Persistent Engagement and Strategic Raiding
Leveraging the UK’s Future Carrier Strike Capability to Effect

Sidharth Kaushal
Persistent Engagement and Strategic Raiding
Leveraging the UK’s Future Carrier Strike Capability to Effect

Sidharth Kaushal

RUSI Occasional Paper, November 2020

Royal United Services Institute for Defence and Security Studies
189 years of independent thinking on defence and security

The Royal United Services Institute (RUSI) is the world’s oldest and the UK’s leading defence and security think tank. Its mission is to inform, influence and enhance public debate on a safer and more stable world. RUSI is a research-led institute, producing independent, practical and innovative analysis to address today’s complex challenges.

Since its foundation in 1831, RUSI has relied on its members to support its activities. Together with revenue from research, publications and conferences, RUSI has sustained its political independence for 189 years.

The views expressed in this publication are those of the author, and do not reflect the views of RUSI or any other institution.

Published in 2020 by the Royal United Services Institute for Defence and Security Studies.

This work is licensed under a Creative Commons Attribution — Non-Commercial — No-Derivatives 4.0 International Licence. For more information, see <http://creativecommons.org/licenses/by-nc-nd/4.0/>.

RUSI Occasional Paper, November 2020. ISSN 2397-0286 (Online).
# Contents

Executive Summary v  

Introduction 1  

I. The Future Strategic Environment and the Role of Maritime Strike 7  

II. Deterrence and Compellence at Sea in the Future Strategic Environment 17  

III. Technology and the Future Operating Environment: Challenges Facing Carrier Strike in the Missile Age 21  

IV. The UK’s Future Maritime Strike Capabilities: Strategic Rationale, Future Concepts of Employment and Operations 33  

   Strategic Objectives and Drivers for the Employment of Carrier Strike 33  

V. Concepts of Operations and Key Lines of Development 43  

VI. Lines of Effort to Deliver a Concept of Operations for Persistent Competition 47  

   Scalable Forward-Engaged Formations 47  
   Surface Strike and Standoff 50  
   Light–Heavy Teaming 54  
   Littoral Integration, C2 and Information Advantage 55  

Conclusion 61  

About the Author 63
Executive Summary

The imminent arrival to initial operating capability of the Royal Navy’s Queen Elizabeth-class aircraft carriers leaves the Royal Navy at an inflection point. While the strategic and operational environment prevailing at present is radically different from the environment in which the carriers were first conceived, the platforms retain the ability to evolve in a way that will provide policymakers with highly flexible capability in the coming decades. In order to do this, however, new concepts of employment and operations will need to be adopted to better match the strengths of the carriers to the changing operating environment while offsetting their weaknesses.

The critical question that this paper answers is how the UK’s carrier strike capability can be leveraged to effect in an era of persistent competition. This will, in turn, drive a number of work strands for the Royal Navy in the coming years with respect to force design, procurement and the C4ISR architecture of the UK Strike Force. RUSI has conducted an analysis of the ways that the Navy can leverage the potential of its aircraft carriers in the context of a strategic environment characterised by persistent competition. The key findings of this paper are:

- The UK’s emerging strategic environment is likely to be defined by great power competition. This is not to say that other threats such as conflict with sub-peer and non-state actors will disappear, but that their salience will be determined by interactions between great powers. This will be characterised by periods of persistent low-intensity competition punctuated by short, sharp escalations to direct but limited warfare before a reversion to competition. Carrier strike forces must be able to generate both kinetic and non-kinetic options across this spectrum of activity at speed – contributing both to war and the ‘campaign between wars’.

- UK Strike Force has the potential to be a hybrid force at sea, operating across the spectrum of competition without heavily drawing on external enablers. Across its carrier and littoral strike groups, UK Strike Force will have a capability to disaggregate into smaller self-sustaining, forward-engaged force packages to shape lower levels of competition in tandem with allies and proxies but also aggregate at speed to deliver high-intensity kinetic effect.

- Carrier strike groups (CSGs) can and should experiment with the force generation of modular sub-units – such as two- and three-ship surface action groups – to better compete across the spectrum of competition in distant theatres without compromising the ability of CSGs to rapidly aggregate. Successful competition at lower levels of intensity will determine the rules and boundaries of competition at higher levels and facilitate aggregation for strategic effect.

- Protracted expeditionary warfare involving large ground forces operating at reach will become less frequent. Rather than providing steady-state support to forces ashore as part of a protracted strike campaign, UK maritime strike forces will, in many ways, return
Persistent engagement will be punctuated with short raids against critical adversary assets exploiting the intra-theatre mobility of CSGs and will characterise future operations. In short, the future of carrier warfare looks more like Taranto or Pearl Harbor than Operation Desert Storm.

- The precision revolution is a real but not insurmountable challenge to maritime power projection. In the context of the maturing of precision strike complexes, it will be operationally imperative to compress the time in which strikes are conducted. This will entail shorter but more exacting operations for the crews of ships and aircraft.

- Tactically, against a mature reconnaissance strike complex which is nonetheless subject to degradation, the side that wins the battle of the first salvo will prevail. This, in turn, will be a function of whether relative information advantage can be delivered in a timely manner. Much of the information on which success depends will be gathered by forward-deployed forces during peacetime. The objective of information advantage will require a significant degree of integration between carrier strike and littoral strike forces – with the latter playing a vital role in delivering the information critical to prevailing in the crucial early days of an engagement.

- The emerging fourth industrial revolution raises both challenges and opportunities for carrier strike forces. On the one hand, the potential production of strike assets in mass is a challenge to be surmounted. On the other hand, a range of increasingly low-cost assets can potentially extend the range of a carrier air wing and its ability to deliver a decisive pulse effect in a compressed timeframe.

- The evolvable nature of both the carrier and its pickets could allow it to leverage the opportunities provided to execute a concept of operations consistent with persistent competition. In the short term, leveraging long-range, low-cost attritable unmanned technology could allow the strike range and firepower of the carrier air wing to be enhanced without major structural changes to the carriers themselves. The introduction of a CATOBAR system in the longer term, which the carriers are built to enable, would open further options with which to increase the carriers’ reach, particularly with respect to unmanned aerial refuelling. Similarly, the introduction of the Co-Operative Engagement Capability to the carriers’ air defence picket could significantly enhance its capacity for integrated air and missile defence. Given that the capacity to integrate these capabilities at pace has been built into the platform design, leveraging them over the lifespan of the carriers is desirable.

---

1. A cooperative engagement capability is a sensor and fire control netting system which enables the integration of track data on air and missile threats between surface combatants and aircraft. This allows them to form a single air defence network with greater situational awareness and efficiency than the platforms would have individually. See Johns Hopkins APL Technical Digest, ‘The Cooperative Engagement Capability’ (Vol. 16, No. 4, 1995), pp. 377–96.
Introduction

The imminent arrival to initial operating capability of the Royal Navy’s new Queen Elizabeth-class aircraft carriers raises a number of encouraging possibilities for the future of UK maritime power projection. However, the platforms will enter an operating environment that differs in many ways from that which prevailed when they were commissioned. When the aircraft carrier programme was green-lit in the 1998 Strategic Defence Review (SDR), the planned model of warfare was sustained expeditionary warfare against relatively weak opponents. In this context, carriers were to spend extended periods in theatre providing a steady drumbeat of airstrikes in a campaign that broadly resembled the 1991 Gulf War. This assumed a fairly linear process in which, if deterrence failed, a Western coalition would build up overwhelming power and then project it to roll back a revisionist adversary’s gains.

The emerging strategic environment of the 21st century will be oriented around great power competition in a multipolar world, with competitors that have ‘bespoke’ anti-access capabilities, as opposed to rogue states or terrorists. While this does not necessarily exclude operations against the sort of rogue state threat that drove planning in the 1998 SDR or against sub-state challengers, these threats will increasingly be defined in relation to great power competition. Carrier strike forces, given their ability to project power at reach, can provide UK policymakers with a number of options with which to deliver policy objectives within this competitive environment. They will, however, need to adapt both their concepts of operations (CONOPS) and technical capabilities to unlock their latent potential. The platforms can deliver significant strategic value but in order to do so will likely be used in ways very different from those envisioned when they were commissioned.

In a multipolar order, it is likely that persistent if limited competition will be institutionalised as a feature of the international system. Rather than operating in clearly defined periods of war and peace, militaries are likely to be engaged in persistent competition for relative advantage in geostrategic dimensions. This invalidates previous CONOPS for strike capabilities, which emphasised surging decisive force against well-defined threats in the context of clearly delineated phases of crisis and warfighting. Instead, competition will likely shift rapidly from low-intensity indirect competition to short bursts of high-intensity activity and back. The steps taken at each stage of competition have the effect of dictating the tempo, scope and scale of operations at the next iteration. For example, Russian planning for ground activities assumes the

preparation of the battlefield by special forces 45 days in advance of high-intensity operations.\(^3\)

The activities of special forces in peacetime can serve the dual functions of strategic coercion and the conduct of activities well in advance of a high-intensity clash.

Deterrence and coercion have a dynamic relationship in this context, with deterrence serving to delineate the rules of competition in one’s favour and coercion exploiting this advantage. For example, Iran is able to use the deterrent threat of its ballistic missiles and its ability to shut the Strait of Hormuz to ensure that competition remains at a low-intensity level – short of open armed conflict – where it enjoys a number of coercive advantages. The salience of the recent US strike on Major General Qassem Soleimani, by contrast, effectively challenged this framework by demonstrating that the US had flexible options for escalation which exceeded the conduct of greyzone operations, but nonetheless fell short of the thresholds which might trigger a large response. Moreover, the capacity of the US to escalate to such a level served as a deterrent against further escalation of the competition by Iran – a salutary missile salvo on US bases notwithstanding. In effect, then, traditional distinctions between deterrence and coercion are eroding.

Within this operating environment, CONOPS geared towards generating sustained strike capacity need to be augmented to provide policymakers with usable steps and options along a spectrum of escalation. Maritime strike forces require, in effect, a CONOPS that allows them to simultaneously compete below the threshold of high-intensity conflict, while deterring undesirable escalation. The ability to generate a posture that is capable of simultaneously dictating the rules of competition through engagement and constraining operations and exploiting a favourable grammar of competition by applying force selectively will be critical to the success of the joint force. Maritime power projection has historically offered strategists precisely this flexibility. The strategic mobility of maritime platforms and their relative survivability in contested environments without recourse to external enablers makes them optimal tools for a range of sub-threshold action ranging from deterrent signalling to ISR gathering and low-intensity kinetic action. In the event of escalation to outright conflict, maritime strike assets can allow policymakers to impose costs on an opponent economically by manoeuvring around their strengths and concentrating force against their weaknesses.\(^4\) However, in the last three

---

decades, this facet of maritime power has been de-emphasised due to a focus on expeditionary operations where control of the sea as a base for sustained power projection was assumed.\(^5\) This saw the rise of a model for employing navies that accented the ability to provide steady-state strike support from offshore positions in a single theatre over a long period.\(^6\)

At the operational and tactical levels, the maritime environment is increasingly characterised by a blurring of the traditional blue-water littoral distinction. Long-range strike capabilities, increasingly quiet diesel electric submarines with longer endurance, air-independent propulsion and a raft of other capabilities are enhancing the capacity of powers to contest expansive stretches of sea space beyond the traditionally defined littoral area.\(^7\) Simultaneously, the complex coastal infrastructure on which these sea-denial assets depend is vulnerable to disruption by amphibious raiding forces operating from littoral areas. These forces can pave the way for carrier-enabled power projection by designating targets, disrupting key nodes of anti-access systems and gathering tactically relevant information in advance of a carrier raid.

Equally, however, the survivability of littoral forces depends, in the final instance, on air control over littoral areas and the ability of pulses of carrier-based air power to disrupt opponents’ ‘systems of systems’ in littoral areas.\(^8\) As such, the distinction between blue-water forces and amphibious units will likely erode in contests for what amounts to an extended littoral in which the threats traditionally associated with littoral waters – such as diesel electric submarines (SSKs), ground-based missiles and UAVs – as well as an increasingly complex information domain are displaced further out to sea.\(^9\) The ability of both attackers and defenders to deliver crippling firepower at range, and the fact that both sides will be in an information-denied environment, means that opportunities for engagement are likely to be fleeting. This results in what naval

---


theorists have dubbed the ‘battle of the first salvo’. In essence, early results will likely prove decisive. As a result, the ability to deliver large volumes of firepower from the air, surface and subsurface quickly on the basis of fleeting information to achieve the maximum possible effect in a short time to disrupt an opposing system and exploit this fact to effect will be critical. Delivering short but intense pulses of force before departing the theatre of operations will supersede the provision of steady-state strike power.

This paper argues that carrier-enabled power projection will evolve towards what might be dubbed ‘strategic raiding’. In peacetime, strike forces will need to become more modular in order to disperse their components to conduct persistent low-intensity competition. Persistently engaged vessels can, if used effectively, serve as stations for actors from across government to engage with a region. The capacity for a major maritime combatant such as a frigate or destroyer to loiter in a theatre for a period of time with a significant organic ISR capability generates options for data collection. Its potential to serve as an offshore conduit for partners ranging from special forces and intelligence officials to local partners and its ability to enable the fusion and dissemination of tactically, operationally and strategically relevant information should not be underestimated. At the level of high-intensity conflict, the temporal scope of tactical engagements will be circumscribed. The strategic reason for this, as outlined above, is that the objective of maritime forces in a conflict will be cost imposition in a limited window of time before both parties revert to low-intensity competition. This will be coupled with the operational imperative to shift emphasis from steady-state support to, for example, an extended counterinsurgency campaign towards short, sharp raids to win the battle of the first salvo or impose damage on a well-delineated target at a lower intensity of kinetic action. The result of these cross-pressures will be a return to a raiding model at both the operational and strategic levels. In strategic terms, introducing uncertainty into an opponent’s decision-making calculus through the ability to select the time and place of an engagement has historically been an advantage of sea powers, with extended commitments of strike power to a single region or theatre being something of a historic aberration. At the operational and tactical levels, we may expect a return to the operating model that characterised actions such as Taranto and Truk with strike forces conducting short, sharp raids as opposed to steady-state operations.


11. The assumption here is that economic interdependence and the risks of nuclear escalation militate against protracted wars and that all parties desire the avoidance of general war. This assumption is borne out by both Russian and Chinese doctrinal literature which stresses the importance of fighting short, sharp local wars. For a review of Russian doctrinal literature, see Dave Johnson, ‘Russia’s Conventional Precision Strike Capabilities: Regional Crises and Nuclear Thresholds’, Livermore Papers on Global Security No. 3, February 2018. For a review of Chinese doctrinal literature, see Sidharth Kaushal and Magdalena Markiewicz, ‘Crossing the River By Feeling the Stones: The Trajectory of China’s Maritime Transformation’, *RUSI Occasional Papers* (October 2019).

In order to leverage its maritime strike capabilities, UK Strike Force will require a CONOPS that allows it to achieve the following four tasks:

1. Generating a flexible and scalable force that allows it to rapidly shift between competitive and warfighting postures.
2. Integrating the activities of forward-engaged forces with entities such as special forces and generating an organic capacity for persistent strategic engagement and information exploitation in peacetime.
3. Enabling the rapid application of kinetic and violent force against discrete targets in a compressed time should deterrence fail.
4. Integrating carrier and littoral strike forces.

This paper articulates the role of carrier-enabled maritime power projection in the future operating environment, the ways in which a Royal Navy built around the nucleus of UK Strike Force can support national strategic aims with respect to resilience, prosperity and competitive advantage, and the adaptations that will be required both in conceptual terms and in terms of force design to meet this end. The first two chapters describe key strategic and technological trends that will shape the future operating environment and the way in which maritime strike assets will be used. While written with the UK in mind, the chapters aim to outline the broad principles that should guide the use of maritime strike forces. Chapter III identifies the key UK strategic objectives that can be delivered by a carrier strike capability that is developed to leverage its strengths and offset its weaknesses in the future strategic and operational environments. Chapters IV and V discuss the CONOPS that might deliver strategic effects using carrier strike and lay out the key lines of development needed to translate these concepts into actionable lines of effort.

The research for this paper relied on a series of interviews with current and former senior naval and marine practitioners in the UK and the US, along with academic subject matter experts. Additionally, the paper has been informed by – but does not directly reflect – work carried out by RUSI and the Royal Navy over the course of two years. In terms of the secondary literature and source material used, the author has used historical analysis, case studies and quantitative studies.
I. The Future Strategic Environment and the Role of Maritime Strike

The UK’s Carrier strike groups will operate in a strategic environment that differs in key ways from the one in which they were expected to operate. The purpose of this chapter is to examine the key strategic trends which will delineate the limitations of existing concepts of employment and create new opportunities for a carrier strike force which can adapt its CONOPS.

