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# Navies and Economic Warfare

## Securing Critical Infrastructure and Expanding Policy Options

Sidharth Kaushal



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# Executive Summary

This paper examines the conduct of economic warfare at sea, and the way it will shape the imperatives of Western navies in the future. Among its key findings are that defensive action against adversary economic warfare will become a more complex task, drawing on ever-greater naval capacity, as the challenges faced at sea come to include the imperative to defend critical national infrastructure at sea.

On the offensive side of the equation, although non-military means of waging economic warfare have grown in significance, this paper finds that the use of naval assets will remain a key tool with which to wage economic warfare, alongside other instruments. However, the methods and instruments through which navies wage economic warfare will likely evolve.



# Introduction

**T**HE PURPOSE OF this paper is to examine the role of Western navies in the context of economic warfare at sea, and the way it will shape the imperatives of Western navies in the future. It aims to answer two key questions:

1. How will the defensive components of economic warfare at sea evolve as the structure of modern economies makes them increasingly reliant, not just on shipborne trade, but also on physical infrastructure such as undersea cables and pipelines?
2. How can navies continue to complement non-military methods of waging offensive economic warfare, such as sanctions?

These questions are currently relevant for several reasons. First, defending lines of communication against an opponent's efforts to conduct economic warfare is likely to be a pre-requisite for ensuring that conflict can be waged at an acceptable cost to Western societies. The evolving economic geography of the maritime domain – including pipelines, offshore energy fields and undersea cables – means that threats from this vector extend beyond traditional threats to shipping. It has been estimated, for example, that an internet shutdown comparable to one caused by large-scale disruption to undersea cables could cost an interconnected economy over \$23 million a day per 10 million people in the population.<sup>1</sup> The question of how the traditional task of sea lines of communication (SLOC) protection should evolve to mitigate these threats is, then, a pressing one.

On the offensive side of the equation, the question this paper seeks to answer is what role navies have in waging contemporary economic warfare. There is presently a mismatch between Western maritime preponderance and the relative non-use of maritime economic warfare by Western states, as well as if and how this contradiction should be resolved. Sir Walter Raleigh's oft-cited aphorism that 'whomsoever controls the sea controls the commerce of the world and thus the world itself' has generally been accepted as something of a cliché. Naval theorists have long extolled the virtues of being able to both secure the seas for one's own commerce and deny them to an opponent.<sup>2</sup> Yet it is noteworthy that in the post-Second World War era there are strikingly few instances of Western navies, which have enjoyed a preponderant position on the world's oceans, waging maritime economic warfare. With a few exceptions, the utilisation of naval power to constrain an opponent's access to critical resources – once central to the naval

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1. Deloitte, 'The Economic Impact of Disruptions to Internet Connectivity: A Report for Facebook', October 2016, <<https://globalnetworkinitiative.org/wp-content/uploads/2016/10/GNI-The-Economic-Impact-of-Disruptions-to-Internet-Connectivity.pdf>>, accessed 24 November 2022.
  2. Alfred Thayer Mahan, *The Influence of Sea Power upon History 1660–1783* (Cambridge: Cambridge University Press, 2011, first published 1890); Julian S Corbett, *Some Principles of Maritime Strategy: A Theory of War on the High Seas: Naval Warfare and the Command of Fleets* (Annapolis, MD: Naval Institute Press, 1972).



mission – has largely been absent from Western concepts of operations, which have focused more heavily on projecting power inland in support of joint operations and the protection of economic lifelines against adversary predation.<sup>3</sup> To some extent this may reflect the relative absence of direct great power conflict in the post-war era. During the Cold War, much of the direct application of force by the US and the USSR was conducted in relatively small states where each superpower could rely on more direct approaches to securing their ends. In a clash with a Soviet proxy like North Korea, for example, the ability to project power ashore was of greater importance than wearing down the North Korean economy. The relatively autarkic economic profile of the West's major opponent in this period and the fact that victory or defeat in a direct European war with the USSR would ultimately be decided on land may also have contributed.<sup>4</sup>

However, this is likely only a partial explanation. Even during the interwar years, when the response to crises such as Italy's invasion of Abyssinia was being debated, there was a divide between an 'Admiralty school' that emphasised economic coercion through the physical interdiction of goods, and a 'Treasury school' that focused on targeting the financial architecture and hard currency reserves that made transactions possible to begin with.<sup>5</sup> The victory of the latter school in interwar debates over how to conduct economic coercion presaged a wider focus on economic sanctions and embargoes – at least by nations with the market power and wherewithal to deploy them.<sup>6</sup> Given that the sources of many raw goods were becoming increasingly diffuse, and the costs of policing neutral shipping were visible even during the successful blockade of the First World War, this shift is in some ways understandable. A number of trends have reinforced the potential of non-military forms of economic warfare, particularly when conducted by Western nations.<sup>7</sup> While a nation such as Iran might have incentives to conduct economic coercion through limpet mines or drone attacks, is this still a necessity for nations that enjoy what Susan Strange described as 'structural power' – centrality to the systems that underpin processes like global finance? Although of course the Admiralty and Treasury schools need not be viewed as competitors, the prominence of the latter over the former has grown during the past century. This raises the question of whether the value added by a naval contribution to economic warfare outweighs the opportunity cost, in terms of focusing on other priorities. In other words, should Western navies treat the ability to contribute to economic warfare as a core competency, or should they view their role here as a strategic relic and focus instead on their other functions, such as expeditionary power projection?<sup>8</sup> Finally, the idea

