if dedicated to a task force, the Type 45, to cue their interceptors. As such, the maritime mobile component of the force would need to ‘plug in’ to an existing ground- or sea-based system. The ground-based sites and Type 45 destroyers would thus provide the architecture into which the containerised maritime component would be plugged. This involves a substantial exercise in systems integration, but not one that is either unacceptably expensive or technologically testing – cooperative engagement capabilities between shore- and ship-based interceptors are being pursued to good effect by Japan, for example, and the idea of bare-bones arsenal ships has been technically feasible since the 1990s.\textsuperscript{148}

\begin{itemize}
\item[145.] Clarke, ‘Arsenal Ships’.
\item[146.] Clarke, ‘Arsenal Ships’; costs of interceptors and loadout ratios from Gunzinger and Clark, ‘Winning the Salvo Competition’, p. 45.
\item[147.] The cost of a Type 45 destroyer is approximately £1 billion, plus additional operating costs, see Jonathan Beale, ‘Type 45 Destroyers: The UK’s £1bn Destroyers See Engine Refit’, \textit{BBC News}, 29 January 2016, \texttt{<https://www.bbc.co.uk/news/uk-35432341>}, accessed 23 April 2019. The Type 45 can hold 48 interceptors in its Sylver VLS.
\item[148.] See, for example, Karako and Rumbaugh, \textit{Distributed Defence}, p. 32.
\end{itemize}
This framework would have ramifications for both fielded forces and homeland defence. The ability to achieve homeland defence against limited salvos would have a strategic impact across the three stages of competition (see Figure 1). In the pre-kinetic phase of competition, limited defences reduce the coercive value of deterrent threats, freeing the hands of political and military decision-makers. Should the conflict enter a kinetic phase, missile defences can mitigate the effects of a limited coercive salvo – forcing an opponent to higher and more risky escalatory measures to achieve a strategic effect. For example, if the UK has the ability to defeat a limited salvo of ballistic and air-breathing threats, a state attempting to coerce the UK would have to escalate to the use of its strategic arsenal or the massed use of its air-breathing arsenal to achieve the required levels of damage. This would obviate the aim of shortening the conflict through well-calibrated doses of pain and shift the onus of accepting escalatory risks to the other side. Moreover, many of the steps an adversary would have to take in this scenario would cross the UK’s nuclear red lines – thereby obviating the advantage of being able to exploit a gap in the UK’s deterrent posture. Limited IAMD would thus remove coercive escalation control through long-range precision strikes from the repertoire of opponents such as Russia. This would have ramifications, needless to say, for both fielded forces and Allies because it would be more politically feasible to live up to Alliance commitments and because air and missile defence-capable assets such as the Type 45 would be freed from a homeland defence role that they might otherwise have to play and could support fielded forces.

A more aspirational long-term course of action could see a UK-based ground site capable of IAMD in principle networked with the sensors and shooters of partners across the JEF. Of course, this would involve substantial systems’ integration costs and would require some form of pre-existing C2 arrangement along the lines of ALTBMD’s ‘plug and play’ system. If effected, this would both enhance homeland defence by allowing UK interceptors to be launched on the basis of tracks provided by forward-based radar and resolve a critical weakness in the defence of the Baltic – the lack of an IAMD capability. An Aegis Ashore site in the UK, equipped along the lines of Japan’s recent Aegis sites with the AN/SPY-6, could in principle be networked with the sensors and shooters of northern tier states, as well as the UK’s own sea-based capabilities. This would serve three roles: first, the system would be able to host a mix of upper- and lower-tier interceptors capable of intercepting both cruise- and ballistic-missile threats against the homeland; second, the Aegis would also play its battle-management role – with defensive fires in theatre being supplemented by the system’s mobile component, which could be redeployed to hotspots; and third, this would create a redundant control system at some distance from the battlefield. As important regional players are members of the JEF but not NATO, a UK missile-defence system which could provide C2 and battle management for the region would fill a vital gap in Western defence in this region. This has ramifications for air and missile defence as states such as Sweden and Finland cannot participate in creating a shared operating picture with NATO for political reasons, but may be less reluctant to coordinate actions through the JEF.\textsuperscript{149} Given that access to ports and logistical nodes threatened by air-breathing and ballistic missiles will be critical to an eventual NATO response to a contingency in the Baltics, playing a leading role in organising a shared operating picture through the JEF could be a useful way for