A factor that is certain to characterise the future conflict operating environment is the return of great power competition with both peer competitors such as Russia and China and sub-peer regional powers such as Iran. The capacity of Russia to act as a peer competitor is, despite occasional claims to the contrary, likely to be a permanent fixture of both the European balance of power and, increasingly, extra-regional orders such as the Middle East and the Arctic.\(^\text{13}\) Though unlikely to return to the superpower status enjoyed by the Soviet Union, modern Russia, if it retains its current military standing, will remain a great military power.\(^\text{14}\) Despite its structural issues, Russia’s economic outlook remains more robust than is often assumed.\(^\text{15}\) This should enable the Russian state to maintain its level of military expenditure. Therefore, competition with Russia will be a permanent fixture of the future strategic environment. Russia is poised to seek a competitive maritime presence on a wide arc running from the Eastern Mediterranean to the Arctic. In these two regions, Russia’s growing capacity for disruption and limited power projection, coupled with its growing relationships with countries such as Egypt

---

13. For the view that Russia should be viewed as a sub-peer threat, see James Dobbins, Howard Shatz and Alit Wayne, ‘Russia is a Rogue Not a Peer, China is a Peer Not a Rogue: Different Challenges, Different Responses’, Perspective Series, RAND Corporation, October 2018. For a rebuttal of this position, see Michael Kofman and Richard Connolly, ‘Why Russian Military Expenditure is Much Higher than Commonly Understood (As Is China’s)’, War on the Rocks, 16 December 2019.
14. Russian military expenditure, once adjusted for purchasing power parity to account for the fact that much of its defence procurement occurs domestically, is valued at roughly $200 billion, exceeding the defence expenditure of the major non-US NATO members combined.
15. Russia’s economic outlook remains more robust than is often assumed. According to IMF forecasts, prior to the coronavirus outbreak, the Russian economy was on a sound fiscal footing, with a modest rise in growth expected in the mid-2020s, particularly if structural reforms are implemented. See IMF, ‘Russian Federation’, Country Report 19/260, August 2019, pp. 1–15.
Persistent Engagement and Strategic Raiding

could, if unchecked, leave it the gatekeeper of two important conduits that will connect both ends of Eurasia: the route through the Suez Canal and the Northern Sea Route.  

Simultaneously, the continuing rise of China in the Indo-Pacific poses a challenge not seen since the end of the Cold War: the risk of a single hegemon dominating one of the world’s key economic regions. Dominance does not necessarily imply territorial expansion. Rather, a hegemonic power is one that can set the rules of the road for its neighbours. For example, by the early 20th century the US could be considered a hegemon in the western hemisphere despite a relatively limited record of territorial expansion. A demonstrated capacity for coercion along with the offer of benefits such as protection from foreign creditors and economic cooperation combined to create a hierarchical regional order in the western hemisphere.

Today, China looks primed to overtake the US as the world’s largest economy. Chinese leaders tend to view the world in terms of a series of concentric circles emanating from China, with Chinese interests and influence being progressively attenuated from one ring to the next. China is likely to use its growing economic and military capacity to attempt to secure a dominant position within the first concentric circle, with maritime East Asia a priority region given both its economic importance and the potential for a hostile country or coalition to use it as a springboard against China. However, China is becoming increasingly strategically intertwined with the second concentric circle, spanning the Indian Ocean and central Pacific. This stems both from economic imperatives and a growing recognition that a competitive if not necessarily dominant position on what People’s Liberation Army (PLA) strategists call ‘strategically exterior lines’ in areas like the Indian Ocean can complement a bid for preponderance along China’s maritime interior lines in east Asia. Partly as a result of its economic success, the Chinese economy will need to recalibrate itself to avoid the ‘middle income trap’ whereby it is too rich to reap dividends from labour intensive components of international supply chains but is not a developed state capable of competing with the West in economic terms. To do this, China has embarked on a state-led drive to generate capacity in the sectors deemed key to sustaining a

18. This was underscored by incidents such as the Venezuela crisis of 1895 and the subsequent declaration of the Roosevelt corollary to the Monroe Doctrine, which stated a right to intervene in the internal affairs of regional countries where mismanagement posed risks to regional security. See Dana Gardner Munro, Intervention and Dollar Diplomacy in the Caribbean 1900–1921 (Princeton, NJ: Princeton University Press, 2015), p. 65.
high-tech economy, embodied by the ‘Made in China 2025’ industrial plan, which will make it an economic competitor to developed countries, particularly in the emerging markets of the Indo-Pacific. This shift also means that it must now export its excess industrial capacity. The Belt and Road Initiative, which represents the natural outgrowth of this imperative, also endows Beijing with extra-regional strategic interests for the first time in recent memory.\textsuperscript{23}

The economic imperative to look beyond East Asia is joined by a military one. At present, the People’s Liberation Army Navy (PLAN) remains primarily geared towards prevailing in a regional conflict and will struggle to achieve effective extra-regional power projection in wartime without first asserting control over the South China Sea and Taiwan and thus enabling it to secure ingress and egress from the first island chain. Nonetheless, the PLAN has added forward-edge defence and sea line of communication (SLOC) contestation to its strategic lexicon.\textsuperscript{24} The PLAN’s rationale for this is that, even if China’s capacity for extra-regional power projection is limited, the ability to maintain a competitive presence in areas such as the Indian Ocean would allow China to compete in scenarios involving limited extra-regional contingencies and, in wartime, act as the outermost layer of the PLA’s system of layered defence. Consider, for example, the ways in which a PLAN flotilla based in the Indian Ocean acting as a ‘fleets in being’ operating from local bases might tie up US resources and slow the flow of resources to East Asia if a conflict involving China broke out there. The emergence of overseas PLA bases in areas such as Djibouti and potential dual-use facilities in countries such as Sri Lanka and Pakistan raises the possibility that the PLAN may exert a degree of competitive presence overseas in the medium term.\textsuperscript{25} In the long term, one might consider whether a combination of economic interests and a strategic interest in maintaining a favourable political climate in the second ring might produce a more interventionist Chinese approach in the wider Indo-Pacific. This would certainly mirror the gradual, often unplanned, evolution of US strategy towards interventionism in areas such as the Caribbean in the early 20\textsuperscript{th} century.

Within this context, traditional missions such as coordinating with partners against non-traditional threats and missions to curtail the activities of non-state actors will not necessarily disappear. However, the activities of peer competitors and regional powers will increasingly delineate the importance, scope and scale of such missions. Non-state actors, for example, will increasingly serve as extensions of a power’s toolkit with which to expand its influence in a given region – something already visible in the context of the contemporary Middle East where actors such as Hizbullah, the Yemeni Houthis and General Khalifa Haftar’s Libyan National Army serve as proxies for state competitors such as Iran and Russia respectively. An insurgency or non-state group will come to matter more in strategic terms only if it is linked

\textsuperscript{24} Andrew Erickson, ‘China’s Blueprint for Sea Power’, \textit{China Brief} (Vol. 16, No. 11, 2016).
Persistent Engagement and Strategic Raiding

to the interests of a state. It is for this reason that the activities of the Houthis are of greater significance than a disruptive but isolated non-state group such as the Moro Islamic Liberation Front in the Philippines. In the context of a great power competition in which there are numerous smaller partners, the time and effort that can be devoted to any given non-state actor will be limited. As such, the model that might be expected to prevail in peripheral conflicts is light-footprint support through small teams of advisers backed by short, sharp pulses of expeditionary firepower at critical junctures. In many ways, this may resemble the approach taken by the US during the Easter Offensive in Vietnam as a large ground footprint was replaced with advisers and forward air controllers embedded in the South Vietnamese army, who coordinated tactical air support against the North Vietnamese army, coupled with deeper interdiction in the form of the Linebacker raids. The ability to execute this model will depend on strategic mobility but also the analytical capacity to identify inflection points in a conflict where pulses of force can be decisive. Engaged teams will straddle intelligence and operational functions to provide this analysis.

Similarly, missions to provide public goods such as regional stability against threats like maritime piracy will gain greater salience in regions that see a significant degree of great power competition compared with those that do not. This will be the case for two reasons. First, as scholars such as David Lake have pointed out, the ability to provide public goods such as maritime security or internal stability to smaller actors remains a potent tool in a major power’s toolkit. Great powers often compete indirectly by attempting to win over smaller players by demonstrating their capacity to cater to the primary threats to these states, which are often

28. For example, sharp demonstrations of force or resolve when a conflict is finely balanced can have the effect of freezing a civil conflict before a supported government begins to lose and creating windows of opportunity for negotiation. This was the case with the limited US intervention in Laos under the Kennedy administration. See Arthur Schlesinger, A Thousand Days: John F Kennedy in the White House (New York, NY: Houghton Mifflin, 2002), pp. 257–60. Alternatively, projecting force decisively can have effects when a rebel force reaches a point at which it is beginning to develop conventional formations and operational bases, the so-called ‘second stage’ of guerrilla conflict that Mao Zedong described as a period of maximal danger for the guerrilla. See Patricia Sullivan and Johannes Karreth, ‘The Conditional Impact of Military Intervention on Internal Armed Conflict Outcomes’, Conflict Management and Peace Science (Vol. 32, No. 3, 2014), pp. 269–88. Similarly, against conventional forces, well-timed bursts of force can frustrate an opposition’s offensives or facilitate those of a partner, allowing a favoured party to improve its position without committing the external ally to open-ended support, as was the case with the Easter Offensive.
non-traditional. By way of an example, China’s willingness to equip the Sri Lankan army for its final offensive against the Tamil Tigers and provide ISR and enablers when regional powers such as India initially would not was key to the cultivation of influence over Colombo.\textsuperscript{30} Contributions to regional security efforts can also serve to socialise regional countries to a great power’s strategic presence. For example, anti-piracy efforts have provided the PLA with a pretext to deploy 34 different vessels including DDGs, FFGs and LPDs far from China’s regional waters over the course of the last decade. Chinese anti-piracy efforts have also allowed its maritime special forces to gain experience. These actions have allowed the PLAN to build the capacity for power projection at long distances and gather information regarding a potential future operating theatre without provoking the international pushback that might have taken place had this occurred under different circumstances.\textsuperscript{31} However, missions to combat non-traditional threats should be prioritised if they can serve a secondary intelligence-gathering function or contribute to great power competition in some other way. Competition will not entirely eliminate such missions, but it will subsume them.

Competition with a great power may also take more direct, albeit limited forms. When the restraints of economic interdependence and mutual nuclear vulnerability discourage protracted high-intensity conflict between peer competitors, states can opt for limited direct conflict over well-delineated stakes. Paradoxically, states may be incentivised to initiate limited conflicts precisely because they do not expect conflict to escalate beyond a point: the stability–instability paradox.\textsuperscript{32} The Russian strategic lexicon has departed from its Soviet predecessor by defining a much broader range of conflicts ranging from local wars involving Russia and a single opponent to regional and global conflicts against coalitions, with an emphasis placed on using the threat of escalation to ensure that the wars Russia does fight remain local wars.\textsuperscript{33} Russia’s 2008 war with Georgia represents an example of precisely such a conflict. Russia expects to prosecute any conflict that might break out between itself and a NATO member such as Estonia in accordance with that strategic model. This can be achieved if NATO mobilisation can be slowed by a combination of political subversion, selective threats against wavering Alliance members and a military anti-access area-denial (A2/AD) strategy on land and at sea.\textsuperscript{34} China also defines its military doctrine in terms of prevailing in crises short of war and winning short, sharp ‘local

\textsuperscript{31} Andrew Erickson and Austin Strange, ‘Six Years at Sea and Counting: Gulf of Aden Anti-Piracy and China’s Maritime Commons Presence’, Jamestown Foundation, June 2015.
\textsuperscript{34} Ben Hodges et al., ‘One Flank, One Threat, One Presence: A Strategy For NATO’s Eastern Flank’, CEPA, May 2020, pp. 20–25.
wars under informatized conditions’ on its periphery. The concept of forward-edge defence outlined in the 2015 edition of the PLA’s *Science of Military Strategy* outlines the role of limited competitive actions beyond the first island chain in complementing this framework. For example, PLAN forces operating at the ‘forward edge’ in the wider Indo-Pacific can slow or preclude the mobilisation of globally positioned US forces to the first island chain, thereby ensuring conflicts on the Chinese periphery remain local. In peacetime, the activities of these forces can undermine the partnerships on which the mobility of US forces depends. Russian and Chinese strategic concepts, while not identical, share certain key features including:

- Periods of sub-threshold competition to shape the rules of competition and to prepare the battlefield and slow the pace of an opponent’s mobilisation.
- Rapid but limited escalation to kinetic action when leadership has deemed the strategic ground to have been prepared.
- The use of the threat of escalation and A2/AD capabilities to slow an opponent’s decision-making processes in a conflict and limit its ability to engage in a timely manner.
- Rapid de-escalation before the mobilisation of political will and capacity by a hostile coalition, followed by a return to low-intensity competition.

In effect, then, the competitive environment might be conceptualised as being divided along two dimensions: how direct the competition between major powers is and the level of intensity of the competition. Competitors can engage in high-intensity indirect competition by committing significant forces to a proxy competition while maintaining the mutual fiction that their forces are not engaging in combat. Alternatively, states may engage in lower-intensity forms of indirect competition. These may include supplying opposing sides in a conflict with equipment or ISR data or vying to prove themselves a more valuable partner for the same state. A number of Cold War clashes including the Angolan Civil War and the covert direct Soviet involvement in the Vietnam War fit the former pattern. Iran’s involvement with the Houthi rebellion fits this model, with the Iranians restricting their involvement to functions such as training specialists in areas including precision strikes and providing ISR using special-purpose vessels such as the *Saviz*. Finally, with respect to ‘competitive cooperation’ in which two parties vie for the alignment of the third, one might refer to the PLA’s support to Sri Lanka. This was partially driven by a desire to gain a foothold in a traditionally Indian-aligned state, as well as contemporary

---

36. Kaushal and Markiewicz, ‘Crossing the River by Feeling the Stones’.
37. For example, during the Korean War, both US and Soviet aircrews engaged in direct high-intensity combat but both states maintained the fiction that the Soviet aircraft in the theatre were North Korean to control escalation. Israeli operations against Soviet-manned SA-2 batteries during Israel’s war of attrition with Egypt fit a similar model. See Austin Carson, *Secret Wars: Covert Conflict in International Politics* (Princeton, NJ: Princeton University Press, 2018); George Simpson Jr, ‘Cold War, Hot Summer: Superpower Involvement in the War of Attrition in 1970’, *Journal of the Middle East and Africa* (Vol. 6, No. 1, 2015), pp. 101–23.
38. Sutton, ‘Saviz’. 
Russian efforts to gain influence within Egypt by proving itself to be a more dependable security partner than the US.\(^\text{39}\)

With regard to direct clashes, lower-intensity options might include the use of military and paramilitary assets against another great power in non-kinetic ways. The harassment of US naval vessels in the South China Sea by both the PLAN and the People’s Armed Forces Maritime Militia might fit this definition.\(^\text{40}\) This could also apply to the alleged use of lasers by the PLA garrison at Djibouti to disrupt the overflight of US aircraft.\(^\text{41}\) Non-kinetic but direct uses of force might also entail coercive diplomacy based around the tacit or explicit threat of force to constrain an opponent. For example, the Nixon administration’s mining of Haiphong harbour during the Vietnam War represented a direct but non-kinetic use of force against the Soviet Union and China. Both parties were notified and thus had the opportunity to avoid the loss of life. However, the minefield served to deny them access to north Vietnam.\(^\text{42}\) In a contemporary context, PLA strategists have discussed the idea that an anti-access network at sea could prevent a rival great power such as the US interfering in China’s periphery. An A2/AD network constrains rival activity by posing risks to deployed vessels. These risks can be underscored by actions such as missile tests near adversary vessels using dummy warheads – which China did during the 1996 Taiwan Straits Crisis during which the PLA carried out a de facto blockade of Taiwan under the aegis of conducting military exercises to demonstrate China’s displeasure with the policies of then Taiwanese President Lee Teng-Hui.\(^\text{43}\)

---


At the lower-intensity end of the conflict spectrum, one might also see the periodic, limited use of force. This has been the case for much of the Israeli maximum pressure campaign against Iran. To be clear, ‘low intensity’ is not synonymous with ‘non-escalatory’. The US attack on Soleimani was low intensity as it was a single isolated strike. Yet, the strike entailed significant escalatory risks. However, there is a general correlation between low-intensity kinetic action and a desire to minimise the risks of escalation. Finally, at the higher-intensity end of the spectrum of competition is the traditional use of military force, albeit for limited ends on a compressed time scale.