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3. For example, see Ministry of Defence, 'Joint Doctrine Publication 0-10: UK Maritime Power', 5<sup>th</sup> Edition, October 2017.
  4. This fact was often the basis of critiques of more forward-leaning maritime strategies. See, for example, John J Mearsheimer, 'A Strategic Misstep: The Maritime Strategy and Deterrence in Europe', *International Security* (Vol. 11, No. 2, 1986), pp. 3–57.
  5. See Nicholas Mulder, *The Economic Weapon: The Rise of Sanctions as a Tool of Modern War* (New Haven, CT and London: Yale University Press, 2022), pp. 280–95.
  6. *Ibid.*
  7. *Ibid.*
  8. On Iranian mining attacks, see Tyler Rogoway, 'US Says Video Shows Iranian Forces Removing Dud Mine from Damaged Tanker', *War Zone*, 14 June 2019; on the concept of structural power, see

of the sea as a common good – central to the liberal international order – has in many ways constrained the ability of Western nations to limit freedom of access in the global maritime commons, a central pillar of the liberal international order and the trade it has facilitated.<sup>9</sup> Although not an absolute taboo, the very centrality of the idea that the maritime commons is a public good to be protected has incentivised a focus on defensive SLOC protection and has in certain ways delinked the application of sea power from economic warfare more broadly.

This paper, written in support of work conducted by the Royal Navy Strategic Studies Centre on the question of naval contributions to economic warfare, examines the question of what the naval function should be in the context of contemporary economic warfare, and how the contributions of navies to economic warfare will need to evolve in the face of emerging strategic and operational realities. The paper is written from a Western standpoint with a particular emphasis on competition with peer competitors, but its findings are not specific to the Royal Navy – rather its aims are to provide a set of principles that might guide the activities of Western and Allied navies operating in tandem. Its core conclusions can be summed up as follows:

- In peacetime, the defensive component of economic warfare – SLOC protection – will retain its enduring importance. The execution of this function, however, may well need to evolve. Navies can support deterrence by punishment through information gathering that sets the political conditions for other policy instruments such as sanctions to be used. To do this, however, requires not just information, but mechanisms for rapidly sharing it. Furthermore, effective deterrence will likely require both a broader range of public–private partnerships and the use of tools such as machine learning to manage large volumes of data.
- In the context of open war with a peer competitor, the effective use of maritime power in support of economic warfare is likely to retain salience. The adaptations of potential target economies to some of the elements of the Treasury school approach mean that a hybrid Treasury/Admiralty effort involving both kinetic and non-military means retains salience. However, both strategic imperatives and trends in the future operating environment will alter the ways in which navies will support economic warfare. Specifically, the ability to enact close blockades in an anti-access context and to control information flows rather than the flow of goods will become vital – and the tools to achieve this may look different from capabilities that navies currently field. In effect, the logic of conducting maritime economic warfare may stand, even as methods evolve.

Chapter I examines the role of economic warfare within a nation's overall approach to deterrence and coercion. The question it seeks to examine is: to what degree should economic warfare writ large be regarded as a core policy instrument? Chapter II addresses the question of where navies fit within the conduct of economic warfare. Chapter III examines sub-threshold competition,

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Christopher May, 'Strange Fruit: Susan Strange's Concept of Structural Power in the International Political Economy', *Global Society* (Vol. 10, 1996), pp. 167–89.

9. On the broad contours of the liberal international order, see G John Ikenberry, 'The End of the Liberal International Order?', *International Affairs* (Vol. 94, No. 1, 2018), pp. 7–23.

where the application of enduring principles has been altered by a changing technological and operational environment. The Conclusion finds that many of the enduring principles regarding the application of sea power to economic warfare remain sound, even if the means used must evolve.

# I. What is Economic Warfare and Why Does it Matter?

**E**CONOMIC WARFARE MIGHT be broadly defined as a set of actions designed to prevent an opponent from mobilising its economic potential to generate power. The generally accepted classification of objectives for economic warfare is: coercion (actions designed to force a specific response), strategic denial (denying an opponent the capacity to generate military power) and strategic economic erosion (eroding an opponent's economic structure to a broader strategic end).<sup>10</sup> The latter two objectives are not necessarily linked to any specific policy concession on an opponent's part, as weakening an opponent can be an enduring long-term objective. Examples include the Coordinating Committee for Multilateral Export Controls' (CoCom) restrictions on exports of technology to the USSR during the Cold War (which substantially slowed the modernisation of the Soviet economy, especially in areas such as computers) and the US government's recent restrictions on the export of technology related to semiconductor manufacture to China.<sup>11</sup>

Economic warfare can form part of simple coercive diplomacy aimed at a specific concession (as in the case of the sanctions leading to the Joint Comprehensive Plan of Action), but need not be tied to a specific political concession by an opponent. Moreover, many of the instruments through which it is implemented may be military in nature. For example, the British blockade of Germany during the First World War encompassed both military elements, such as the physical interdiction of shipping, and non-military ones, such as purchasing goods that the German economy needed from international markets to increase the scarcity of supply (and limit third-party pushback against the blockade).<sup>12</sup>

The consideration of what value economic warfare delivers has been somewhat contested. Literature on the efficacy of economic coercion, for example, tends to deliver mixed results.<sup>13</sup>

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10. See, for example, Michael Mastanduno, *Economic Containment: CoCom and the Politics of East–West Trade* (Ithaca, NY: Cornell University Press, 1992).

11. *Ibid.*; Stephen Nellis, Karen Freifeld and Alexandra Alper, 'US Aims to Hobble China's Chip Industry with Sweeping New Export Rules', *Reuters*, 10 October 2022.

12. Christian Götter, 'From a Militarily to a Politically Enforced Instrument: The Development of the Allied Blockade During the First World War', *Les Cahiers Sirice* (Vol. 26, 2021), pp. 59–71.

13. See, for example, Robert A Pape, 'Why Economic Sanctions Do Not Work', *International Security* (Vol. 22, No. 2, 1998), pp. 90–136; for a rebuttal of Pape, see David Baldwin's contribution to David A Baldwin and Robert A Pape, 'Evaluating Economic Sanctions', *International Security* (Vol. 23, No. 2, 1998), pp. 189–98.