\footnotesize{149. Harper et al., \textit{Air Defence of the Baltic States}, p. 35.}
the UK to play the framework nation role it covets within the Western defence system. If, as British Army Lieutenant General Stuart Skeates has argued, frameworks such as the JEF are to have a meaningful role in allowing the UK to act as a regional first responder, the coordination of defensive fires will have to be a core component of its mission.\(^{150}\)

Elsewhere, in the Persian Gulf, an ashore site based in Bahrain could at a minimum enhance the security of HMS Jufair and related Allied facilities. Additionally, in the medium term, such a facility could also help resolve the collective action problem facing the states of the GCC – namely that political circumstances render them less than willing to share information with one another. One solution to this would be for a partner that each individual state trusts to act as an information clearing house. GCC states could share information with the UK, but not with each other – allowing for a hub-and-spoke system that satisfies the need for integration without compromising local actors’ sensitivities. It has been suggested that a C2BMC system from which Gulf states could ‘unplug’ their national assets at will might provide an imperfect solution to the collective action problem as a system that could be stood up in crises, for example. While playing this role is subject to political considerations, it is technically feasible and of strategic value. The US \textit{Arleigh Burke} DDGs currently play this coordinating role and would likely cue Allied sensors in the region in a crisis. However, given that the force of DDGs is likely to be stretched over the coming years, a site along the lines of the Aegis Ashore has been suggested as an alternative solution. Given that there has been no movement in the US on the subject, despite it being a requirement, the UK could usefully contribute here and, moreover, serve the stated policy aim of deepening relations in the Gulf.\(^{151}\)

In the context of an Alliance-wide strategy, a UK capacity to both protect the homeland and surge dedicated forces into critical theatres would free what would be an otherwise overstretched Type 45 fleet for tasks such as carrier escort and theatre air defence. It would also have a knock-on effect in regions such as East Asia – freeing US DDGs from tasks in the Gulf and Mediterranean. Additionally, the mobile component of the proposed force could substantially enhance a carrier group’s capacity for self-defence both in the aforementioned regions and further afield in East Asian waters. The Type 45 destroyer’s existing capacity for tracking both air-breathing and ballistic threats means that a relatively cheap vessel dedicated to holding interceptors and capable of cooperative engagement with the Type 45 could provide carrier groups and fielded forces ashore with substantial coverage against both air-breathing and ballistic threats if operating in conjunction with the Type 45. There would be costs to integrating a bare-bones dedicated vessel into a carrier group in terms of manoeuvrability and stealth, not to mention systems’ integration costs, but also benefits in terms of coverage – a trade-off

\(^{150}\) Tormod Heier, ‘Britain’s Joint Expeditionary Force: A Force of Friends?’, in Rob Johnson and Janne Haaland Matlary (eds), \textit{The United Kingdom’s Defence After Brexit: Britain’s Alliances, Coalitions and Partnerships} (Cham: Palgrave McMillan, 2018).

that may prove acceptable in some circumstances. Certain risks such as electronic detection could be reduced by ensuring that the ship is purely a downlink receiver – which will be its role in any case.\textsuperscript{152}

Notably, the missile defence of Gibraltar and the Falkland Islands is excluded due to the lack of an imminent threat. Needless to say, this may change, and with it the need for point defences in these two UKOTs; however, based on present circumstances, these contingencies are treated as being low probability. Should the UK’s posture need to adjust, however, the flexibility of the mobile component of the proposed force would mean that only limited steps in the form of radar emplacement and C2 arrangements would need to be taken to reallocate cover to these two UKOTs.

\textit{Procurement in the Immediate and Medium Term}

The system proposed above would consist of three ashore sites along the lines of Aegis Ashore, but the three sites need not be identical. A UK site would need to provide air and missile defence against air-breathing threats and IRBMs, while a site in Cyprus or Bahrain would be primarily concerned with defence against short- and medium-range threats. As such, only the UK site would need an interceptor along the lines of the SM-3 Block IIA in conjunction with long- and medium-range air defences such as the SM-6, whereas sites further afield would need some combination of the cheaper SM-3 Block IA and air defences. Also, given the existence of a mobile component, the number of interceptors at sites further afield can be limited. In terms of costs, three shore-based sites along the lines of Aegis are likely to cost around £1.9 billion over the course of 10 years, including life-cycle and operating costs, while the development of containerised launch platforms is likely to be relatively marginal. The initial capital cost for the sites themselves is likely to be in the region of £1.8 billion.\textsuperscript{153} The proposed mobile component would add £1.8 billion in capital costs in addition to the operating costs and cost of implementing a Cooperative Engagement Capability to allow them to plug in to shore-based sites. The enterprise would thus cost approximately £4.5 billion over the course of a 10-year period.