Table 1: The Spectrum of Competition

<table>
<thead>
<tr>
<th>High Intensity</th>
<th>Low Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Direct</strong></td>
<td><strong>Indirect</strong></td>
</tr>
<tr>
<td>• Direct mid- to large-scale kinetic clashes.</td>
<td>• Deployment of troops or conduct of strikes against a competitor’s partner state/proxy.</td>
</tr>
<tr>
<td></td>
<td>• Covert large-scale clashes under the aegis of local participants.</td>
</tr>
<tr>
<td></td>
<td>• Competitive engagement.</td>
</tr>
<tr>
<td></td>
<td>• Covert or overt non-combat support to opposing parties in a conflict.</td>
</tr>
<tr>
<td></td>
<td>• Non-kinetic harassment of opposing forces via electronic warfare and the use of civilian vessels.</td>
</tr>
<tr>
<td></td>
<td>• Small-scale kinetic clashes.</td>
</tr>
</tbody>
</table>

Source: Author generated.

Table 1 is not meant to be exhaustive but serves an orienting function. In the context of overarching great power competitions, actions at the lower-intensity end of the competitive spectrum might be viewed as part of a ‘campaign between wars’. While they are individually strategically insignificant, the repetitive use of such actions can either psychologically or physically constrain an opponent’s freedom of action over time, paving the way for the limited use of force at a high-intensity level to secure concrete war aims. For example, the steady Israeli attrition of Iranian Revolutionary Guard Corps (IRGC) assets in Syria has limited the direct support that Iran can lend President Bashar al-Assad’s regime and Hizbullah. It has also set the terms of competition so that certain forms of Iranian actions below the threshold continued while others, such as the placement of precision strike assets and IRGC personnel near the Israeli border, could not. This has created a situation whereby Israel can conduct limited high-intensity operations from a position of strength if it so chooses, placing itself in a favourable position when competition returns to a low-intensity level.

A similar dynamic is at play in the South China Sea. Low-level provocations by the PLAN and People’s Armed Forces Maritime Militia against regional actors, coupled with efforts to paralyse regional coordination against China using economic levers, has socialised regional countries into dealing with Beijing on a bilateral basis by demonstrating the futility of attempting multilateral coordination against China.
Persistent low-level provocations, for which there is no adequate US response, convey a message that China’s presence is less transient than that of the US, while failed attempts at multilateralism give states an incentive to engage with Beijing on a bilateral basis. In tandem, the erection of local air defence and anti-ship networks on artificial islands has created a regional military balance that could potentially enable China to enjoy local dominance in the early stages of a short, sharp regional conflict. Low-intensity actions, the threat posed to regional actors who cooperate with the US, and economic incentives and disincentives all serve a shaping function: ensuring that China is able to fight a short, sharp local war, as opposed to a protracted conflict against a regional coalition which it might lose.

This line of reasoning is also echoed in Russian military literature which reiterates the importance of limited kinetic use (particularly of conventional precision strikes), persistent threats in peacetime and non-military means as a tool by which conflict can be localised and fought on Russia’s terms. This framework is visualised in the figures below.

**Figure 1: The Russian General Staff’s Integrated Approach to Local Conflict**

**Figure 2: Chinese and Russian Models of Escalation Control**

<table>
<thead>
<tr>
<th>Local preponderance enables</th>
<th>Deterrent sufficiency constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Non-kinetic/indirect activity</strong></td>
<td><strong>Limited direct clashes</strong></td>
</tr>
<tr>
<td>Coercion to alter adversary patterns of deployment</td>
<td>Leveraging local preponderance to win short, sharp clashes</td>
</tr>
<tr>
<td>Coercion to alter adversary patterns of deployment/gain local advantages</td>
<td>Avoided through deterrence by denial</td>
</tr>
</tbody>
</table>

Recompete on favourable terms

II. Deterrence and Compellence at Sea in the Future Strategic Environment

Based on the analysis above, several general principles regarding the strategic employment of maritime forces are apparent. Two characteristics of the future operating environment and the conduct of deterrence and compellence at sea bear restating:

- The shift from classical deterrence to cumulative strategies centred on a campaign between wars punctuated by short bursts of direct kinetic action.
- The shift from escalation dominance to risk manipulation, whereby victory is attained by manipulating an opponent’s risk calculus to ensure that war is fought at a level of escalation where one’s own side enjoys comparative advantages.

Deterrence theory has traditionally focused on ‘specific deterrence’: the notion that a deterrent threat is primarily geared towards preventing a discretely defined action.44 This might be accomplished by strategies of denial which pose the threat of military failure, or punishment which targets an opponent’s valued assets such as economic infrastructure.45 The shared assumption, however, is that operations proceed in a sequential pattern for discrete objectives – forces might be steadily built up in a region in a crisis scenario, before either leaving, having deterred an adversary action, or conducting subsequent operations to either punish an opponent or roll back an adversary’s gains on the ground. Operation Desert Shield, which played a role in deterring an Iraqi invasion of Saudi Arabia and enabled subsequent operations to evict the Iraqi army from Kuwait, is a useful illustration of this model.46 By contrast, cumulative deterrence emphasises the aggregate effect of multiple, often simultaneous actions that usually involve forces operating on a smaller scale. The objective of a cumulative strategy is not to win some specific stake per se, but rather to achieve a favourable psychological and material balance by graduated actions. Insurgent strategies which emphasise localised distributed actions to erode the will and resources of a stronger actor fit within this pattern. However, such approaches are neither the sole preserve of non-state actors nor are they necessarily always kinetic.47

47. For a discussion of cumulative deterrence, see Yoav Ben-Horin and Barry Posen, Israel’s Strategic Doctrine (Santa Monica, CA: RAND, 1981); J C Wylie, Military Strategy: A General Theory of Power
so-called ‘third battle of the Atlantic’ between US and Soviet submarines, for example, was an exercise in cumulative deterrence. Here, one party used a drumbeat of localised actions to demonstrate to the other its ability to track its submarines. The other, in turn, sought to demonstrate a capacity for evasion. The object was not to surge force for a specific objective but to maintain competitive actions over the course of several decades. This dynamic will now be replicated on the sea surface.

The second, interrelated trend is a shift from a traditional emphasis on escalation dominance to ‘strategies of risk manipulation’. The concept of escalation dominance implied the ability to retain initiative and control by outmatching an opponent at every stage of the escalation ladder, thereby disincentivising escalation at any level. In effect, this is the basis for the oft-cited precept that preparing for the high-end fight allows one to deter all other forms of threat as well. Strategies of risk manipulation, by contrast, aim to use deterrence and coercion in a synthetic way, with the former paving the way for the latter. In effect, rather than attempting to prevail at the highest levels of the escalation ladder, strategies of risk manipulation attempt to achieve minimum deterrence at this level – making it unacceptably costly to escalate and thus displacing competition to levels where a competitor has advantages.

These twin trends have several ramifications for the future concepts of employment of UK Strike Force. While these ramifications will be explored in more depth later, it is useful to signpost them here:

- To deliver cumulative deterrence, forces will need to spend more of their time forward deployed and persistently engaged. Maintenance and readiness cycles will need to adapt to this.
- Carrier air wings will need to deliver scalable strike packages to prevail in a context where the use of force is a persistent, if low- to moderate-intensity, feature of international politics. Carrier air wings, for example, may need to become accustomed to launching one or two ship sorties at reach and at very short notice for regular ISR missions or limited strikes in support of engaged special forces or littoral operation teams. They will no longer be able to husband strike capabilities exclusively for large-scale uses of force. The inclusion of non-kinetic capabilities such as electronic-warfare-capable UAVs or UAVs mounting directed energy weapons into an air wing’s repertoire might also be desirable to constrain adversary freedom of action in the context of persistent competition.
- On the sea surface, strike formations will also need to be made modular in order to simultaneously compete at lower levels of competition and, if necessary, aggregate quickly to deter short, sharp bursts of high-intensity escalation. In effect, the Corbettian

---

model of a force geographically dispersed but subject to unified command will be central to future maritime deterrence and coercion. Strike groups should function, as per Julian Corbett’s formulation, as ‘a homogeneous body, but a compound organism controlled from a common center and elastic enough to permit it to cover a wide field without sacrificing the mutual support of its parts’.

- In wartime, the unique contribution of maritime strike forces will shift from supporting expeditionary operations to generating short bursts of high-intensity force at multiple points on an opponent’s periphery. This would allow Western forces to regain the strategic and operational initiative. This raiding model will, however, make new demands of naval forces and embarked air wings in wartime. They will operate at a much higher tempo, albeit for shorter periods.

The strategic concept that will likely guide maritime coercion within this rubric can be roughly compared to Alexander George’s framework of ‘turning the screw’. Within this context, coercion requires two elements:

- A calibrated and direct cost-imposing measure.
- A tacit demonstration of the capacity to rapidly move up the ladder of escalation at the time and place of one’s choosing but which leaves an opponent space to relent without losing face.

This differs subtly but importantly from escalation dominance as it does not imply seeking outright superiority at every level of conflict. Instead, like opponent concepts, it combines deterrent sufficiency with coercive advantage. The concept depends on the ability of forces to be broken down into packages capable of prosecuting limited-aims operations while holding the threat of escalation over the horizon. Carrier strike groups can, in principle, serve both ends: delivering limited kinetic and non-kinetic coercion while holding heavier strike forces at the edge of an operating theatre as a tacit signal of the ability to escalate at the time and place of the UK’s choosing. To do so, however, they will need to adapt and evolve to increase their reach, scalability and ability to deliver prompt effects.

---

51. Ibid., p. 134.
III. Technology and the Future Operating Environment: Challenges Facing Carrier Strike in the Missile Age

Related to, but distinct from, the strategic challenges outlined above are technical challenges to carrier-enabled power projection. Underpinning the strategic innovations undertaken by peer competitors is the maturation of increasingly long-range reconnaissance strike complexes. The term ‘reconnaissance strike complex’, coined by Soviet Marshal Nikolai Ogarkov, referred to a network of sensors and long-range strike capabilities delivering effects at range. The challenge of long-range strike by land- and air-based assets is not new. Soviet doctrine during the Cold War stipulated the use of cruise missiles launched from bombers against US carriers. However, the means by which areas can be denied are growing in sophistication and number and proliferating beyond peer competitors. This is mirrored by the proliferation of increasingly sophisticated air defences contesting the airspace in littoral areas.

In the maritime domain, the cruise missile threat is increasingly shifting from air-launched missiles such as the Exocet to ground-based launchers that can be more easily dispersed and camouflaged. Additionally, relatively cheap littoral-oriented vessels such as the Chinese Type-22 Houbei-class catamaran and the Russian Krakurt-class corvette can launch long-range anti-ship missiles such as the C-803 and the P-800 Oniks. As a result, the suppression of anti-ship missiles increasingly requires the ability to target relatively cheap launch platforms that can be hidden in littoral areas. The speed and sophistication of modern anti-ship missiles is another factor worthy of consideration. Missiles such as the P-800 Oniks, which travel at supersonic speeds and receive mid-course navigation guidance waypoints as well as retargeting instructions...

53. Krepinevich, A War Like No Other.
56. See Mark Gunzinger, ‘Long Range Strike: Resetting the Balance Between Stand-In and Stand-off Forces’, Mitchell Institute for Aerospace Studies, June 2020, p. 22. A similar dynamic can be seen with regard to anti-ship capabilities.
from satellites, are more accurate and provide more attack vectors than older generations of anti-ship missiles and leave targets with shorter reaction times.\(^5^8\) Next-generation cruise missiles such as the hypersonic 3M22 Zircon will exacerbate this challenge further still.\(^5^9\)

Moreover, such assets need not be the sole preserve of large states. The export of the P-800 to Syria by Russia in 2010 and the use of older C-802 missiles by both the Houthis and Hizbullah in recent conflicts would suggest a trend towards proliferation.\(^6^0\) Indeed, countries can indirectly support proxies at a low cost by providing them with the ISR to effectively cue these assets — as Iran did by providing the Houthis with electronic and signals data gathered from the Saviz to allow them to target their anti-ship missiles.\(^6^1\) Alternatively, weaker actors can cue anti-ship missiles on the basis of data from low-cost UAVs. However, the low quality of data from UAVs and their narrow fields of view limit their effectiveness.\(^6^2\) This being said, weaker actors may still surprise a stronger navy, as Hizbullah did against the INS Hanit and the Houthis have done against Emirati vessels more recently.\(^6^3\)

This is not an insurmountable problem. Navies have been developing countermeasures against long-range anti-ship cruise missiles (ASCMs) since the Egyptian sinking of the INS Eilat with a Soviet SS-N-2 missile during the Six Day War.\(^6^4\) Data gathered by John C Schulte suggests that over the course of the 20th century, an alert, large-surface combatant capable of deploying robust hard- and soft-kill countermeasures had a low probability of being sunk by an ASCM.\(^6^5\) Indeed, the majority of the victims of successful ASCM strikes have been merchant vessels and tankers.\(^6^6\) Furthermore, the attrition imposed on non-stealth aircraft by shipboard air defences suggests that blue-water forces with long-range air defences can circumvent the challenge of


\(^5^9\) Ibid.


\(^6^1\) Sutton, ‘Saviz’.

\(^6^2\) The field of view is the area an asset can search at a given moment in time.


\(^6^5\) A large naval vessel is defined as one with approximately 7,000 tonnes of displacement or more by John C Schulte’s study. Notably, smaller warships such as the HMS Exeter, the USS Stark and the INS Eilat have been sunk by ASCMs, but factors such as more limited point defence capabilities, or surprise in the case of the Exeter and Stark, are worthy of consideration. See John C Schulte, An Analysis of the Historical Effectiveness of Anti-Ship Cruise Missiles in Littoral Warfare (Monterey, CA: Naval Postgraduate School, September 1994).

\(^6^6\) While Schulte’s study is dated, the relative lack of missile firings since its writing renders it the most up-to-date source available. Moreover, Schulte’s regression analysis correlating missile
missile defence against some air-based threats by ‘shooting the archer rather than the arrow’.\(^67\) Long-range combat air patrols can also achieve this against some aircraft – an assumption which underpinned US naval planning during the Cold War.\(^68\) While replicating an outer air battle against bombers operating at reach may prove difficult, it is still a viable means of mitigating the fighter threat and potentially holding ISR assets such as maritime patrol aircraft at risk. Of course, aircraft are one launch platform among many, but given the ranges at which they can operate they represent the longest-range element of land, sea and air platforms from which anti-ship missiles can be launched. The effective ranges of anti-access systems may be limited by a reliance on land-based launchers and littoral vessels. Moreover, the relatively limited ISR capabilities of weaker actors would likely limit the ranges at which they can designate targets and thus limit them to using ASCMs at shorter ranges.

This should not be regarded as a basis for understating the anti-access challenge posed by the proliferation of missiles. This is especially important because modern missiles are significantly more sophisticated and lethal than their predecessors. Furthermore, much of the existing data – and consequently much of the analysis – on lethality is based on older missile models. For example, extrapolation from Schulte’s regression analysis of cruise missile lethality against ships of various displacements would find that a P-800 which has a kinetic energy of approximately 20 Exocet missile equivalents would have a significant chance of achieving a mission kill against even the largest warships and, at supersonic speeds, would allow air defenders significantly less reaction time.\(^69\) Nonetheless, historical evidence shows that anti-access systems built around cruise missiles are not insurmountable. Among the solutions explored in this paper are evolving soft- and hard-kill measures and efforts to disrupt the kill chain on which such defensive systems depend, as well as developing concepts of employment that limit vessels’ time in a threat envelope.

Cruise missiles are joined by longer-range ASBMs such as China’s DF-21D and the Russian KH-47M2 Kinzhal, as well as hypersonic boost glide missiles such as the DF-17. ASBMs can, in principle, strike targets at long ranges of up to 2,000 km at speeds of up to Mach 10.\(^70\) Hypersonic glide vehicles (HGVs), which have the potential to manoeuvre at speeds over Mach 5, combine aspects of the cruise and ballistic missile threats, moving speeds comparable to ballistic missiles but manoeuvring on non-parabolic trajectories to evade missile defences.

\(^{67}\)Hughes and Girrier, *Fleet Tactics and Naval Operations*, p. 150.


While these technologies have significant disruptive potential, some caveats are needed with regard to their use.

First, the ISR capabilities needed to cue them in are complex and costly. At present, for example, China – which maintains a constellation of eight high-resolution earth observation and infrared satellites – would, in the western Pacific, expect time intervals of up to two days between satellite passes over a given object. This can be reduced to three hours with cueing either by over-the-horizon (OTH) radar or lower-resolution ELINT (electronic intelligence) satellites of which China fields 24.  