Few instances of blockades being independently militarily decisive exist.<sup>14</sup> Similarly, mid-20th-century work on the wartime potency of strategic bombing against key nodes within the German economy, such as factories producing ball bearings, shows that this did not paralyse military production, despite the hopes of proponents of strategic air power.<sup>15</sup> However, this may underestimate the pre-war effect that the threat of deterrence by punishment has, which may be more substantial. Although a nation may accept costs once it has committed itself to a conflict, the threat of costs may deter it from doing so in the first place.<sup>16</sup> Moreover, even if economic coercion is not a war-winning approach, preventing an opponent from using economic coercion effectively is central to securing peace and post-war national prosperity.

Moreover, the fact that economic warfare has historically not lived up to the promise of delivering rapid low-cost victory through an indirect riposte does not render it tangential. To return to the example of the Second World War, contemporary scholarship suggests that the transaction costs imposed on the production of German and Japanese armaments by both strategic bombing and blockade had a disproportionate impact that is often underappreciated.<sup>17</sup> This is because the costs of adaptation – for example, dispersing factories to avoid bombing or relying on substitutes for blockaded materials – necessarily created inefficiencies. While this did not bring either country's military to a halt, it did mean that they mobilised a fraction of their theoretical military potential.<sup>18</sup>

In effect, the cost of economic warfare is not the cost of absolute scarcity but rather the combined effect of relative scarcity and the transaction costs of adaptation. It may not be a substitute for battlefield victory, but it is a key enabler. Adaptation by an opponent may not always be possible, and when it is not, absolute scarcity may be inflicted. There are certain nonfungible goods which cannot be substituted by a target economy. During the Cold War, for example, the success of CoCom in denying the Soviet economy easy access to modern computers and semiconductors was a move that the Soviets could not mitigate through substitution.<sup>19</sup> Similarly, Allied bombing of German synthetic oil plants – for which there was no ready substitute – did induce genuine

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14. John J Mearsheimer, *The Tragedy of Great Power Politics* (New York, NY: W W Norton and Company, 2001), pp. 200–05.

15. Mancur Olson, 'The Economics of Target Selection for the Combined Bomber Offensive', *RUSI Journal* (Vol. 107, 1962), pp. 308–14.

16. Robert A Pape Jr, 'Coercion and Warfare: Why Denial Works and Punishment Doesn't', *Journal of Strategic Studies* (Vol. 15, No. 4, 1992), pp. 423–75.

17. Richard Overly, *The Air War 1939–1945* (Lexington, MA: Plunkett Lake Press, 2020), pp. 150–200; Phillips Payson O'Brien, *How the War Was Won: Air–Sea Power and Allied Victory in World War II* (Cambridge: Cambridge University Press, 2015).

18. Payson O'Brien, *How the War Was Won*.

19. Mastanduno, *Economic Containment*, pp. 50–60; Chris Miller, *Chip War: The Fight for the World's Most Critical Technology* (New York, NY: Simon & Schuster, 2022), pp. 141–50.

scarcity of this commodity.<sup>20</sup> Consider the impact of denying an opponent access to critical technologies such as miniaturised electronics and semiconductors as a modern analogue.<sup>21</sup>

To return to the broader peacetime deterrent of fear of blockade, punishment and denial can play a symbiotic role, and the threat of effective punishment makes deterrence by denial much easier. States that fear economic erosion will often only initiate conflicts if they believe that they can be kept very short – a major feature of the interwar planning of nations such as Germany.<sup>22</sup> This, in turn, sets a more modest aim for those parts of the joint force aiming to achieve deterrence by denial – rather than proving that they need to defeat an opponent, they need only demonstrate the capacity to deny it a quick victory. Notably, the operational concepts of both the People's Republic of China (PRC) and Russia hinge on fighting short wars (although the latter has found itself in a protracted conflict).<sup>23</sup> Should conflict occur nonetheless, as a result of a miscalculation by one party (as was the case in the Second World War), economic pressure has the potential to goad risky operational and strategic decisions. Nations that fear the erosion of their warmaking potential as a conflict continues have incentives to use their forces in risk-acceptant ways to achieve victory before the effects of economic warfare are felt. This can expose them to higher risks of conventional defeat. The highly risky German invasion of Norway in 1940, Japan's gambit in attacking Pearl Harbor in 1941 and the 1918 Ludendorff offensive, for example, reflected a sense of urgency created by the spectre of a blockade, which led to forces being gambled in potentially catastrophic ways.<sup>24</sup>

As such, in both peace and war, the value of economic warfare lies less in its ability as a substitute for defeating a nation's fielded forces than in its ability to both facilitate battlefield victory and render it decisive by slowing the agile replacement of losses. By way of a contemporary example, economic pressure on Russia will not, in the final instance, decide the outcome of the conflict in Ukraine. It will, however, limit Russia's capacity to replace battlefield losses. Moreover, it may well compel Russian political leaders and military commanders to take operational risks to end the conflict on favourable terms before the cumulative effect of economic erosion renders this impossible.

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20. Olson, 'The Economics of Target Selection for the Combined Bomber Offensive', p. 310.

21. James Byrne et al., 'Silicon Lifeline: Western Electronics at the Heart of Russia's War Machine', RUSI, 8 August 2022.

22. On German fears of blockade, see Adam Tooze, *The Wages of Destruction: The Making and Breaking of the Nazi Economy* (London: Penguin, 2006), p. 288.

23. On China's Local War concept, see Xiao Tianliang, *The Science of Military Strategy* (Beijing: National Defence University, 2020), p. 2; on Russian thinking, see Michael Kofman and Rob Lee, 'Not Built for Purpose? Evaluating the Russian Military's Ill-Fated Force Design', *War on the Rocks*, 8 June 2022.