\textsuperscript{153} Figures based on the cost, including life-cycle costs over a 30-year period, of two Japanese Aegis Ashore sites (approximately $5 billion). Although Japan will spend $5 billion for two systems, a major component of this cost (roughly $2.4 billion) is accounted for by the selection of the LRDR over the AN/SPY-6 and the heavy emphasis on purchasing large numbers of the SM-3 interceptor for long-range BMD missions against North Korea. The initial cost estimate, without these additions, was roughly $800 million per site. The life-cycle costs over 10 years of the proposed vessel are based on the $50 million ($35 million) per year life-cycle costs of a DDG. This is a rough estimate, though – the life-cycle costs of a less specialised vessel will likely be lower. Reuters, ‘Japan Picks $1.2 Billion Lockheed Radar for Aegis Ashore Batteries’, 30 July 2018, <https://uk.reuters.com/article/uk-northkorea-usa-japan-aegis/japan-picks-1-2-billion-lockheed-radar-for-aegis-ashore-batteries-idUKKBN1KK981>, accessed 23 April 2019.
This sum is substantial, though not exorbitant given that it includes operating costs over a 10-year life cycle. Moreover, it is worth reiterating that missile defence should not be seen as competing with other avenues for defence expenditures per se. If the strategies of peer competitors and other states is to hamstring the UK through a risk manipulation approach, then a credible means of defending the homeland is a prerequisite to effectively using the UK’s power projection assets. Given that the threats faced cannot be deterred easily using traditional nuclear deterrence and given that conventional retaliation is factored into (and countered by) the risk manipulation strategies of peer competitors, there are few alternatives to IAMD. Absent this, the strategic utility of investing in conventional power projection tools declines significantly as allies and partners come to doubt the UK’s will to commit these assets. Additionally, UKOTs’ sovereign bases and facilities are the infrastructure upon which the material ability to respond to a contingency depends – the inability to defend these assets against an A2AD challenge that involves targeting logistical nodes could cripple the UK’s capacity to respond to regional contingencies. Furthermore, a dedicated means of defending the homeland and overseas assets frees up tools better suited to power projection from potentially having to play this role. As such, rather than being seen as an alternative to investing in power projection assets, missile defences might be seen as a critical enabler for their use and a foundation on the basis of which future investments in forward-postured assets can be justified.

In the long term, the UK should also begin to explore defences against hypersonic glide vehicles – a threat which is not imminent but will feature more prominently in the coming years. Early work suggests that the F-35 can play a role in this endeavour, as can high-altitude long-endurance UAVs, although concrete prescriptions cannot be made until further work is done in the area.\textsuperscript{154} Given that these assets are or will be distributed across the services, a cross-service effort to integrate IAMD efforts should take place.

Conclusions

MISSILE DEFENCE, LIKE all military technology, does not exist in a political vacuum. The capabilities sought ought to be calibrated to the strategic end state desired – in this case, a strategy for global engagement. To make this strategy viable, the UK needs the political will and operational capacity to project force abroad. This strategy requires the UK to be able to mount a viable defence of the homeland and UKOTs against missile threats that may aim either at eroding the political will for engagement or destroying the military infrastructure on which engagement depends. Furthermore, the UK’s increasingly maritime national strategy requires the carriers that are the centrepiece of this approach to have adequate air and missile defence – which they cannot do if they have to alternate between defence of the homeland and carrier defence.

As such, at a minimum, the UK requires a limited IAMD capability for the homeland. The creation of a string of IAMD nodes extending from the Eastern Mediterranean through the Persian Gulf, coupled with a mobile force capable of surging to theatres or to the defence of fielded forces on the basis of contingent circumstances, would serve the dual purpose of defending vital facilities on which the UK depends and making the UK a net contributor to theatre air and missile defence in the Eastern Mediterranean and Persian Gulf – freeing up an increasingly overstretched US DDG force. The existence of these capabilities will allow the Type 45 to remain untethered from defending the land.

The critical point is that the old dichotomy George Robertson identified between the Maginot mentality of homeland defence and a forward posture is no longer valid.155 In the context of the risk manipulation strategies adopted by both peer competitors and rogue states, this way of thinking no longer holds. To be a forward-postured state, the UK needs credible homeland defence.

About the Author

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