The time between satellite passes, even with cueing, coupled with the challenges of coordinating disparate ISR assets held by different organisations, classifying and tracking a target and conducting a launch, means that it is unclear whether the PLA can execute its kill chain in a timely manner – that is, before an aircraft carrier has moved beyond the 100-km area that a synthetic-aperture radar’s (SAR) field of view can survey at any given time. In areas beyond and adjacent to the first island chain, the geographical scope of the theatre and the time to target will likely make hitting a manoeuvring target more difficult still. To be sure, these are not insurmountable problems and it is more likely than not that the PLA will eventually develop the capacity needed to quickly cue its ASBMs. However, in the short term, ASBMs and HGVs remain technologies in need of a system of systems to leverage their potential. The fact that the PLA’s Strategic Rocket Force has thus far built a relatively small force of 40–70 ASBMs, representing a fraction of its 1,500 conventional missiles, illustrates the fact that it sees these tools as being an asset which should receive cautious investment until the maturation of Chinese integrated ISR.  

More importantly, the ISR requirements for accurately targeting moving vessels at long ranges of 1,000–2,000 km mean that the barriers to entry for using long-range ASBMs and hypersonics, such as the DF-17, are exceedingly high, even for peer competitor states such as Russia. Russia does not possess a SAR satellite constellation like China’s. It would have to rely exclusively on either low-quality early-warning radar data from OTH radars such as the Kontainer system or scarce airborne assets such as maritime patrol aircraft to track a target at ranges relevant to the use of an ASBM or a missile carrying an HGV.

73. For a relatively recent inventory of China’s missile forces, see Anthony Cordesman, ‘The PLA Rocket Force: Evolving Beyond the Second Artillery Corps (SAC) and Nuclear Dimension’, CSIS, October 2016, p. 48.
Maritime patrol aircraft are vulnerable at the ranges at which they could generate reliable data on a carrier group, particularly given that in order to search a given area they need to place their radar in active search mode. Given the quality of the data that can be relayed from early-warning OTH radar, which have uncertainties of roughly 40 km that can be exacerbated by climatic factors, Russian commanders would have to expend large numbers of very scarce assets to saturate an area in which a targeted vessel might be to achieve a high probability of kill, rendering this an unlikely option. Moreover, OTH radar have difficulties differentiating between vessels returns and sea clutter should they maintain the same doppler and have poor range resolutions which are not sufficient to enable target discrimination and classification. They can deliver information on a target’s size and will likely identify a carrier during flight operations, but while they will intermittently track large warships they will not do so persistently. Civilian traffic rarely stops entirely in times of conflict, even when merchant vessels are directly targeted, as during the Iran–Iraq tanker war. So, a number of large vessels with a large radar cross-section may be present in an area, though as a conflict continues this traffic may lessen. As such, while OTH radar will establish intermittent contacts and periodically allow target classification, Russian forces will need recourse to other assets to eliminate false positives and establish a target’s precise location.

It is, then, not entirely surprising that despite investing in long-range strike capabilities such as the Kinzhal, the priority of the Russian navy and Coastal Defence Forces has been shorter-range assets that can be cued by ground-based radar, helicopters and UAVs at distances of 200–300 km from the shoreline. Beyond this range, Russian green-water naval vessels such as the Krakurt corvette and the Sergei Gorshkov frigate can range to distances of approximately 200 km from friendly shores to track and target vessels using either organic radar or UAVs and helicopters. Larger vessels such as the Slava-class destroyer and Kirov-class cruiser may range even further. Given that they are firing from forward positions, these assets can contest waters further out than ground forces. However, because the exterior lines that they are scanning are larger than the close-in areas defended by ground-based assets, and because these vessels are fewer in number, the threat is attenuated at ranges of 500–800 km from a Russian-held...

78. Green-water vessels are designed to operate in littoral areas 100–200 km from a friendly shoreline. On Russia’s green-water assets see, for example, Bogdanov and Kramnik, The Russian Navy in the 21st Century, pp. 10–30. The ranges at which Russian naval vessels sortie are not fixed. Recent exercises in the Barents Sea saw the Russian Navy conduct large-scale exercises at significantly longer distances. See, for example, Thomas Nilsen, ‘Russia Claims to Have Demonstrated Complex Exercise Outside Norway’, Barents Observer, 11 April 2019.
shoreline. Beyond these ranges, fighter aircraft such as the MiG-31K and bombers such as the Tu-22M3M can target vessels with air-launched cruise missiles. Fighter aircraft, however, need to get relatively close to blue-water forces to track them with their organic sensors, even though they can detect radar returns from further out. This has the effect of placing them at risk from a carrier’s combat air patrols and DDG-launched SAMs, particularly if they are using their radar in active search mode to scan an area, thereby disclosing their own location. Bombers can launch their missiles from safer distances, but are reliant on limited ISR assets. Certainly, the radar cross-sections of large vessels can make target discrimination based on contacts easier, but such an approach would incentivise countermeasures such as spoofing using auxiliary vessels. As such, fighters would likely rely on offboard ISR, much like bombers. Equally, as one moves further away from one’s shores, the target’s area is even greater. Thus, at both its own shores and near-overseas bases such as Tartus, Russia aims to create a layered air and missile threat that becomes progressively more dense as an opposing force approaches Russian-held littorals.

The emphasis on short-range anti-access will likely also hold for regional powers such as Iran and weaker state and non-state actors. This does not completely disincentivise the possession of long-range strike assets, however. Iran, for example, fields the Khalej Fars ASBM. Despite not being able to reliably cue ASBMs and missiles carrying HGVs at long ranges, smaller states may regard the threat they pose as a means of complicating the deployment patterns of enemy carrier groups. Moreover, these assets can be cued at shorter ranges and against constricted chokepoints such as the Strait of Hormuz using either ground-based radar or assets such as UAVs. That said, the emphasis of Iranian missile forces will likely be on shorter-range ASCMs such as the Noor and Ghadr built along the lines of the Chinese C-802/803.

In the long term, a cluster of assets associated with what is often described as the fourth industrial revolution will render areas close to hostile shores more contested still. Additive manufacturing is likely to render the production of large numbers of relatively low-cost loitering munitions increasingly viable even for relatively weak actors, as evidenced by the Houthis’ use of 3D printing to manufacture UAVs for use against the Saudi-led coalition in Yemen. This is likely to intersect with two interrelated trends. The first of these is the emergence of increasingly powerful explosive materials such as aluminium nanofiber, which burns at twice the rate of traditional conventional explosives, resulting in smaller munitions carrying a greater explosive...

79. Fighters like the Su-30 and MiG-31K can detect the radar return from a large vessel such as an aircraft carrier from further out but can track it from distances of 200–300 km.
80. This was the Soviet approach during the later stages of the Cold War, where a pathfinder aircraft (usually maritime patrol) would cue bombers operating from beyond the range of an aircraft carrier’s combat air patrol. Today’s Russian Air Force likely lacks the numbers, both of bombers and pathfinders, to execute such an approach. See Tokarev, ‘Kamikazes’.
82. Ibid.
‘punch’. The second trend is an exponential increase in the on-board processing capacity of relatively small vehicles.\textsuperscript{84} This can enable a loitering munition to effectively designate its own targets or, in the case of more sophisticated opponents, allow them to leverage technology in the area of edge processing whereby the individual components of a UAV swarm perform a kill chain by aggregating data among themselves as opposed to sharing it with a central node.\textsuperscript{85} To be sure, these tactics would entail expending large numbers of UAVs to cover a given area for a limited period of time but, given the declining costs of UAVs, may well be deemed viable, particularly if they enable a mission kill on a high-value asset.

The aerial- and ground-based threat is joined by more traditional challenges such as SSKs which, though not new, are proliferating. Moreover, newer SSKs equipped with air independent propulsion (AIP) can operate at longer distances than their predecessors, acting as an ‘SSN for a day’.\textsuperscript{86} SSKs such as the improved Russian \textit{Kilo}-class and the Chinese \textit{Yuan}-class are equipped with long-range ASCMs such as the KH-35 and YJ-18, allowing them to engage targets such as the picket of a carrier battle group in hit and run attacks.\textsuperscript{87} These assets have longer reach than ground- and littoral-based assets, but are somewhat constrained by speed. Moreover, the ability of a submarine to cue long-range missiles at OTH distances based on its organic sensors is questionable. The use of sonar can deliver information on target-bearing and range but not its precise location. Active sonar can rectify this, but risks giving away a submarine’s position. Studies reviewing the work of Chinese authors suggest that these authors propose using offboard data sources communicating with a submarine via radio, but acknowledge that challenges regarding data latency may impede real-time cueing and, moreover, that the use of a floating wire antenna to receive transmissions increases the submarine’s chances of being detected by anti-submarine warfare (ASW) forces.\textsuperscript{88} Nonetheless, submarines can launch limited sequential attacks at the outer edge of an anti-access system. In this, they will be joined by surface vessels that can operate at reach such as the Russian \textit{Kirov}-class and \textit{Slava}-class or the Chinese Type 052D and Type 055 Cruiser which are equipped with the supersonic YJ-18 ASCM. In the case of China, the PLAN’s aircraft carriers may sortie beyond the first island chain, although at present it appears that the preferred formation for forward-edge defence is a three-ship surface action group composed of vessels such as the Type 052D destroyer and Type 054 frigate, given the limitations on China’s ability to sustain carrier groups at reach.\textsuperscript{89}

87. For a discussion of the capabilities of modern SSKs, see Kaushal and Markiewicz, ‘Crossing the River by Feeling the Stones’, pp. 54–63. For a discussion of how ASCM-equipped SSKs and SSNs can be coordinated as part of a sea-denial approach, see Godwin, ‘China’s Emerging Military Doctrine’.
89. Kaushal and Markiewicz, ‘Crossing the River by Feeling the Stones’, p. 18.
Longer-range maritime assets armed with ASCMs can complicate the sea denial problem for aircraft carriers, particularly if operating in tandem with support from local bastions. They are, however, presented with the aforementioned scouting problem. Moreover, weaknesses in areas such as ASW would create certain vulnerabilities to SSNs such as the Astute, which accompany a carrier battle group particularly for the PLAN, which views ASW as a critical vulnerability. Although capable of credible air defence, surface action groups can be rendered vulnerable to fifth-generation carrier aircraft equipped with appropriate standoff capabilities and augmented with unmanned support, which this paper explores later. As such, the threat posed by hostile blue-water assets is attenuated unless they operate under the cover of land-based air forces and ASW-optimised patrol aircraft operating either near a competitor’s domestic territory or in a fortified overseas outpost. The most effective wartime use of such assets may be operating in close coordination with ground-based assets as a seaward extension of a reconnaissance strike complex.

What are the imperatives of maritime strike forces in this operating environment? This paper makes three arguments:

1. The ability to launch the first salvo accurately and rapidly will be critical in a competition between maritime forces and ground-based reconnaissance strike networks. The latter are prone to disruption by strikes on the key nodes that enable it such as radar, data-fusion nodes and maritime vessels that hold a disproportionate portion of its throw weight. The former is vulnerable to the loss of single points of failure such as a capital ship. As such, both sides are vulnerable to irreparable disruption if an opponent successfully launches the first salvo of a competition effectively.

2. The preparation of the information environment will, in large measure, dictate who launches the first critical salvo. Counter-ISR in the cyber and EW domains prior to a major escalation and the collection and exploitation of data in peacetime will dictate who wins the competition to launch the first salvo. Intelligence ranging from HUMINT, SIGINT and ELINT will be critical to delivering early situational awareness. While none of these forms of data-gathering are new, they will now need to occur well in advance of high-intensity operations to enable a quick shift to a warfighting posture. Moreover, targeting based on predictive analysis and optimisation algorithms as opposed to direct observation will become increasingly important as navies seek to leverage strides in areas such as neural networking to conduct strikes with limited direct observation.

90. Gabriel Collins et al., ‘Chinese Evaluations of the US Navy Submarine Force’, Naval War College Review (Vol. 61, No. 1, 2008), pp. 68–86. Although the PLAN’s capacity for anti-submarine warfare has improved in the time since the publication of this source, it remains a critical weakness and one shared by Russian long-range assets.

91. Neural networks, deep learning, reinforcement learning and deep reinforcement learning represent mutually reinforcing components of a system that will enable a range of activities. At the more mundane end of the spectrum, deep learning can enable automated target classification at rapid rates. More interestingly, a combination of deep learning and reinforcement learning based on optimisation algorithms can be used to predict the likely ways in which an opponent chooses to
Given the volumes of data needed to train these systems, the data enabling this must be gathered years in advance by forward-engaged forces conducting data-gathering in non-cooperative environments as part of their routing functions.\(^9\) Equally, given that these systems can be corrupted by conscious efforts to feed poor information into them, forward forces and opponents will alter patterns of behaviour to frustrate efforts at effective training and will need to adopt technical countermeasures to identify and sort out poor data intentionally fed into a system.\(^9\) In essence, the competitive environment will see back and forth efforts to train and frustrate the training of predictive models by both parties.

3. **Maritime strike forces** operating on strategically exterior and tactically interior lines with greater reach and mobility than littoral-bound opponents supported by limited blue-water assets, have an advantage in the early stages of a clash.\(^9\) They can select the time of an engagement, confront opponents with more attack vectors and have a simpler scouting problem than opponents who need to survey vast sea spaces. They can also more readily saturate small bastions of land-based ASCMs such as Kaliningrad or Tartus with firepower simply because there is a limited space within a littoral where a ground- or sea-based sensor or shooter can move if it is to retain tactical relevance. However, sea-denial forces have two major advantages. First, blue-water forces are more expensive and less replaceable than, for example, a single transporter erector launcher (TEL). Second, the probability of a successful strike on a high-value maritime asset naturally increases as the probability of a successful scouting and striking mission increase. As such, with the passage of time, the likelihood of a sea-denial force dealing a strategically significant blow to its maritime competitor increases. In summary, either maritime strike forces win quickly or not at all. Moreover, even degraded reconnaissance strike complexes can launch a successful attack, by firing blind or on the basis of low-quality SIGINT or ELINT data.

---


\(^9\) Exterior lines converge on a single point while interior lines radiate from it. So, for example, maritime forces that can operate along Russia’s periphery are operating on strategically exterior lines. In any given clash, however, these forces can move quickly from a single point (the initial location) to multiple points on a defended coastline, making their lines tactically interior. See Antoine Henri de Jomini, *The Art of War* (Philadelphia, PA: J B Lippincott, 1862), chap. 9.
While the emphasis in this paper is on operations and not technical adaptations, it is also worth noting that a range of active defensive measures can render maritime strike forces more survivable in the future operating environment. In the short term, a cooperative engagement capability between the aircraft carriers’ picket vessels such as the Type-45 DDG and a fifth-generation combat air patrol could, for example, extend the situational awareness of both and exponentially increase the effectiveness of a CSG’s capacity for air and missile defence. In the medium term, technology such as solid state lasers can provide close-in defence against air-breathing projectiles – though they are limited by factors such as weather and the need to fire sequentially. High-power microwave systems can, similarly, provide the capacity to soft kill threats such as loitering munitions, albeit at the risk of damage to the electronics of friendly forces by high-power microwave weapons. Technology such as the railgun could be integrated onto existing vessels such as the Type-26 which have an adequate power generation capacity to provide dense close-in air and missile defence salvos. Each technological adaptation cited here – with the possible exception of a cooperative engagement capability – comes with its own risks and trade-offs and the precise contours of future carrier integrated air and missile defence pickets is beyond the remit of this paper. Nonetheless, it is worth noting that shorter-range, multiple-use systems such as directed energy weapons can augment interceptors and allow CSG commanders fallback options even if they are tracked and fired upon. Nevertheless, losing the scouting battle is still likely to be the critical factor in these competitions.

Building on these three propositions, the operational aim for maritime strike forces must be to win the battle of the first salvo at a particular point of an opponent’s strategic periphery and exploit the window of opportunity this creates to achieve strategically significant effects, whether this is the destruction of an opponent’s critical infrastructure or enabling the joint force to deliver assets into a theatre. What maritime strike forces cannot do is loiter in a theatre providing steady-state support. Their aim in a warfighting context will be to create windows of opportunity or eliminate critical military infrastructure before moving on to different targets. In effect, they will conduct multiple raids across an opponent’s periphery rather than steady-state support in one theatre. In many ways, this represents a return to form for forces competing against land-based A2/AD networks. It is often forgotten that the advent of land-based airpower saw maritime forces faced with many of the problems they face today. True, land-based airpower was slower than today’s threats, but shipboard defences against it were less mature, resulting in a roughly comparable offence–defence balance. The successful operational answer, alongside

98. See, for example, Daniel Evans and Mark Peattie, Kaigun: Strategy, Tactics and Technology in the Imperial Japanese Navy 1887–1941 (Annapolis, MD: Naval Institute Press, 1997), pp. 228–50;
the tactical effort to improve air defence, was focusing maritime power on ‘hit-and-run’ strike raids, exploiting its operational mobility. During the Battle of the Mediterranean, for example, the Royal Navy faced land-based airpower that was a precursor to the missile threat faced today. Nonetheless, raiding actions such as the strike on Taranto significantly hampered the Reggia Marina’s ability to use the freedom of action that this anti-access network provided to secure Axis shipping or hamper Allied convoys. In a similar vein, raids such as the attacks on Truk and Rabaul during war in the Pacific theatre had the effect of isolating key nodes in the Japanese anti-access system in the central Pacific and creating gaps where it could be bypassed.99

IV. The UK’s Future Maritime Strike Capabilities: Strategic Rationale, Future Concepts of Employment and Operations

The following sections outline the links between the UK’s wider national security objectives and the employment of carrier strike assets, along with a concept of operations through which carrier-enabled power projection can contribute to the wider joint force. As a strategically mobile entity with the capacity for both forward engagement and high-intensity operations, UK Strike Force can act as a peacetime enabler for the wider joint force, enabling information exploitation in tandem with other persistently forward-engaged entities such as the Army’s 6th Division and Special Forces and contributing to efforts to constrain opponents. This could also allow for the emergence of a federated model for the gathering of tactically and strategically salient information which could be integrated both organically within UK Strike Force and at a higher level by UK STRATCOM.