24. Erik Sand, 'Desperate Measures: The Effects of Economic Isolation on Warring Powers', *Texas National Security Review* (Vol. 3, No. 2, 2020), pp. 12–37.



## II. The Role of Navies in Contemporary Economic Warfare

**I**N A DEFENSIVE role, it is likely that the importance of navies in economic warfare is likely to grow. Western opponents, particularly those that lack robust non-military options with which to wage economic warfare, may have strong incentives to rely on sabotage at sea as a means of coercion. Iran's decision to respond to the Trump administration's sanctions with a campaign of mining in the Persian Gulf in late 2019 and the alleged Russian attacks on the Nord Stream pipelines in 2022 illustrate how both shipping and infrastructure at sea may provide a riposte to Western economic pressure.<sup>25</sup> Moreover, these events illustrate that attacks on infrastructure may not be construed as a *casus belli* – especially if they are partially deniable – further incentivising this type of attack. As such, deterring attacks on both shipping and critical infrastructure is likely to become an enduring naval function during both peacetime and conflict.

There is also the question of whether navies can still wage offensive economic warfare. Over the latter half of the 20th and the beginning of the 21st century a number of non-military tools with which to prosecute economic warfare have become available to Western policymakers. One factor driving this is a general feature of complex networks – returns to scale that in turn create bottlenecks. Once a given architecture to facilitate transactions exists, it is easier to join than to substitute, leading to ever greater returns to scale. Consider, for example, the importance of the SWIFT mechanism that facilitates interbank transactions.<sup>26</sup> To this one might add the centrality of Western and in particular American financial institutions to global trade. Much of the world's trade – including in key commodities – is conducted in US dollars. The centrality of US dollars and (albeit to a far lesser extent) euros in global financial flows and national currency reserves is also driven by a variety of additional factors, including relative institutional stability that large contenders such as the PRC cannot match.<sup>27</sup> Critically, in the latter part of the 20th century both Russia and China integrated themselves into this order – meaning that they are far more heavily exposed to weaponised interdependence than they might have been previously. This has conferred upon Western nations several financial levers with which to wage economic warfare

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25. CBS News, 'Iran News: US Says Mines Used in Tanker Attacks Bear "Striking Resemblance" to Weapons Touted by Tehran', 19 June 2019; Katya Adler, 'A Journey to the Site of the Nord Stream Explosions', *BBC News*, 18 November 2022; Deloitte, 'The Economic Impact of Cable Disruptions to Internet Connectivity'.

26. Henry Farrell and Abraham L Newman, 'Weaponized Interdependence: How Global Economic Networks Shape State Coercion', *International Security* (Vol. 44, No. 1, 2019), pp. 42–79.

27. Eswar Prasad, *The Dollar Trap: How the US Dollar Tightened its Grip on Global Finance* (Princeton, NJ: Princeton University Press, 2014).



sans military tools. Instruments ranging from full blocking sanctions against large swathes of the Iranian banking system to restrictions on Russia's central bank have inflicted substantial costs on the economies of target states.<sup>28</sup> The centrality of Western and Allied producers to the design and manufacture of technologies critical to modern industries represents another bottleneck on access to goods required for both civilian and military applications. The effect of US technology restrictions on Huawei stands out as an example of how this asymmetrical interdependence can be weaponised. Similarly, Russia, despite concerted efforts to substitute Western components in its military machine, achieved import substitution in only seven out of 127 categories of equipment highlighted as priorities by the Russian national security council.<sup>29</sup> One might then ask, in the vein of the Treasury school of the interwar years, whether the physical interdiction of goods remains a necessary component of economic warfare, at least for coalitions of Western states.

There are, however, reasons to believe that the capacity to physically control the flow of goods and services retains its salience, and that the role of physical interdiction within the context of economic warfare is likely to grow rather than diminish. Several factors are likely to contribute to this.

First, though likely to remain preeminent, it is unclear that Western financial institutions and instruments will retain a monopolistic role, as Russia and China, in particular, react to the vulnerabilities that they have created through over-reliance on the West. Indeed, even in the context of Western financial hegemony, sanctions evasion can sometimes occur at scale. Take, for example, the case of Iran, which has developed an elaborate network of front companies to conduct transactions with both Western and non-Western institutions – resulting in the nation seeing a mild economic rebound, including growth rates of around 4% in 2022 that led one Western official to conclude that Iran had 'won' the 'maximum pressure' campaign.<sup>30</sup> The rise of currencies that can serve as alternatives to Western fiat will likely exacerbate this. With Iran, the country's exports of oil rebounded in 2020, largely driven by trade with China denominated in yuan. The Saudi Arabian government is currently in negotiations with the PRC to conduct transactions with China in yuan and should these negotiations prove fruitful Saudi Arabia will join Russia in trading energy assets in a non-Western currency. Mechanisms such as the digital

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28. See, for example, Jeffrey Sonnenfeld et al., 'Business Retreats and Sanctions are Crippling the Russian Economy', SSRN, 19 July 2022, <<https://ssrn.com/abstract=4167193>>, accessed 10 January 2023.

29. Richard A Bitzinger and Nicu Popescu (eds), *Defence Industry in Russia and China: Players and Strategies*, Report No. 38 (Paris: EU Institute of Strategic Studies, 2017).