As competition reaches higher levels of intensity, a framework based around strategic raiding can allow carrier-enabled power projection to complement the activities of other services obliquely – drawing on shared assets such as the F-35 for discrete windows of time to conduct raiding operations which either enable or complement the activities of other services without denying the bulk of them to other missions for extended time periods. This model of operations could also enable UK Strike Force to aggregate with a variety of partner states both within a NATO context and bilaterally. In addition to traditional NATO missions, bilateral operations through the UK–France Combined Joint Expeditionary Force (CJEF), in tandem with a US Marine Expeditionary Force or, in the longer term, with LHA (helicopter carriers) and light carrier operating partners such as Japan, India and potentially Australia, could be congruent with this framework. This would enable the UK to leverage the mass provided by partners while it provided them with a niche capability – namely the ability of a carrier strike force engaged in a strategic raiding framework to create breaches in adversary networks that a partner with requisite local mass can exploit.

Strategic Objectives and Drivers for the Employment of Carrier Strike

Based on the assessment of the threat environment outlined above, this chapter lays out the key strategic imperatives that should drive the concepts of employment and CONOPs for the UK’s Maritime Strike and Carrier Strike forces. This paper proposes ‘strategic raiding’ as a framework
for the use of carrier strike. The basis for this prescription is that the UK has the following objectives\(^{100}\) to which carrier strike can be relevant:

- Maintaining conventional deterrence against Russia in Europe as part of NATO.
- Maintaining freedom of navigation at contested maritime crossroads, such as the Eastern Mediterranean, the Arctic and the Strait of Hormuz.
- Cultivating influence in critical regions such as the Indo-Pacific, both to serve its own wider economic and geostrategic interests and to contribute to balancing dynamics that will be necessary to uphold regional stability in this economically vital region.

Strategic competition with Russia will invariably draw the Royal Navy towards Russia’s extended maritime peripheries in the Black Sea and Eastern Mediterranean to the south and the Arctic to the north. This is partially due to the fact that Russia may choose to challenge freedom of access to these key maritime conduits. However, it is also because Russia's extended maritime periphery is an asymmetrical Russian vulnerability. It may become even more significant if Russia achieves its stated aim of increasing the number of overseas facilities it possesses.\(^{101}\) The ability to project power into key maritime crossroads such as the Arctic, the Eastern Mediterranean and the Strait of Hormuz will be critical both to assure maritime access and to compete effectively with peer competitors such as Russia and sub-peer challengers like Iran.

While the first two objectives are uncontroversial, the third is not. This paper presumnes that as the decade progresses, the UK’s relationship with China will combine elements of economic and geostrategic competition with collaboration in other areas. While this paper does not necessarily contend that the UK will find itself in direct military competition with China alongside the US in a region such as the South China Sea, the assumption that limited competition will become a facet of UK policy towards China is tenable for several reasons. This paper makes several assumptions in its analysis of the third objective:

- Economic interdependence tends not to override geopolitical threat perceptions indefinitely, particularly if policymakers expect future economic competition with a present-day economic partner.\(^{102}\) As China shifts from an export towards a consumption-driven economy, and seeks to compete with the developed world in the high value-added sectors, it may well become an economic competitor to states such as the UK in certain sectors.\(^{103}\)

---

100. This excludes other maritime missions such as SSBN protection and protection of critical infrastructure to which strike forces have less relevance.


• To the extent that great power competition is likely to be the orienting factor of the geopolitics of the Indo-Pacific, the UK will need some stake in the management of great power competition if it wishes to play a role in shaping the dynamics of this economically pivotal region.

• Activities such as freedom of navigation operations in the South China Sea and the maiden deployment of the UK’s carrier strike group to the region in 2021 suggest a policy desire to play a shaping role in the region.\(^{104}\)

• To the extent that the UK–US bilateral relationship remains a critical pillar of UK national security policy, any UK strategy in the Indo-Pacific will be complementary to US regional policy, if not necessarily directly entwined with it.

A final proposition that this paper makes with regard to the Indo-Pacific is that the most meaningful direct contributions that the maritime component of UK regional strategy can make are beyond the first island chain, where the UK lacks sufficient mass to operate at higher levels of intensity on its own. Rather, it is in the Indian Ocean, where proliferating Chinese strategic interests and, potentially, military commitments raise the possibility of the PLAN needing to operate at reach beyond China’s dense A2/AD network where the Royal Navy can take on burdens from the US Navy. Additionally, this represents a region where the UK can potentially coordinate with both regional partners such as India and globally engaged European partners such as France through the bilateral UK–France CJEF framework.

As such, despite being global, the Royal Navy’s maritime priorities in an era of great power competition will likely be clustered on twin arcs at the peripheries of Eurasia: the High North and Arctic at one end, with an arc running from the Black Sea and Eastern Mediterranean through the Suez Canal to the Persian Gulf and the Indian Ocean at the other. The object of maritime strategy will be to cultivate a pivotal, if not quite preponderant, presence in these twin arcs which include several regions from which the US is pivoting away. As a middle power navy, the Royal Navy cannot necessarily generate the mass to independently deliver sustained power to the doorsteps of all peer competitors. However, this is not necessarily an impediment to its use as an effective tool of statecraft, particularly in the context of the persistent limited-aims competition described in previous sections. Its ability to pressure the extended maritime interests of peer competitors can allow the Royal Navy to serve as the basis for an indirect approach to deterrence and coercion – something scholars from Corbett to B H Liddell Hart have identified as being central to the historic British way of warfare.\(^{105}\) Rather than confronting enemy strengths, naval power allows force to be concentrated against weaknesses.

In regions where it lacks the power to compete directly at high intensity, the UK can compete obliquely. For example, it has been noted that many claimant states in the South China Sea can develop daunting A2/AD networks of their own – something that could be abetted by data

---


gathered by engaged naval teams and, perhaps, efforts to develop local ISR capabilities. Alternatively, bespoke capabilities such as improvised loitering munitions based on commercial off-the-shelf (COTS) technology could be provided to regional competitors to make their coastal denial systems more robust. Similar support might conceivably be extended to partner states such as Ukraine, which is facing a hybrid blockade in the Sea of Azov.

The strategic rationale of concentrating force against weaknesses should guide the way a persistently engaged raiding force fights as a competition approaches mid to high levels of intensity. What unifies the suite of actions that can be grouped under the rubric of raiding activities at the strategic level is not necessarily the temporary insertion of forces, but rather an emphasis on time-bound disruption as a means of shaping the contours of a competition. For example, the initial Russian air and missile strikes in Syria represented a strategic raid as their aim was not to seize a well-defined objective but to disrupt the momentum of anti-Assad rebels and to shape the contours of the ongoing conflict. The subsequent Russian intervention, by contrast, departed from the raiding paradigm and more closely resembled traditional attrition-centric expeditionary warfare. As a middle power with the potential for extended strategic reach, the Royal Navy can use the raiding paradigm to achieve several key military ends including:

- Regaining the strategic initiative against peer competitors by exploiting its strategic reach to shift the locus of a competition to favourable ground. Rather than focusing exclusively on denying a continental revisionist from achieving its territorial aims on the ground, the UK can exploit its strategic reach to circumvent opponents’ strengths and target their vulnerable maritime peripheries.
- Ensuring that a post-conflict return to competition occurs on favourable terms. If, for example, a conflict initiated by Russia in the Baltics saw raids conducted against its naval facilities and power projection assets in regions such as the Eastern Mediterranean, the Arctic and the Black Sea, this would constrain Russia’s ability to shift the locus of competition to another region after the conflict. In Liddell Hart’s formulation, high-intensity military activity in persistent competition should be conducted ‘with one eye to the [competitive] peace that follows’.
- Delivering policymakers a framework to conduct low-intensity actions sufficient to achieve deterrence by punishment in competitions at lower levels of intensity and to deter subsequent escalation consistent with George’s ‘turning the screw’ framework.

• Shaping a given conflict and shifting its momentum by operational disruption so that it can be exploited by a partner with sufficient locally available mass.

The expanding maritime footprint of peer competitors, and the increasing intersection between their interests and those of allies and partners beyond their immediate regions represents a challenge. It is also an avenue for pressure to be applied to them at a time and place of a maritime power’s choosing. Take, for example, the resurgence of Russian power in the Eastern Mediterranean. On the one hand, Russia has gained significant strategic leverage from the emplacement of Bastion-P batteries in Tartus along with S-300 and S-400 missiles and the presence of Russian naval vessels such as two permanently stationed Kilo-class submarines from the Black Sea Fleet, as well as periodic visits by surface vessels. In the long term, Russia plans a permanent Mediterranean presence of 15 vessels from the Black Sea Fleet.

It is not unlikely that Russia will be able to exert influence over significant swathes of the Eastern Mediterranean.\footnote{Delanoe, ‘Russia’s Black Sea Fleet’; Paul Iddon, ‘Russia Expanding Middle East Footprint With Egypt Bases’, New Arab, 15 December 2017, <https://english.alaraby.co.uk/english/indepth/2017/12/15/russia-expanding-middle-east-footprint-with-egypt-bases>, accessed 29 September 2020.} This will be particularly true if Russia does secure access to a permanent air or naval facility in Egypt. However, these assets represent the basis for significant national prestige and are defended by a less dense A2/AD network than the Russian mainland. In a context where Russia mounted a limited-aims operation to challenge NATO credibility in the Baltics, the threat of a limited-aims raid to disrupt these symbolically valuable targets might offset the psychological value of the limited gains Russia could hope to make on the ground. In the context of conflicts in which prestige as opposed to the tangible value of ground is the object at stake, the risk of symbolic costs can be significant.\footnote{On the outsized importance placed by countries on symbolic but materially peripheral commitments in great power politics when prestige is the object, see Jonathan Renshon, Fighting for Status: Hierarchy and Conflict in International Politics (Princeton, NJ: Princeton University Press, 2017).} This is particularly true given the fact that the value of Russia’s Mediterranean assets may well be more than symbolic in competitions short of war – a phase for which Russian planning envisions an eventual return in any conflict it plans.

In a similar vein, although China’s growing network of dual-use facilities along the ‘maritime Silk Road’ that serve as ‘places rather than bases’ are currently used for non-military purposes, this could change as the PLAN adds SLOC contestation to its list of missions.\footnote{Leah Dreyfuss and Mara Karlin, ‘All That Xi Wants: China Aims to Ace Bases Overseas’, Brookings Institute, September 2019.} SLOC contestation, a sub-concept of the PLA’s concept of forward-edge defence, could conceivably see the PLAN deploy a component of its force beyond the first island chain in areas such as the Indian Ocean.
as a fleet in being in order to alter the deployment patterns of extra-regional states such as the US and India in peacetime and, potentially, slow the pace at which the US can redeploy forces to the first island chain. As the recent harassment of US pilots by PLA forces from Djibouti using lasers has shown, this need not involve lethal kinetic action but could consist of sub-threshold activities to introduce friction into the movement of an opponents’ forces.\textsuperscript{114} In principle, one could envision China following the Russian example and placing A2/AD capabilities such as the YJ-18 ASCM in overseas outposts as it has on its artificial islands in the South China Sea, enabling forces at these outposts to engage in limited kinetic action, especially if backed by PLAN vessels.\textsuperscript{115} Yet, overseas outposts represent a liability, particularly if host nations see the presence of the PLA as bringing unwanted attention to their territory in peacetime. Probing, sub-threshold activities in peacetime might represent a way to respond obliquely to PLA provocations in the seas near China, while in conflict scenarios neutralising the military potential of such outposts may represent a means of both horizontal escalation and shaping the future conflict environment. Given the risks of operating within the first island chain, a middle power navy might best contribute to deterrence in maritime East Asia by developing a position astride these outposts.

In situations short of outright conflict involving low-intensity direct competition, peripheral raiding can take the form of limited-aims kinetic action or visible non-kinetic action, such as counter-ISR activity. Scalable force packages generated from a carrier strike force, backed by a carrier operating OTH to control escalation by deterring vertical escalation can serve a number of ends. They can allow a state to send a ‘costly signal’ regarding its resolve – a step which, though (implausibly) deniable and limited in scope, nonetheless involves a significant commitment and risk. Alternatively, such smaller-scale raids may have a more limited objective of target balancing: eliminating key capabilities that are deemed of particular interest.\textsuperscript{116} For example, Israeli raids on shipments of advanced technology to Syria follow a target balancing model – their objective being not to destroy Hizbullah’s capabilities but deny it those which are deemed particularly threatening. For example, should Russia obtain a base in Egypt, a limited raid against any ASCM batteries placed there would represent target balancing. It would not deny Russia the base but would constrain the ways in which it could be used. Alternatively, policymakers might choose to respond obliquely to an escalation short of war in Eastern Europe with a strike on nominally Syrian Russian-manned ASCM batteries. This matches the deniability of Russian actions inasmuch as the assets targeted are, nominally, not Russian. Of course, these hypotheticals are policy dependent. These scenarios are worthy of consideration, however, because of a tendency towards low-intensity direct competition. Typically, this would involve the use of force in a manner sufficiently deniable to allow an opponent to save face and limit escalation (though the provenance of an attack is usually known) coupled with the presence of OTH of a heavier force to act as a damper on further escalation. Russia’s use of both proxies and unbadged forces in Ukraine while heavier ground forces conducted snap exercises on Russia’s

\textsuperscript{115} Poling, ‘The Conventional Wisdom on China’s Island Bases is Dangerously Wrong’.
side of the border represents an example of this in the land domain. In the maritime domain, one might envision a carrier group generating a small strike package using a surface action group or a single four-ship air sortie operating from outside the theatre with air-to-air refuelling, while the CSG as a whole loitered beyond the edge of the theatre to deter counter-escalation without a large publicly visible regional presence.

In addition to peripheral pressure, a strategic raiding posture can contribute to high-intensity direct great power competition in theatres a competitor deems more directly vital, albeit at higher levels of risk. Consider, for example, the case of the Black Sea and the Arctic as theatres of interest for Russia. Both theatres have seen the construction of expensive military facilities and contain Murmansk and Sevastopol, home to the Northern and Black Sea Fleets respectively. While sustained power projection against these targets is likely to be risky, short, sharp pulses of force to target particularly important strategic assets are more viable, albeit with coalition support. In the Arctic, should NATO planning allow it, a short strike raid targeting surface vessels such as the Northern Fleet’s *Udaloy* ASW destroyers could well force Russian SSNs to be pulled back from efforts to break into the Atlantic to fill an ASW gap to defend Russia’s SSBNs. This would significantly ease the ASW problem at the Greenland–Iceland–UK (GIUK) gap. Short raids against the Northern Fleets’ other surface vessels and Arctic military infrastructure such as floating docks and airfields could constrain the Fleet’s ability to target ASW assets in the GIUK gap or to launch land-attack missiles against fixed infrastructure in Europe. A Northern Fleet put on the defensive could less readily hamper allied SLOCs in the Atlantic and the need to defend military infrastructure in the North would draw on resources such as air defence systems that Russia might otherwise use elsewhere in support of ground forces. Moreover, limited raids against the Russian mainland would pose a strategic dilemma. They are escalatory as they challenge the notion that mainland Russia is inviolable but not sufficiently escalatory to justify a massive response which would invite retaliation in kind. In effect, such raids can invert the challenge of risk manipulation currently faced by Western policymakers in the face of provocative actions that are limited in scope and scale. After a clash, this would also hamper the Northern Fleet’s capacity to play a future competitive role either in the High North or in support of expeditionary operations once both parties switched postures to lower-intensity competition.

Similarly, targeted raids launched from the Eastern Mediterranean against naval facilities such as Sevastopol with limited numbers of manned aircraft relying on aerial refuelling and the extensive use of long-range attritable UCAVs could well damage both expensive vessels and critical infrastructure that is difficult to replace and, most importantly, prestige in a competition

Persistent Engagement and Strategic Raiding

to cultivate it and erode that of an opponent.¹¹⁹ The fact that maritime raiding forces can be withdrawn from a theatre rapidly allows a state to limit the possibility that a raid is mistaken for a precursor to a larger-scale attack and gives the target state time for pause to recalibrate its policies. In essence, the challenge of limiting conflict can be matched by calibrated escalation on ground that an opponent has not prepared so as to force the UK to either accept vertical escalation or accede.

Raiding as a posture could also serve the direct end of rolling back a less sophisticated anti-access system, like Iran’s, should a regional conflict escalate. The Iranian A2/AD network in the Persian Gulf relies on a combination of ground-based ASCMs, small boats equipped with long-range missiles, such as the Chinese Houjian-class which can also serve as minelayers, midget submarines and, increasingly, UAVs. The second layer of defence, manned by the Iranian navy, seeks to contest the Gulf of Oman using Iran’s two operationally available Kilo-class submarines.¹²⁰

While certain components of this force, such as ground-based radar, are vulnerable to traditional strike missions, others are far more dispersed and numerous. For example, ground-based TELs (transporter erector launchers) launching cruise missiles can be cued in the absence of radar using organic UAVs and ELINT data. This means that these dispersed assets may well need to be neutralised individually. Similarly, Iran’s submarines are well defended in underground shelters in bases such as Qeshm.¹²¹ Raids involving company-sized force packages backed by carrier strike assets from further afield conducted on a simultaneous basis across a theatre may well be necessary to neutralise hardened assets on redoubts such as Qeshm and Abu Musa. Amphibious forces will be critical to targeting hardened sites directly and neutralising them from within using assets such as charges and can cue strike aircraft in against fleeting or well-disguised targets.¹²² As the German assault on Fort Eben-Emael illustrated (albeit in a land context), relatively small units capable of rapid and discrete insertion and equipped with charges can neutralise hardened sites from within if given adequate air support.¹²³

¹²². An example, albeit from the land domain, of the need to destroy hardened sites from within would be the Israeli campaign against Hizbullah’s tunnel network as part of Operation Northern Shield. See, for example, Yaacov Ayish, ‘The Underground Arms Race in the Middle East’, RealClearWorld, 11 July 2019, <https://www.realclearworld.com/articles/2019/06/11/the_underground_arms_race_in_the_middle_east_113036.html>, accessed 24 August 2020; author remote interview with UK subject matter expert (SME), 12 July 2020.
Such forces will, however, require carrier strike support to effect theatre entry, with the role of supporting and supported force shifting over the course of a raid. While the UK likely lacks the mass to perform theatre-wide raids on a simultaneous basis, it could add niche capabilities to a force such as a US Marine Expeditionary Force performing this task. The US will increasingly rely on LHAs such as the *America*-class in regions such as the Persian Gulf as US supercarriers are drawn towards East Asia. While capable of carrying F-35Bs on board, these platforms have very low sortie rates, taking up to an hour to get the aircraft needed for a sortie in the air.\(^\text{124}\)

There exists room for synergies between a CSG capable of generating greater sortie rates than a lightning carrier and an amphibious-ready group. For example, if sorties were flown from a UK carrier, the deck of an LHA could be reserved for the Osprey for troop insertion at range. Alternatively, a raiding concept might see carrier strike and littoral strike forces play a role in creating temporary gaps in local A2/AD capabilities for marine companies launched from LHAs to insert themselves into holdouts such as Qeshm to root out targets like TELs. Moreover, a redesigned commando force could provide a light forward-engaged capability supporting US Marine Corps forces capable of supplying mass.\(^\text{125}\) Forward-deployed littoral strike companies conducting counter-ISR activities and designating key targets could open the door for strikes from aircraft carriers against key targets such as SAM batteries, in turn allowing larger units to be delivered into theatre using vertical lift assets to hold ground for limited periods – either to disrupt local military infrastructure or to hold it as a bargaining chip. The ability to mount simultaneous raids across the theatre as opposed to providing a steady rate of strike power could allow strike forces to act as a breaching force for a partner with mass.

In the context of indirect competitions, carrier strike forces can play a more kinetic supporting role for proxies and partners in indirect competitions – similar to what Turkish and Russian forces are doing for their respective partners in Libya. Maritime forces, as an offshore asset, are relatively easy to insert and withdraw from a theatre, which serves the end of limited-aims warfare. Depending on the level of deniability desired, it may be deemed necessary to operate from significant reach. This could be facilitated by the use of organic tankers, which is explored later in the paper.

Alternatively, for operations at the lower end of the spectrum, it might be deemed valuable to either detach SAGs from the CSGs to provide limited strike options in support of partners on the ground. For actions such as the provision of close air support to partners, a platform cheaper than the F-35\(^\text{126}\) might be used, with the future air wing resembling what Elmo Zumwalt referred to as a ‘high–low mix’.\(^\text{127}\) Given that the cost of an unmanned asset such as the XQ-58

---

125. Author remote interview with UK SME, 12 July 2020.
126. Such as a relatively cheap UCAV built along the lines of the Kratos QX-58 Valkyrie or the Chinese GJ-11, or even a tactical UAS such as the Turkish Bayraktar.
is in the range of several million dollars, around 40 such assets can be purchased for the cost of an F-35.\footnote{128} Indeed, for certain operations involving a particularly low footprint, the purchase of bespoke off-the-shelf technology such as UAVs on a needs basis may be desirable.\footnote{129}
V. Concepts of Operations and Key Lines of Development

This paper now considers how the imperatives guiding the employment of carrier strike forces outlined above can be translated into well-defined military lines of effort. CONOPS geared towards delivering the strategic raiding framework outlined above would rely on several doctrinal tenets including:

- Geographically dispersed strike groups capable of aggregating at speed.
- Shaping operations and low-intensity strikes at short notice from the edge of the threat envelope.
- Portions of the force taking part in long periods of forward engagement to enable the conduct of short, high-intensity pulses before re-competing.
- Conceptual and structural integration between littoral and carrier strike.

While the threats to carrier strike assets emanating from land- and littoral-based anti-access capabilities are manageable at this point in most contexts, they remain real and are likely to become more significant as time progresses. Developments such as rapid data fusion and the proliferation of space-based ISR assets to a range of actors, including commercial firms, will in all likelihood improve the ability of both peer and sub-peer competitors to carry out maritime strikes using land-based anti-access capabilities.\(^\text{130}\) Moreover, the risk that CSGs absorb the bulk of a navy’s capacity for self-defence raises the prospect that the cost of their defence outweighs the value they add.

This being said, a concept of operations built to deliver persistent presence and strategic raiding can alleviate many of these challenges. Under this rubric, UK CSGs would, in peacetime, be disaggregated into SAGs of two to three vessels in formations that might, for example, be comprised of a DDG and two FFGs. The purpose of these scalable units would be to operate in tandem with forward-positioned littoral strike groups to serve in both cooperative roles with regional partners and the low-intensity strategic aim of applying low-intensity pressure in circumstances short of conflict and contributing to early efforts to constrain an opponent’s freedom of action should a crisis escalate. Vessels such as the Type-26, which can hold platforms such as smaller USVs (unmanned surface vehicles) in their mission bays, could contribute to littoral containment operations by deploying relatively cheap unmanned systems in EW roles.\(^\text{131}\) Alternatively, the mission bay could hold container (CONEX) boxes from which a range of both loitering munitions and long-range strike assets can be dispersed on friendly shores. Distributed, cheap assets can be used by littoral strike units in tandem with the counter-ISR capabilities

\(^{130}\) Author remote interview with US Navy SME, 12 July 2020.
Currently being developed to introduce uncertainty into an opponent’s decision-making cycle and provide early shaping fires in a limited, low-intensity kinetic clash.

Perhaps most importantly, however, forward-engaged forces will have a data-gathering and counter-ISR role. The ability to conduct raids successfully has historically depended on situational awareness to facilitate decision-making on a compressed time-cycle. This will be all the more important given the importance of winning the first salvo in contested environments. Today, a range of tools including data fusion on unprecedented scales and predictive algorithms are making it increasingly viable to conduct targeting operations without recourse to persistent direct observation.\(^{132}\) This can, in turn, enable targeting decisions to be made by using available data to set the parameters for an AI-based system to identify likely target locations based on limited information using pattern recognition. Even if permissions for strikes still require direct observation, such systems can narrow search parameters significantly.\(^{133}\) Training such systems, however, requires substantial volumes of data, much of which will be gathered in peacetime. Forward engagement at low intensity, whether in cooperative or non-cooperative environments, and the generation of high-intensity force pulses in kinetic conflict thus operates in a feedback loop with each enabling the other. This represents a novel but important role for the F-35.

As a system with an unparalleled capacity for data-gathering and the ability to operate ‘alone and unafraid’ in constrained environments, the F-35 can be used in peacetime to gather the volumes of data needed to train targeting systems.\(^{134}\) This would, however, require a politically risk-tolerant approach to the use of the carrier air wing as a forward-deployed intelligence asset in peacetime. Equally, this might require a system of classification access that allowed highly classified data such as the information from an F-35 to be scrubbed for particularly sensitive information and its key findings presented in a format compatible with a common classification scheme. This is in principle achievable, particularly if data from higher levels of classification was presented in terms of findings rather than processes.\(^{135}\) In effect, then, rather than remaining dormant in peacetime, a carrier air wing could be deployed in small packages to support the aim of forward engagement either as an ISR node or to provide limited strike packages to UK Strike Force and littoral strike teams without the carrier group having to redeploy as a unit.

If their range was extended by air-to-air refuelling, F-35s operating from carriers could discretely enter a theatre from a carrier loitering at range to contribute to low-intensity activity. The aircraft could, for example, support EW operations in the greyzone using its on-board AN-APG81 radar’s electronic attack capabilities. This would force opponents to either escalate the scope and scale of their activity or back down from limited provocations. Alternatively, they could

\(^{132}\) This has been theoretically understood for decades. See, for example, Bradley G Boone et al., ‘New Directions in Missile Guidance Signal Processing Based on Neural Networks and Fractal Modeling’, \textit{Johns Hopkins APL Technical Digest} (Vol. 11, No. 1–2, 1990), pp. 28–35.
\(^{135}\) Author remote interview with UK Navy SME, 27 July 2020.
conduct targeted quasi-deniable strikes, either for disruptive effects short of high-intensity conflict or to prepare the theatre should further escalation occur.

As a crisis escalates, the carrier and the dispersed components of its strike group could aggregate to deploy larger strike packages. Current Royal Navy planning assumptions involve the aircraft carrier providing six days of high-intensity air operations, followed by roughly 30 days of steady-state support at moderate intensity.\textsuperscript{136} Within the rubric of a strategic raiding CONOPS, this balance might shift to increase the number of high-intensity operations and decrease the level of steady-state support offered to forces in theatre. Instead of being an offshore airbase, carrier strike would emphasise providing a short, sharp pulse of activity before the carrier is withdrawn from a theatre, either to exploit its strategic mobility by conducting a raid elsewhere on an opponent’s maritime periphery, following a sufficient pause, or to withdraw from the threat envelope and leave the exploitation of its breaching actions to legacy forces such as UK and allied forces fielding fourth generation aircraft. The advantage of a pulse of activity is twofold: it would limit the time an aircraft carrier spends within an opponent’s threat envelope; and it would render carrier operations more consistent with the imperative to switch rapidly between war-fighting and competitive postures. Rather than providing steady-state support to a force ashore, aircraft carriers could surge in and out of the threat envelope of an opponent’s A2/AD network in multiple short cycles. This would have the effect of shortening the 12-hour operating cycle of the carrier air wing to account for the time taken to transit in and out of the threat envelope.

This shortening, however, could be compensated for in two ways: the generation of larger eight-ship sorties; and a higher operating tempo built on the presumption of, at an upper limit, 10–15 days of high-intensity activity as opposed to 36 days of high-to-moderate levels of activity.\textsuperscript{137} This tempo will likely wear on both pilots and deck crew and will not be sustainable in the longer term due to human limitations. However, in the strategic and operational environment described in this paper, the latter aim may not be paramount. Second, as examined in the next chapter, augmenting the F-35B with low-cost UCAVs built along the lines of the Kratos XQ-58 Valkyrie could significantly increase the number of aim-points that could be targeted in a single sortie. Moreover, the long ranges of UCAVs such as the Valkyrie (which can fly a 2,000-km combat radius) could allow them to be cued in by F-35s using, for example, Link 16. If the task of the F-35 was using its on-board SAR to identify targets, it would have the effect of shortening the flight an F-35 pilot has to make. UCAVs could also serve deep strike missions autonomously using on-board sensors if policy allows. Finally, littoral strike elements could contribute to the generation of fires from closer-in using long-range UAVs and loitering munitions. Given the strategic reach of the CSG, and the potential presence of two forward-engaged littoral strike forces at multiple points simultaneously in a direct and high-intensity great power clash, this could be repeated at some other point on the competitor’s extended periphery.

\textsuperscript{136} Author remote Interview with UK Navy SME, 20 July 2020.
\textsuperscript{137} Of which six are assumed to be high intensity and 30 moderate. Author remote interview with UK Navy SME, 20 July 2020.
VI. Lines of Effort to Deliver a Concept of Operations for Persistent Competition

This chapter will seek to identify the key lines of effort which will be critical to delivering a future raiding CONOPS. This does not represent an exhaustive list of Royal Navy priorities but rather those central to strategic raiding. Lines of effort such as the fielding of an airborne early-warning capability in the form of Crowsnest and fleet sustainment, though critical to the future CSG’s ability to operate, are not examined.

Scalable Forward-Engaged Formations

As outlined earlier in the paper, the Royal Navy will find itself committed to multiple ongoing competitions, many of which will be below the threshold of direct high-intensity conflict across multiple regions. Assuming that by the mid-2020s two carrier groups can be held at very high readiness and high readiness respectively, the Navy can expect to maintain a presence across multiple theatres. 138

However, the high-value assets such as the Type-45 and Type-26 that constitute part of a CSG are likely to be less useful tied to the carrier in circumstances short of direct, high-intensity conflict. Additionally, an entire carrier group is too visible an asset to deploy into a theatre at acceptable political risk in circumstances involving either indirect competition or direct, limited-aims competition. The size and expense of such a force renders its presence within a theatre a direct and visible challenge to an opponent, which could be useful for deterrent signalling but less so for low-intensity operations. An alternative model would see the carrier’s escorts detached from the CSG to form small SAGs of a single FF and DD.

SAGs can interact with forward-engaged littoral engagement forces and provide them with the organic strike and defensive capabilities that they lack. For example, a forward-deployed Type-45 destroyer could provide theatre air and missile defence to commando teams operating from a littoral strike ship or, alternatively, enable the coast guard and maritime irregular forces of a partner state to take a more assertive stance against greyzone aggression by protecting greyzone aggression by protecting

---

138. An aircraft carrier at very high readiness can be mobilised to a theatre in five days, while a carrier at high readiness will require a longer mobilisation time. Author remote interview with UK Navy SME, 20 July 2020.
them against limited kinetic strikes. Alternatively, the Type-26, which will hold a MK41 vertical launch system (VLS) that can launch Tomahawks, could provide forward-deployed special forces with limited strike capabilities. This could prove useful in a key point strike against a specific target either for declaratory signalling purposes or to deny an opponent a scarce asset. The VLS capacity of small SAGs can be padded out by using the mission bays of vessels such as the Type-26 to hold either CONEX-launched munitions or UUVs capable of launching short-range standoff munitions. These assets could be off-boarded in friendly territory with launch orders being delivered by a range of methods such as burst communications using high-frequency radio. Larger USVs such as the US Navy’s planned XLUSV or the USVX concept vessel proposed by BAE in 2007 could also augment SAGs serving as floating VLS launchers cued by a DDG.

In circumstances short of full-scale warfare, these assets could serve an competitive function, serving as a convening point and source of niche data that could be shared with regional human assets and could also play a constraining function and enable limited competitive action in support of littoral strike forces and partner forces. In effect, these vessels could act as forward-engaged stations for assets from across the joint force to conduct peacetime competition. As a conflict escalates, these vessels could expend their offensive VLS capacity to support littoral strike efforts at disruption before leaving the theatre to join the carrier as part of a battle group. Aircraft carriers themselves could, within this rubric, loiter well beyond the edge of a theatre and the threat range of adversary strike but could launch small sorties in the constraining phase of operations.