30. The 'maximum pressure' campaign was the Trump administration's effort to force Iran to negotiate on a wide range of issues through a sweeping set of economic sanctions. See Eliot Abrams, 'Did the Maximum Pressure Campaign Against Iran Fail?', Council on Foreign Relations, 12 July 2021, <<https://www.cfr.org/blog/did-maximum-pressure-campaign-against-iran-fail>>, accessed 10 January 2023; Matthew Karnitschnig, 'Iran Teaches Russia its Tricks on Breaking Oil Sanctions', *Politico*, 9 November 2022, <<https://www.politico.eu/article/iran-russia-cooperation-dodging-oil-sanctions/>>, accessed 10 January 2023.

renminbi can further complicate the application of sanctions by enabling transactions not involving institutions linked to the international financial system.<sup>31</sup> Although transacting in yuan is nobody's first choice, it is a viable backup for states that fear their trade being interrupted by sanctions. As such, the capacity of target states to adapt to sanctions may well increase over the coming decades, even if sanctions will impose costs on them. In a similar vein, the growth of China's capacity to manufacture capabilities such as semiconductors – it now surpasses Taiwan in exports of semiconductors – could signpost a similar shift in the structure of high-tech manufacturing, although the country's lack of access to extreme ultraviolet lithography technology and reliance on American technology makes this far from certain. This is not to say the collective West will be displaced by the PRC either in financial or technological terms – merely that potential targets of sanctions now have options – and the more sanctions are used, the more their potential targets will explore these options. Nations may prefer to trade in dollars, but may have access to renminbi in extremis, just as they may prefer Taiwan's TSMC semiconductors, but can in certain areas rely on Chinese products as substitutes.

Second is the question of escalation against third parties and neutrals. Both physical interdiction by means such as a blockade and sanctions carry risks here, but it is arguably the case that the latter imposes greater systemic blowback. The effective enlistment of disinterested third parties in sanctions necessitates a form of deterrence by punishment – typically through secondary sanctions. This implies imposing significant economic costs on a target state if sanctions are not to be substantially diluted. This is particularly complex if the third party is a geopolitical partner. Consider the diplomatic complexities faced by the US in imposing sanctions under the Countering America's Adversaries Through Sanctions Act, given that this would entail targeting the economies of states such as India and Indonesia, with which it wishes to cooperate in the Indo-Pacific.<sup>32</sup> Moreover, if the basis of structural power is indeed the expectation of regularity – which democracies can provide but autocrats, without effective checks and balances, cannot – weaponising any given structure should logically undermine it over the long term. If the rules of a financial institution can change in response to the contingent nature of foreign policy, it is not necessarily more predictable than an autocratic analogue.

In contrast, physical interdiction operates on the principle of deterrence by denial – the target in question typically being individual agents, such as the crew of a ship, which is deciding

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31. Robert Greene, 'What Will be the Impact of China's State-Sponsored Digital Currency?', Carnegie Endowment for International Peace, 21 July 2021, <<https://carnegieendowment.org/2021/07/01/what-will-be-impact-of-china-s-state-sponsored-digital-currency-pub-84868>>, accessed 22 November 2022.

32. The Countering America's Adversaries Through Sanctions Act is US legislation, passed in 2017, designed to curb Russian arms exports by, among other things, providing the president with the discretionary power to impose a number of penalties on customers of Russian arms manufacturers. See US Department of the Treasury, 'Countering America's Adversaries Through Sanctions Act: Related Sanctions', <<https://home.treasury.gov/policy-issues/financial-sanctions/sanctions-programs-and-country-information/countering-americas-adversaries-through-sanctions-act-related-sanctions>>, accessed 10 January 2023.

whether to run a blockade. While not diplomatically cost free, physically preventing trade from accessing a given area is often less likely to induce unwanted second-order diplomatic effects than deterring third parties through punitive measures. For example, while Russia has paid a diplomatic price in the developing world for its blockade of Odesa, it has been able to partially mitigate this blowback by attributing the situation to undesired wartime circumstances. The reason for this is that military measures such as blockades are enacted at or near the zone of conflict and can be framed as a wartime necessity impacting all actors. This is distinct from controlling the economic activity of specific actors within their respective states. As an example of how invidious the latter can be, consider the EU response to the 1996 US decision to sanction foreign companies, including European ones, that were trading with Cuba. The decision was decried as a violation of EU nations' sovereignty and international norms, and precipitated EU counter legislation.<sup>33</sup> Partly because it implies (or is at least perceived to imply) a challenge to national sovereignty, the threat of punitive extraterritorial control carries greater blowback than a declaration that a given stretch of sea is off bounds to all comers – one that targets no specific state and can be framed as an exigency of wartime.

Thirdly, it is unclear that sanctions and embargoes – although they may devastate a target economy – can independently cripple a state's capacity to generate military power. Iran, for example, has fielded modern ballistic missiles like the Zolfaghar (with a reported 10-m cep) under sanctions. Similarly, ODK Saturn, which produces Russian Kalibr cruise missiles, announced openings for 500 new employees in April, suggesting a confidence in the capacity to continue producing these missiles (albeit likely in smaller numbers) even under economic restrictions. Part of the reason for this is that a relatively limited number of key inputs are required for many modern capabilities such as missiles. Economic measures designed to restrict activity at scale are unlikely to close every avenue through which a specific product on which a state places a particularly heavy emphasis can be secured. However, though there may be many routes around administrative and legal restrictions, there are still a limited number of routes allowing physical ingress into a state. This is critical, as those instances in which economic warfare has or could have had a decisive impact on the outcome of a war have typically involved the capacity to interdict flows of key goods, without which a nation's warmaking capacity could not operate. The US Navy's successful interdiction of Japan's shipping from its southern resource base between 1941 and 1945 represents one example of this.<sup>34</sup> While this can sometimes be accomplished through the possession of monopolistic control over a given resource, more often it is the result of physical interdiction.