While an aircraft carrier operating around 1,200 km from the theatre would be well beyond the operating range of the F-35B, it could extend its range either by accessing a bare-bones forward-arming and refuelling point (FARP) set up on friendly soil, relying on tanker refuelling or landing on the deck of an allied asset in theatre such as an American LHA, as opposed to returning to the carrier directly. While large sorties could not be generated at this reach, smaller sorties in support of persistent competition could. The stealth of the aircraft, coupled with the putative distance of the launch platform from the theatre, could render this a valuable asset for the quasi-deniable kinetic activities that characterise persistent competition. This would be particularly true if in the future use could be made of a relatively stealthy unmanned tanker along the lines of an MQ-25. Of course, the former is F-35C optimised, but a variant of the platform compatible with the F-35B has been floated by the US Marine Corps (USMC) Commandant General David H Berger and could be an area for joint capability development. Tanker refuelling would represent a bottleneck in sortie generation rates, and would entail a reliance on non-organic assets either from across the joint force or from allies, but this might

139. Discussion of CONEX munitions and padding VLS capacity derived from remote interview with US Marine Corps (USMC) SME, 10 July 2020.
not be an excessively restrictive factor in sub-threshold competition where the scale and pace of operations is limited. The rationale for relying on a sovereign asset to mount sensitive operations in the competitive space would remain, with the use of aircraft carriers limiting the need for access to allied bases and overflight rights.

As a competition escalated, the aircraft carrier could join its escorts to aggregate into a CSG at the edge of the threat envelope which, for the foreseeable future, should be roughly 800 km from hostile shores in a scenario involving a peer competitor such as Russia and potentially closer in a scenario involving a sub-peer competitor such as Iran. Rather than sustained strike ashore, the CSG could sortie into this threat envelope to generate high-tempo pulses of force on shorter operating cycles. Given the limitations of high-resolution, shore-based OTH systems such as the Monolit-B, which have maximum tracking ranges of 120 km depending on their elevation, systems such as the Bastion-P and littoral-oriented vessels would likely have to rely on sources such as MALE UAVs to spot aircraft carriers beyond this range. Given the limitations of the areas these assets can scan, their chances of spotting a manoeuvring asset and conveying targeting data to a shooter beyond ranges of 250 km from the shore are limited, but grow with time as the odds of a successful contact increase with the time a carrier spends in the threat envelope.\textsuperscript{142} Surging into the threat envelope in short bursts exacerbates this problem further by limiting the amount of time the carrier spends within the range of a shooter which can be cued from these sources. Offsetting this is the fact that the number of sorties generated, even assuming a higher tempo of operations, will be restricted. However, in the context of a strategic raiding framework, the criterion for success need not be exclusively based on sorties generated. Rather, maximising the number of offensive munitions that can be placed on target in a short period is the primary variable of interest, with sorties a proxy for this end. The number of offensive munitions on a given target set can be maximised in several ways. First, reliance on smaller short-range standoff munitions that can be carried in large numbers can achieve this end. Larger eight-ship waves capable of delivering, as an illustrative example, roughly 48 Spear-3 or an equivalent payload weight per wave (based on the F-35’s internal payload capacity in stealth mode) could compensate for the limited time spent in striking range. Moreover, the firepower delivered in a given sortie could be significantly increased by teaming manned aircraft with low-cost unmanned vehicles such as the XQ-58. Relatively compact UAVs such as the XQ-58, which has been containerised, can fit on an aircraft carrier’s flight deck in larger numbers than strike aircraft. Each XQ-58 can add another 500 kg of ordinance to a sortie.\textsuperscript{143} UCAVs could also act as attritable spotters, communicating targeting data for F-35s operating from outside the missile engagement zone of an integrated air defence system (IADS). This could potentially enable the F-35Bs to mount longer-range standoff munitions such as the JSOW-ER externally if required, with stealth being less of a concern if operating outside the IADS threat envelope. Certainly, the

\textsuperscript{142} Dalsjö, Berglund and Jonsson, \textit{Bursting the Bubble}, pp. 26–32.


The cost of this platform, at $1–2 million, is comparable to a Tomahawk missile and significantly lower than most manned aircraft.
recovery of attritable UCAVs (assuming they are to be recovered) poses technical challenges if conducted at sea, but these challenges are not insurmountable. The XQ-58, for example, uses a rocket-assisted launch and parachute-assisted recovery system. It could potentially be recovered with a combination of parachute-assisted landing and recovery by helicopter as the US Navy did with the lightning-bug UAS in the early days of its service and continues to do with certain target UAVs.\textsuperscript{144}

This would entail shorter but more intense operating cycles over a period of several days, resulting in higher rates of both munitions expenditure and crew exhaustion, but this would be offset by shorter bursts of activity followed by periods of rest as a strike group moved to a different target. In particular, deck crews will likely be particularly heavily worked by high-tempo operations. This said, the effects of exhaustion are cumulative, and may not be apparent in short raids.\textsuperscript{145} In essence, rather than delivering a steady drumbeat of strike operations through the course of a conflict, the operating concept envisioned would see carriers generate short, sharp bursts of strike capability along an opponent’s periphery in the context of escalating great power competition. This, in turn, could enable CSGs to shift back to a competitive posture in the post-conflict environment on favourable terms.

**Surface Strike and Standoff**

Delivering this concept of operations would require a greater emphasis on sea-control missions both during the constrain phase of a competition and as it escalated to direct conflict. In the competitive phases of a competition in which the objective would be to constrain as opposed to destroy or disable hostile littoral vessels within 200 km of the shoreline as well as coastal ASCM batteries, forward-positioned littoral strike units backed by SAGs could conduct a number of activities ranging from offensive mining and counter-ISR through to early surface strike to disrupt an opponent’s anti-access system, although this effect is likely to be transient. Accomplishing this will require investments in cheap mid-range strike assets such as loitering munitions and would require some form of maritime or surface strike capability to be integrated into the launch cells of the Type-26, Type-31 and potentially the Type-45 destroyer. Anti-ship capable Block V variants of the Tomahawk land attack missile, a dual-use missile comparable to the SCALP Naval which can be launched from a Sylver VLS, or the LRASM, which can potentially serve both anti-ship and land attack roles and can be launched from the MK-41 VLS that will be held on the Type-26 and can be held on the Type-45 represent examples of the type of capability either in existence or being developed which might fit this role.\textsuperscript{146}

\begin{itemize}
  \item \textsuperscript{145} Based on author conversation with Royal Navy SME.
\end{itemize}
Carrier-strike capabilities themselves will likely need to hit dynamic maritime targets in the first waves of strikes launched to eliminate the outer layer of an opponent’s anti-access system. An anti-ship variant of the Spear-3 might allow smaller vessels to be sunk and could potentially achieve a mission kill against larger vessels through the targeting of key equipment such as a vessel’s organic radar.\(^{147}\) The stealth of the F-35 and its organic ISR capabilities could allow it to target well-defended vessels with large numbers of shorter-range standoff munitions such as the Spear-3 in order to saturate their less-emphasised short-range defences. As mentioned earlier, attritable UAVs could be used as strike assets if cued by forward-positioned F-35s. Candidates for such a role might include a UCAV along the lines of an XQ-58 or, potentially, a heavier asset. Given that carrier-launched UAVs such as the PLAN’s carrier based GJ-11 are expected to be able to carry roughly 4,000 pounds of munitions, a similar UCAV could carry the weight of four NSM missiles or two LRASMs.\(^ {148}\) Unmanned assets such as the XQ-58 can be launched from the carrier deck with few modifications using a containerised launch system but very heavy UAS in the weight class of the GJ-11 would still likely require catapult launching. It is also worth considering the possibility of developing low-cost UCAVs capable of VTOL operations along the lines of the USMC-planned MUX UAV which could be interoperable across carrier strike and littoral strike forces.\(^ {149}\)

These options notwithstanding, the most immediately viable means by which the range and firepower of the carrier air wing can be immediately enhanced remains the introduction of long-range unmanned assets such as the XQ-58 that can be fielded in large numbers and procured at low costs. Of course, low unit procurement costs of $2–3 million for a platform like the XQ-58 do not convey the entirety of the programme cost of integrating new systems. However, the fact that such solutions are optimised to be rapidly integrated with and launched from a variety of platforms, including modified civilian vessels, and use mobile containerised launchers, would suggest that the costs of systems integration with the *Queen Elizabeth*-class (QEC) are not necessarily exorbitant. In the longer term, a CATOBAR conversion would enable heavier unmanned assets to be integrated onto the QEC.

Another promising avenue for future development would be leveraging the opportunities afforded by the ‘fourth industrial revolution’ and the emergence of low-cost expendable UAVs as a means of disrupting an opposing system of systems. Studies by RAND have established the technical viability of producing swarms of attritable UAVs, such as the platforms pursued under the L-CAAT programme (low-cost attritable aerial technology) capable of blanketing an area 100 km wide at intervals of 5 km at roughly 1,000 nautical miles from the launch area. The price of this swarm – comprised of assets comparable to but smaller than the XQ-58 – was relatively


\(^ {148}\) Whether such UCAVs can be launched from a STOVL (short take-off and vertical landing) aircraft carrier is the subject of further research, though in principle there is little reason they should not be with barrier recover and, in the medium term, with arresting gear.

\(^ {149}\) Author remote conversation with UK Navy SME, 12 July 2020.
modest at $300 million, comparable to three fifth-generation fighters.\textsuperscript{150} RAND assumed a relatively sophisticated mesh network linking these UAVs using millimetre wave radios, and assumed a desire to recover most of them following a strike mission.

It is worth considering, however, that certain functions could be performed by even cheaper systems based on COTS technology and used as expendable assets. If equipped with multispectral sensors and dispatched towards a kill box on a fixed trajectory, jamming would be less of an issue for these assets as they would rely on on-board systems for navigation and targeting.\textsuperscript{151} Candidate platforms might include swarms of a relatively cheap UAV built along the lines of the Banshee targeting drone which can fire a Mach-2 missile, with the proviso that any candidate UAV would need to operate at longer ranges than the 100 km radius of the Banshee. Commercial UAVs such as the Aerovel Flexrotor and the DX-3, which have costs in the range of $200,000–300,000 – comparable to the Excalibur guided shell launched from an M777 – have demonstrated the ability to operate at ranges of up to 1,500 km with payloads of around 3 kg. While their payloads are insufficient for strike missions, such assets could theoretically support strike missions by acting as jammers, decoys or surveillance assets. Despite their limited capacity, they could also potentially carry explosive payloads to target fragile points of failure such as the fire control radar of a SAM or coastal defence system. Recovery of these assets, when desired, could be achieved relatively easily. Some of them, like the DX-3, are configured to act as VTOL UAVs but they could also be recovered with a net as many navies already do with lightweight surveillance UAVs.\textsuperscript{152} Of course, this speaks to the physical requirements of launch and recovery and not the total costs of training crews to recover assets and other costs that accompany the integration of any system.

Alternatively, the fact that many COTS systems are designed to be launched from a variety of platforms raises the possibility of launching low-cost UAVs with emitters from auxiliary vessels such as converted civilian vessels or fleet auxiliaries to act as decoys against long-range OTH radar such as the Kontainer system. Such radar can provide rough estimates of a carrier’s location to other assets by tracking flight operations but lack the resolution to discriminate between vessels that can be identified as being of interest by their rough size and nearby flight activity.\textsuperscript{153} VTOL UAVs such as the ALTI Ascend could theoretically be equipped with emitters

\begin{footnotes}
\item[151.] Author remote interview with USMC SME, 10 July 2020.
\item[152.] Erikkson and Ringman, ‘Launch and Recovery Systems for Unmanned Vehicles Onboard Ships’.
\end{footnotes}
and launched from an auxiliary vessel. At unit costs of $35,000, modified versions of such platforms could be used to spoof OTH radar at a limited cost.

Commercial technology is, however, no silver bullet. COTS UAVs will have higher rates of failure due to factors such as climatic conditions and would doubtless suffer from poor coordination but could also be mobilised from a flight deck in larger numbers and deemed more expendable precisely because of their low costs. In the final instance, should an objective be met, a degree of wastage may be deemed an acceptable cost for missions such as jamming or the temporary disruption of activity ashore. Such assets, if equipped with jammers or explosively formed penetrators, could prove instrumental to disrupting the IADS and sea-denial capabilities in small enclaves such as Kaliningrad and Tartus and enable and augment air strikes. As such, commercial technology can support a raiding CONOPS by supporting missions such as jamming, spoofing and, if expended in large numbers, long-range strike.

All the options cited will require further study with respect to the programme costs of training and systems integration which likely exceed unit costs. Moreover, technology such as COTS systems may fall well below the standards expected of military procurement. This raises the question of whether, in order to integrate expendable assets en masse, these assets may need to be modified, or if standards may be relaxed with respect to specific categories of equipment that are used with the expectation that they will probably be expended (albeit at relatively low cost). Should this not be viable, more costly networked systems comparable to those sought under the L-CAAT programme should be pursued. These questions are a subject for further research.

The major preliminary finding of this paper, however, is that the mass delivered by the carrier air wing in a short timespan, as well as its versatility, can be significantly expanded through the integration of a number of platforms ranging from the XQ-58 to lower-cost UAVs which can be integrated with the QEC without significant structural modifications and at low unit costs. In the longer term, heavier, more sophisticated unmanned assets could further extend both the reach and the firepower of the carrier air wing should a CATOBAR adaptation be sought.

The options laid out above would extend the carrier air wings’ reach in a number of ways. First, the addition of a standoff surface strike capability to both the carrier air wing and picket vessels would allow the CSGs to strike at surface and littoral targets from longer ranges. Standoff munitions such as the Spear-3 and JSOW-ER can extend the reach of the F-35 by up to 130 km and 500 km respectively, while a long-range VLS missile comparable to the LRASM could allow surface strike missions and deep strikes into hostile territory against key nodes at ranges over 1,000 km, although targeting at these ranges may well depend on off-board data and the availability of a cooperative engagement capability. Manned–unmanned teaming could have a similar effect. F-35s acting as sensors for unmanned assets with long ranges could operate at ranges of up to 200 km from targets using their on-board SAR in order to cue in unmanned

---

154. The ALTI Ascend was built to be launched without a runway and is currently used in a civilian context for terrain mapping. See ALTI, ‘Ascend’, <https://www.altius.com/> , accessed 5 September 2020.
155. Author remote interview with USMC SME, 10 July 2020.
strike assets. This would, in effect, extend the reach of the F-35 from 830 km to 1,000 km. Unmanned assets such as the XQ-58, with 2,000-km unrefuelling ranges, could also operate deeper within a target area as ISR assets or attritable strike assets using their own on-board sensors autonomously should policy allow.

Moreover, the ability to augment a wave of manned strike assets with unmanned assets such as the XQ-58 which can be launched from a carrier deck in large numbers could substantially increase the strike firepower of a single wave, limiting the time the carrier spends in the threat envelope by enabling it to deliver larger volumes of firepower against a given target set in a compressed time period. Cumulatively, these adaptations could extend the effective reach and pulsed firepower of the CSG without recourse to aerial refuelling. In circumstances where refuelling is required, non-organic refuelling using assets such as the RAF A400 Voyager will likely be necessary in the short term. In the medium to long term, the adaptation of the carriers to a CATOBAR configuration might enable the integration of an unmanned organic refuelling asset such as the MQ-25.

While the emphasis has been on equipment that can be integrated into the carriers and their pickets with few structural adaptations and limited unit costs, each of the adaptations described involves programme costs exceeding the capital invested in acquisitions. This is a subject which requires further research with respect to total programme costs. Nonetheless, the weight of evidence does suggest that a number of relatively low-cost avenues to extend the reach of the carrier air wing exist and can be leveraged even while the QEC remains a STOVL carrier.

Light–Heavy Teaming

A major feature of the future strategic environment is the large number of UK partners and allies both within and outside NATO that will operate light STOVL aircraft carriers. Countries such as Japan, Italy, Turkey, Spain and, in the future, South Korea and potentially Australia will all operate light carriers.\textsuperscript{156} The lightning carrier concept being espoused by the USMC will likely see its \textit{America}-class LHAs play a similar role.\textsuperscript{157} As the impetus for the lightning carrier concept is freeing US supercarriers for service in the Pacific by using LHAs as auxiliaries, the Royal Navy will likely find itself interacting with forces built around the lightning carrier should it backfill in regions the US is pivoting away from.