Lastly, the structure of the global economy has in some ways incentivised physical interdiction. Specialisation and interconnectedness are both a source of efficiency and a systemic risk, often discussed in a global context. National economies are dependent on fragile critical infrastructure and supply chains for critical flows of information and goods. Moreover, internal and external

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33. Jacob J Lew and Richard Nephew, 'The Use and Misuse of Economic Statecraft: How Washington is Abusing its Financial Might', *Foreign Affairs* (Vol. 97, No. 6, 2018), pp. 139–49.

34. James M Scott, 'America's Undersea War on Shipping', *Naval History Magazine* (Vol. 28, No. 6, 2014), <<https://www.usni.org/magazines/naval-history-magazine/2014/december/americas-undersea-war-shipping>>, accessed 30 August 2022.

integration means that disruption to the flow of goods can produce nonlinear effects through feedback loops, such as the mutually reinforcing relationship between supply-chain backlogs and inflation.<sup>35</sup> Much of this is well discussed, but through the lens of systemic risk.<sup>36</sup> It is also, however, the case that modern economies, both of friendly states and adversaries, draw their sustenance from increasingly narrow windpipes, which creates the conditions for interdiction to have substantial effects. The recent attack on the Nord Stream 1 and 2 pipelines, for example, highlighted the vulnerability of other gas pipelines, such as the Baltic Pipe, which connects Norwegian gas supplies to the rest of Europe. Supplies of gas are much less fungible than oil, given that they require either fixed infrastructure or specialised temperature-controlled vessels to be transported. In a similar vein, undersea cables represent a physical chokepoint in the global financial system. This represents a vulnerability for Western strategic lines of communication, but could also represent a challenge to adversaries in the future.

Of course, non-military methods of waging economic warfare will remain a highly prominent instrument in policymakers' toolkits. Particularly in the context of competition short of warfare they are likely to remain a preferred tool. However, the capacity to physically interdict flows of goods and to hamper production by kinetic means is likely to remain central to the prosecution of economic warfare – particularly in wartime – and remains a task that navies should be expected to prosecute.

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35. Pierre-François Kaltenbach, 'Inflation, Disruption and Supply Chains: Decisions to Make Now', Accenture, 31 May 2022, <<https://www.accenture.com/us-en/blogs/business-functions-blog/inflation-supply-chain-disruption>>, accessed 10 January 2023.

36. See, for example, Ian Goldin and Mike Mariathan, *The Butterfly Defect: How Globalization Creates Systemic Risks and What to Do About it* (Princeton, NJ: Princeton University Press, 2014).



# III. Navies in Sub-Threshold Competition

IN THE CONTEXT of persistent competition short of high-intensity conflict, it is likely that the role of navies will shift to that of an enabler, as opposed to a primary tool of competition, except in very specific circumstances. Instruments such as pacific blockades, once a legitimate tool of competition short of outright warfare, are unlikely to be regarded as usable in scenarios short of war.<sup>37</sup> Undeclared blockades, such as the one Russia ran in the Sea of Azov during the latter half of the last decade, can deliver meaningful economic effects.<sup>38</sup> However, such blockades typically require military escalation dominance to remain pacific. The crisis precipitated by the 1996 Chinese exercises off Taiwan (which were interpreted as a de facto blockade) is an example of the consequences when this precondition is not met.<sup>39</sup>

Nor does covert interdiction consistently offer much by way of strategic utility. Most literature on maritime covert warfare suggests that it usually has limited economic effects, that it is difficult to hide attribution in complex operations and, moreover, it often tends to lead to diplomatic repercussions that exceed the strategic value of interdicting flows of goods on a limited scale. The US mining of Nicaraguan harbours in the Reagan era, which did little to impact the Nicaraguan economy but placed the US within the crosshairs of the International Court of Justice, represents one example.<sup>40</sup> Nations can secure tactical successes through low-level maritime coercion – as Iran did when it (arguably) secured the release of the tanker *Grace 1* by seizing the British-flagged *Stena Imperio* as a bargaining chip.<sup>41</sup> This is unlikely to translate into long-term results – and may well not be preferred by nations which have a number of more economically destructive non-military sanctions to use as threats in peacetime. The major

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37. This is now axiomatic, but it was once possible to declare a pacific blockade without having entered a state of war – consider, for example, the 1902 Venezuelan crisis, when Britain, France, Germany and Italy attempted to enforce a pacific blockade to ensure debt repayment. See George Arthur Boston, 'A Doctrine Revised: The Venezuelan Crisis of 1902 and the Roosevelt Corollary', Master's thesis, Western Michigan University, 1989, <[https://scholarworks.wmich.edu/masters\\_theses/1110](https://scholarworks.wmich.edu/masters_theses/1110)>, accessed 10 January 2023.
38. Roger Hilton, 'Russia's Strategic Miscalculation in Blockading the Sea of Azov', European Leadership Network, 27 November 2018, <<https://www.europeanleadershipnetwork.org/commentary/russias-strategic-miscalculation-in-blockading-the-sea-of-azov/>>, accessed 10 January 2023.
39. Andrew Scobell, 'Show of Force: Chinese Soldiers, Statesmen and the 1996 Taiwan Strait Crisis', *Political Science Quarterly* (Vol. 115, No. 2, 2000), pp. 227–46.
40. Alexander Powell et al., 'Maritime Sabotage: Lessons Learned and Implications for Strategic Competition', CNA, October 2021.
41. *BBC News*, 'Stena Imperio: Seized British Tanker Leaves Iranian Waters', 27 September 2019.

challenge is that to have an economically meaningful effect, covert warfare has to be conducted on a scale that makes it highly likely to be attributed and treated as a *casus belli*.

There are instances where this rule may not apply, however. As discussed, when a mode of economic transfer depends on a limited number of physical avenues – such as specialised liquefied natural gas vessels or large tankers like the *Grace 1* – the interdiction of these assets will likely have disproportionate effects without necessitating large-scale action. To an extent, this may apply to shipping more broadly. The concentration of global flows of goods on increasingly large supercontainer and supertanker vessels could make the impact of losing relatively few vessels more acute.<sup>42</sup> This is likely to be especially true if tools such as sanctions limit the number of vessels that will actually risk carrying a nation's cargo in the first place. This is likely also true of infrastructure such as undersea pipelines, which are heavily concentrated. Consider, for example, the degree to which flows of Norwegian gas to the rest of Europe depend on the Baltic Pipe. Where vessels or pipelines can be damaged using relatively unsophisticated tools such as mines with disproportionate effect, an interdiction campaign that includes sabotage need not be so complex or conspicuous as to invite obvious attribution. It will, moreover, deliver significant effects. However, this is not typically the case. Most nations have the spare capacity to realign shipping in most categories of goods, and damaging large vessels requires sophisticated (and thus conspicuous) tools. Moreover, even undersea infrastructure such as cables often have multiple layers of redundancy – meaning that causing catastrophic damage will likely require sabotage on a scale that makes attribution all but inevitable. Limited sabotage in circumstances short of war can certainly have its uses, albeit under specific circumstances.

While effective non-military means of inflicting economic costs on an opponent are likely to be preferred by Western policymakers for a number of reasons, including their substantial effect and the fact that they do not (in the eyes of Western policymakers in any case) cross the threshold between peace and war, this view may not be held by target states. Iran, for example, responded to the Trump administration's maximum pressure campaign with its own campaign on limpet mining and missile attacks in the Persian Gulf which were designed, among other things, to send shock waves through global energy markets.<sup>43</sup> In effect, adversary responses to sanctions may well include military measures, partly because some prospective opponents may lack the economic heft to respond to sanctions in kind. Russia, for example, fields a substantial array of capabilities that can damage undersea infrastructure at depths that make repair difficult, if not impossible. These capabilities, operated by the Gadzhiyevo-based 29<sup>th</sup> separate submarine brigade under the direction of the Main Directorate of Deep Sea Research (GUGI), include the titanium-hulled special-purpose submarines *Project 1190*, *X-Ray* and *Losharik Belgorod*, which

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42. Bruce Jones, *To Rule the Waves: How Control of the World's Oceans Shapes the Fate of the Superpowers* (New York, NY: Simon & Schuster, 2021), p. 136. The *Grace 1* carries the equivalent of roughly 2 million barrels of fuel, see Tanker Trackers.com, 'Iranian VLCC Supertanker Detained in Gibraltar', 8 July 2018, <<https://tankertrackers.com/articles/grace1-detained-gibraltar>>, accessed 13 November 2022.

43. Sidharth Kaushal, 'Why the Strait of Hormuz Will Remain a Flashpoint with Iran', *National Interest*, 2 February 2022.



are capable of tapping and serving undersea cables.<sup>44</sup> The *Losharik*, currently under repair following a 2019 accident, is capable of interfering with undersea infrastructure at depths of up to 1,000 m – a function of its unique hull structure. The *Losharik* is comprised of a series of spherical titanium hulls – a design that maximises its capacity to withstand the pressures it endures at extreme depths and it is equipped with manipulator arms which can, among other things, interfere with objects such as cables.<sup>45</sup> In addition to these vessels and their motherships – the *Belgorod* and *Podmoskovye*, respectively a modified cruise missile submarine (SSGN) and a ballistic missile submarine (SSBN) – Russia also fields special-purpose surface vessels, such as the *Yantar*, which can act as launch platforms for unmanned assets capable of both surveying and potentially damaging undersea infrastructure.<sup>46</sup> In principle, attacks may also be conducted using auxiliary civilian vessels as launchpads for either divers or unmanned capabilities. Attacks on undersea critical infrastructure or the sustained interdiction of global information might be used as a riposte to non-military forms of economic warfare.<sup>47</sup> Notably, many of these capabilities would not be particularly survivable in an open war. The *Belgorod*, for example, is likely to be comparable in detectability to the *Oscar*-class submarines on which it is based (and with which it still shares many features, including the reactor on board). However, short of open warfare, destroying such submarines at sea is unlikely to be an option. Furthermore, while the regulation of national waters through mechanisms such as exclusion zones around critical infrastructure is viable, there exists no legal mechanism to police and secure things like cables, which traverse international waters.<sup>48</sup>

The capacity to carry out an economic campaign at acceptable cost depends, then, on the ability to defend against or deter potential military responses that do not unambiguously cross the threshold between peace and war.<sup>49</sup> The use of economic tools may become far more strategically costly. This in turn creates a requirement for naval capabilities that can mitigate these risks.

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44. GlobalSecurity, 'Main Directorate of Deep-Sea Research', <<https://www.globalsecurity.org/intell/world/russia/gugi.htm>>, accessed 23 November 2022.

45. H I Sutton, 'Spy Submarine AS-31 Losharik', *Covert Shores*, 18 July 2021, <<http://www.hisutton.com/Spy%20Sub%20-%20Project%2010831%20Losharik.html>>, accessed 10 January 2023.

46. Alexander Andreev, 'Sudno spetsial'nogo naznacheniya «Yantar» voshlo v Sredizemnoye' ['Special Purpose Vessel "Yantar" Entered the Mediterranean Sea'], *Parlamentskaya Gazeta [Publication of the Parliamentary Assembly of the Russian Federation]*, 17 November 2017, <<https://www.pnp.ru/politics/korabl-specnaznacheniya-yantar-voshyol-v-sredizemnoe-more.html>>, accessed 22 November 2022; H I Sutton, 'Russian Spy Ship Yantar Loitering Near Transatlantic Internet Cables', *Naval News*, 19 August 2021, <<https://www.navalnews.com/naval-news/2021/08/russian-spy-ship-yantar-loitering-near-trans-atlantic-internet-cables/>>, accessed 22 November 2022.