This represents both an opportunity for the UK to add value to a joint effort, particularly on a bilateral basis, while at the same time unlocking some of the potential of the raiding CONOPS described above. Given that the major drawback of LHAs such as the \textit{America} class is the sortie rate they can generate using VTOL aircraft, given the need to conduct all the activities required to prepare an aircraft for launch on the flight deck, a framework that saw a lightning carrier

\textsuperscript{156} For the purpose of this paper, LHAs capable of launching aircraft are defined as light carriers.

teamed with a UK carrier strike capability could leverage the strengths of each platform.\textsuperscript{158} If the role of the aircraft on a lightning carrier was restricted primarily to providing a combat air patrol for a QEC, its sortie generation rate would be a less significant restricting factor. Moreover, the carrier air wing, freed from the task of providing CAPs for itself, could generate a larger number of sorties in a shorter timespan against key targets such as coastal missile batteries. This would open the way for an LHA-mounted amphibious raid using organic assets such as the Osprey. Finally, aggregating formations allows efficiencies of scale with regard to force protection. Aggregating a UK CSG with an amphibious-ready group, for example, would require fewer picket vessels than defending each separately and would free both groups’ picket vessels for other tasks.\textsuperscript{159}

Alternatively, one might see cross-decking used to extend the reach of a carrier air wing in circumstances short of high-intensity conflict and, perhaps, in its early stages. Effectively, this would amount to an emulation of the Doolittle raids in which US carrier-based aircraft were able to strike Tokyo at ranges beyond their combat radius because they were expected to fly onwards to bases in China rather than back to their carriers.\textsuperscript{160} If, for example, an aircraft which took off from an aircraft carrier at some distance landed on an LHA operating close to the theatre of a conflict, rather than flying back to the carrier immediately, it could be launched from further out. This might be desirable if, for example, a prompt sovereign response to a given provocation was required at short notice. Alternatively, this might confront an opponent with a large sortie at reach from an unexpected vector in the early stages of a direct conflict. Needless to say, this would require a system of permissions to be established with partner states that would allow cross-decking at short notice, as well as an awareness of available and willing partners with LHAs in any given scenario. The precise nature of such arrangements is beyond the remit of this paper. That said, it is likely that a system of permissions could be established with relative ease with other F-35B operators. Moreover, the global F-35 supply network could allow spare parts and support kits to be delivered at rapid rates to any platform on which a fighter lands.\textsuperscript{161}

\section*{Littoral Integration, C2 and Information Advantage}

Integrating effects with the littoral strike groups will be critical to inserting the carrier into a theatre and directing its use to deliver strategic effects. While the precise contours of a future littoral strike force have been discussed elsewhere, the issue of concern here will be the C2 structure and enablers that might allow the UK to aggregate a contact layer of littoral strike forces and a mobile carrier strike package into a joint strike force.\textsuperscript{162}

\textsuperscript{158} Author remote interview with US Navy SME, 12 July 2020.
\textsuperscript{159} For a discussion of the returns to scale provided by aggregation, see Hughes and Girrier, \textit{Fleet Tactics and Naval Operations}, pp. 150–60.
\textsuperscript{161} Author remote interview with UK Navy SME, 20 July 2020.
\textsuperscript{162} See, for example, Sidharth Kaushal and Jack Watling, ‘Requirements for the UK’s Amphibious Forces in the Future Operating Environment’, \textit{RUSI Occasional Papers} (November 2019).
At the tactical/operational level, a number of factors will be salient:

- A command structure that allows for the handoff of assets between the two groups in operations that will increasingly be nonlinear in their nature with the supporting/supported role shifting at pace.
- A communications architecture that enables the exploitation of tactically relevant information across the force is a prerequisite.
- Forward-engaged forces from both carrier and littoral strike groups can play a critical role in gathering information needed to train the deep reinforcement learning tools that will be critical to enabling high-tempo operations in an information-denied environment. This will require capacity at the higher level of command for information aggregation from these forces and its use to train deep reinforcement algorithms in peacetime. Forward-deployed forces can also play a role in frustrating opponent efforts to generate similar early situational awareness.
- At higher levels of command, offensive information operations such as cyber activities can play an enabling role for both littoral and carrier strike forces.

At the tactical/operational level, existing C2 structures are fit for purpose in structural terms but could benefit from greater agility. The use of a two-star command to oversee twin one-star commands over the littoral and carrier strike groups is, in principle, a sound basis for arbitrating resource allocation and enabling the two groups to interface. However, the tempo of operations envisioned will require information to move through this chain of command more rapidly. Much of this has to do with the automation of fairly routine tasks, such as the provision of strike permissions and the population of targeting boards. Technological means for automating these routine tasks in line with a commander’s intent are reaching maturity and being adopted in military organisations around the world.

The architecture and techniques underlying communications-enabling tactical information sharing will likely need to be altered to allow littoral and carrier strike assets to take advantage of each other’s situational awareness. Technological developments leveraging phenomena such as tropospheric scatter, for example, might enable forward-engaged forces to conduct reach-back communications without giving away their positions. Elsewhere, the USMC has demonstrated the ability of the F-35 to act as an ISR asset for long-range precision strike assets such as the HIMARS without broadcasting its position. This was likely achieved using Link 16 with a directional antenna as opposed to an omni-directional broadcast. This model of communications could allow short bursts of communication between carrier strike assets and a variety of other platforms. Finally, disposable UAVs can be used by forward-deployed...

---

163. Author remote interview with Royal Marines SME, 22 July 2020.
165. Author remote interview with Royal Marines SME, 22 July 2020.
166. Author interview with US SME, 12 July 2020.
forces as attritable communications relays. It will likely be increasingly the case that littoral and carrier strike forces will need to rely on burst communications to assets that they can track via a network such as BlueForce tracker or stitches. The ability to rely on relaying sufficient information as opposed to shared situational awareness will be critical to operating in an information-denied battlespace.

At the higher echelons, it will increasingly be necessary to generate information advantage at both the strategic and operational levels in peacetime. At the strategic level, building links between forward-engaged forces and local networks of human resources, embedding members of strike forces in, for example, intelligence organisations and vice-versa, can allow maritime strike forces to anticipate strategic shifts and adopt a coordinated approach to delivering strategic effects. In forward locales, there exists a strong rationale for integrated planning with, for example, special forces and persistent engagement with defence attaché networks. The ability to both shape regional strategy and anticipate shifts can make the UK strike force a more agile provider of tailored offers to a whole-of-government approach in a given region. Certainly, this approach – marrying special forces with highly mobile units – has been applied to good effect in other contexts such as General Vladimir Shamanov’s restructuring of the Russian Airborne Forces and Spetsnaz under a joint rapid reaction force.

While this paper is not necessarily suggesting a comparable unification, the engagement of forward forces, special forces, human resources and defence attachés will likely contribute to the ability to manage persistent competition and leverage points of advantage. When conducting limited coercion, a clear understanding of a rival’s objectives, theory of victory and thresholds is critical to both managing escalation and manipulating an opponent’s risk perceptions. This makes the tight coordination of military, informational and diplomatic assets critical to avoid unwanted escalation or a failure to convey resolve.

An objection could be that this could create duplications of effort with other organisations. However, redundancies are not necessarily a negative characteristic of organisations in competition. Indeed, efforts to eliminate redundancies can often create organisational fragility. Given that group-think, the lack of processing capacity to eliminate the ‘noise from the signal’, insufficient collection in advance and the lack of tactically actionable information are the four most significant causes of strategic intelligence failure, a federated information-gathering system, of which a navy is an important part, could mitigate these risks. Multiple organisations

169. Carson, Secret Wars; George, Forceful Persuasion, pp. 1–50.
170. Different scholars weight each variable differently but broadly agree on the factors. See Erik J Dahl, Intelligence and Surprise Attack: Failure and Success from Pearl Harbor to 9/11 and Beyond.
performing a single overarching function can give policymakers multiple perspectives, increase the aggregate information-processing capacity of a country’s apparatus and provide each other with techniques to eliminate false positives and identify salient information. These organisations can also develop specialisms. For example, they can leverage the organic ISR capabilities of maritime platforms to identify and disseminate tactically actionable information that a more strategically focused organisation may not have.\(^{171}\) A growth in capacity for forward engagement can deliver tactically relevant information while efforts to embed naval intelligence and engagement efforts with relevant communities in a mosaic of organisations working towards a shared end would create a more heterogenous federated information-gathering system that can mitigate the risk that key information is missed due to a lack of capacity or group-think. The ability to leverage bespoke capabilities from other entities, and to share them with other entities, would also go a long way towards delivering effective sub-threshold activities to prepare the theatre for force projection.

Securing the information advantage in peacetime also has operational implications for the high-intensity fight. Training the predictive tools needed to win the first salvo in a raiding context will require significant swaths of data.\(^{172}\) A combination of data from forward-deployed forces, engagement teams and other sources will need to be aggregated and curated. Indeed, even open-source classification at lower levels of secrecy using tools such as tournament competitions can add value here. Moreover, a common protocol to enable the release of relevant information across the joint force will likely be a requirement. Given the classification incompatibility between data gathered from, for example, an F-35 and another ISR asset, data from the former source could be curated and key information presented in a format compatible with a standard classification system.

In terms of capacity to curate and process information, deeper integration between the Royal Navy and future commando force might go some way to delivering it. Units such as the 30 Commando information exploitation group could add significant value if placed directly within UK Strike Force as the nucleus of an organic information exploitation cell held under the two-star command, the remit of which could encompass information operations more generally and give UK Strike Force a capability not organic to most formations across the joint force. This, in turn, would enable UK Strike Force to project power at pace without drawing on enablers from other forces. It would also enable an end-to-end kill chain against high-value targets to be constructed within the organisation.

To enable all of this, however, a degree of organisational integration and standardisation of information processing and sharing protocols across classification levels will likely need to take place under the aegis of higher commands. As automation enables some of the tactical and

---

operational functions currently performed at the two-star level to be performed with smaller staffs, and perhaps even shifted to the one-star level, command at a two-star level might then shift its emphasis to aggregating data and generating information advantage in peacetime as well as providing broad intent in conflict.

Tactically, efforts by engaged forces to generate offensive information advantage can support a raiding concept in a number of ways. During late-Cold War exercises such as Operation Haystack, for example, US naval exercises emphasised forward positioning ELINT emitters on islands and interspersing CSGs with civilian vessels.\footnote{Robert D Angevine, ‘Hiding in Plain Sight—The U.S. Navy and Dispersed Operations Under EMCON, 1956–1972’, Naval War College Review (Vol. 64, No. 2, 2016), pp. 1–17.} Similarly, assets such as the AN/SSQ-74 Integrated Cover and Deception System demonstrated utility as a means of spoofing defenders by simulating an aircraft carrier’s signature from a trailer-based system that could be placed on a range of decoy vessels.\footnote{Norman Friedman, Network-Centric Warfare: How Navies Learned to Fight Smarter Through Three World Wars (Annapolis, MD: Naval Institute Press, 2009).} Forward-positioned littoral groups could, hypothetically, experiment with ways to generate false positives for defenders as a CSG approached the theatre using comparable systems from auxiliary vessels or converted civilian assets. Cheap UAVs deemed incapable of combat operations could also be launched from vessels with emitters as decoys to simulate flight operations. This would complicate the use of OTH radar such as the Kontainer and make the task of locating, classifying and tracking a carrier based on other radar contacts more difficult. For example, the US Navy has experimented with using swarms of UAVs to simulate the radar returns of ships to spoof OTH radar.\footnote{Brett Tingley, ‘The Navy’s Secretive and Revolutionary Program to Project False Fleets From Drone Swarms’, The Drive, 7 November 2019.} These efforts will need to take place alongside more traditional measures such as emissions control and signature management which will retain central importance with respect to maintaining carrier survivability. In the context of an environment in which AI will be increasingly important, one can compromise the data processed by an opponent and by extension their algorithms by, for example, presenting them with information in which key contextual details have been subtly altered, perhaps by changing ship appearances or patterns of behaviour during exercises.\footnote{For example, introducing perturbations (adversarial samples) in close proximity to a relevant sample can lead to drastically poorer classification by a system that lacks the ability to understand context. Doing so in peacetime using, for example, decoys could compromise an opponent’s capacity for high-speed classification in conflict. See Kui Ren et al., ‘Adversarial Attacks and Defenses in Deep Learning’, Engineering (Vol. 6, No. 3, 2020), pp. 346–60.}

Finally, offensive cyber operations coordinated at the two-star command level could complement counter-ISR efforts at the tactical level. Subtle efforts to increase the rates of error in an opponent’s tracking system by identifying and exploiting an underlying assumption driving the
algorithm which processes data and sorts false positives from relevant data can, for example, degrade an opponent’s ability to deliver the first salvo.\footnote{For an example in the air domain, see Blake Hounshell, ‘Syrian Radar P0wned by Israeli Hackers?’, Foreign Policy, 5 October 2007.} To be sure, the effects of cyber warfare are transient. However, a model of operations that is based around exploiting transient windows of opportunity to achieve strategic effects could be fruitfully integrated with cyber operations.

As such, persistent engagement and strategic raiding have a feedback relationship. The former enables the latter while the latter, if executed to effect, can enable subsequent engagement and competition on favourable terms.
Conclusion

IN HIS SEMINAL work on military innovation, Stephen Peter Rosen suggested that militaries have two means by which to mitigate uncertainty about their future needs in an ever-changing world: they can invest in capabilities that can be retooled for multiple purposes; and they can invest in information gathering and experimentation to identify the enablers that can unlock a platform’s potential in any given future strategic and operational context.

The aircraft carrier represents an example of the first option: while its role may change, it is flexible enough to adapt to a changing operating environment. The task ahead – to which this paper has tried to contribute – is to identify the enablers that will unlock its potential in the emergent environment. The emergence of a UK carrier strike capability creates a number of pathways by which the Royal Navy can deliver asymmetrical advantages in an age of persistent competition. A middle power such as the UK can, by the judicious application of force on ground that it – not an opponent – chooses, contribute meaningfully to alliances such as NATO and a growing raft of bilateral security relationships beyond Europe. However, leveraging the opportunities provided by emerging maritime strike capabilities will require a CONOPS consistent with both strategic imperatives and operational realities.

First and foremost, both the strategic imperative to engage in persistent competition and the operational imperative to adapt to the missile age have conclusively buried any notion of the carrier as a sea base for expeditionary forces or a deterrent symbol that can be moved offshore in a theatre in times of crisis as was originally envisioned. Rather, aircraft carriers will deliver the greatest value if they re-emphasise warfighting missions that traditionally characterised carrier warfare, such as hit-and-run raids that exploit a maritime power’s operational mobility, and generating scalable force packages in peacetime to contribute to persistent sub-threshold competition. A re-emphasis on the raiding concepts that leveraged the strategic mobility that carrier strike forces have historically allowed should thus replace a turn of the century emphasis on protracted strike campaigns in support of an expeditionary force.

These objectives will require a number of adaptations which, though not insignificant, are broadly achievable. Critical among these will be:

- Emphasising a CONOPS based on striking key nodes on a prompt basis as opposed to conducting protracted strike campaigns.
- Extending the reach and firepower of the carrier air wing by equipping it with standoff capabilities and exploiting long-range, low-cost attritable technology, both as wingmen to the F-35 and in independent roles.

• Integrating carrier and littoral strike lines of effort to deliver information advantage.
• Developing scalable force packages consistent with low-intensity competition at reach.

Operationally, a CONOPS centred on short, sharp raids in wartime and persistent engagement in circumstances short of war can leverage the advantages of inter-theatre mobility provided by a mobile strike capability. Moreover, the carrier strike force, if its operations are integrated with those of littoral strike forces, can effectively serve as a hybrid force at sea, capable of delivering effects across the spectrum of competition and reinforcing the efforts of other forward-engaged assets without necessarily duplicating their efforts. The platform should be viewed as a competitive force multiplier and used in a manner that leverages its abilities in this area. Modular forward-engaged formations represent one means of achieving this, as does the more persistent use of the carrier air wing at longer ranges to support lower-intensity competition with lower levels of political visibility. A capacity to integrate organic tanker refuelling, which could be made possible by the integration of catapult launching and arrestor gear, would be particularly valuable for enabling low-intensity competition at a distance.

The UK’s carrier strike forces can leverage advances in areas such as unmanned technology, deep reinforcement learning and the cluster of technologies associated with the fourth industrial revolution. Over time, the carrier air wing may evolve into a high–low mix of fifth-generation fighters and a range of cheaper unmanned assets. The cumulative effect of these adaptations will be the ability to open windows of opportunity in which strategic effects can be delivered at reach. Technical adaptations, such as the adoption of an arrested recovery system on the platforms in the short term, and the introduction of a cooperative engagement capability onto the Type-45 destroyer, could represent a relatively quick and cost-effective means of extending their defensive and offensive reach in line with this concept.

The UK has developed a highly evolvable platform with the QEC carriers. Exploiting the flexibility of these platforms to adapt to the future strategic operating environment will be a key task for the Royal Navy and one that can allow it to secure UK interests in an age of persistent competition.
About the Author

Sidharth Kaushal is a Research Fellow in Sea Power in the Military Sciences team at RUSI. Sidharth holds a doctorate in International Relations from the London School of Economics, where his research examined the ways in which strategic culture shapes the contours of a nation’s grand strategy.