47. Bryan Clark, 'Undersea Cables and the Future of Submarine Competition', *Bulletin of the Atomic Scientists* (Vol. 72, Issue 4, 2016), pp. 234–37.

48. Christian Bueger and Tobias Liebetrau, 'Protecting Hidden Infrastructure: The Security Politics of the Global Submarine Data Cable Network', *Contemporary Security Policy* (Vol. 41, No. 1, 2021), pp. 319–413.

49. Notably, NATO's Secretary General has hinted that an attack on undersea critical national infrastructure would be a *casus belli*, but this would likely depend on Alliance consensus at the



In some instances, risk mitigation will take the form of traditional methods of SLOC protection – for example the Royal Navy’s offer to escort any British-flagged ships through the Strait of Hormuz following the *Stena Imperio* incident.<sup>50</sup> In other cases, particularly the protection of infrastructure, a new mix of tools may be needed. While navies may not have the permissions needed to destroy adversary submarines short of war, they can be vital in providing the evidence base required to use other policy instruments, such as more stringent sanctions. Moreover, calibrated peacetime sabotage depends in part on deniability – however implausible.<sup>51</sup> If a party conducting sabotage believes that ambiguity will give wavering opponents an opportunity to avoid escalation, this gives them greater latitude for action. However, if attributed, sabotage could be a *casus belli* – forcing the hands of policymakers who cannot ignore a direct and brazen attack. It follows, then, that the capacity for attribution may complicate an opponent’s decision-making by disabusing them of the notion that escalation is something they can control.<sup>52</sup> To convince an opponent that their activity will be attributed even if national policymakers might prefer otherwise may have deterrent value – in a manner analogous to Thomas Schelling’s famous metaphor about the coercive advantage a driver might receive in a game of chicken by cutting his brakes and informing his opponent of this fact.<sup>53</sup> In the context of undersea warfare, this might entail setting up channels between navies and bodies capable of independent verification and public reporting – such as private sector actors, international organisations and news outlets. Rapid data transfer would require both political consent and protocols for sharing information – neither of which are easy to achieve. However, the deterrent of having a system primed for rapid public attribution may justify an attempt to accomplish this.

Tracking special-purpose submarines such as the Russian *Belgorod* will likely require many of the same anti-submarine warfare capacities and skills that NATO navies honed during the Cold War to track Russian attack submarines. What is potentially more difficult is releasing information gathered by more expensive capabilities. Open source and commercial capabilities, cued in from military data, may provide an answer. For example, many companies operate unmanned underwater vehicles to protect privately owned infrastructure. Much in the way that commercial satellite imagery allowed the US to release data on the locations of Russian forces ahead of their invasion of Ukraine without compromising sources, commercial providers could, if cued, provide evidence on the activities of subsurface assets. Individual navies such as the Italian navy have signed data-sharing agreements with commercial internet providers to

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moment of a crisis, as well as unambiguous attribution. See Sabina Siebold and Philip Blenkinsop, ‘NATO Warns Moscow Against Attacking Allies’ Critical Infrastructure’, *Reuters*, 11 October 2022.

50. Kim Sengupta, ‘Royal Navy to Escort UK-Flagged Ships Through Gulf’, *The Independent*, 25 July 2019.

51. On implausible deniability as a means of escalation control, see Austin Carson, *Secret Wars: Covert Conflict in International Relations* (Princeton, NJ: Princeton University Press, 2018).

52. On the relationship between beliefs about controlling escalation and deterrence, see Alexander L George and Richard Smoke, *Deterrence in American Foreign Policy: Theory and Practice* (New York, NY: Columbia University Press, 1974).

53. Thomas C Schelling, *The Strategy of Conflict* (Cambridge, MA: Harvard University Press, 1960), p. 52.

generate situational awareness around cables.<sup>54</sup> Sensors on infrastructure – such as magnetic anomaly detectors, pressure detectors, passive sonar – can also serve to enable detection and are an area in which navies can lend expertise to the private sector.<sup>55</sup>

Organisational models, tactics and technology may evolve accordingly. For example, it has been suggested that a combination of unmanned underwater vehicles (UUVs) and seabed refuelling stations, such as the US's Forward Deployed Energy and Communications Outpost programme, could allow for more persistent surveillance of critical undersea infrastructure.<sup>56</sup> Similarly, where a putative opponent uses surface assets such as the Russian *Yantar* to operate near key infrastructure, non-military capabilities might be used to maintain situational awareness without drawing on naval assets. This could include the unmanned assets used by commercial enterprises like oil companies to survey their underwater assets, but also assets held by government agencies, such as coastguards. Additionally, nations such as Sweden have historically enlisted civilian communities that operate in coastal areas to reinforce their situational awareness – with the navy providing avenues of communication and basic naval literacy in these communities.<sup>57</sup> Automation may also significantly aid searches for civilian vessels being used as auxiliary assets to abet sabotage. For example, machine learning can simplify the process of tracking atypical patterns of vessel activity.<sup>58</sup> The data needed to feed such models, however, may often come from sources beyond navies, including civilian coastguards, law enforcement and commercial sources – reinforcing the need for public–private partnering.

Although deterrence by punishment, in the event of successful attribution, need not take a military form, this could be the case. Inflicting commensurate costs may be a task to which more covert means of employing maritime power may be well suited. Although not always useful as a coercive tool to secure strategic concessions or materially target a nation's economy, semi-covert operations can be used to signal the risk of escalation to an opponent.<sup>59</sup> Limited damage to a commensurately valuable or symbolically important target can serve to communicate the potential for escalating costs while limiting an opponent's immediate imperative to retaliate – as in, perhaps, Iran's attack on the MV *Mercer Street* in the wake of the Israeli sabotage campaign against Iranian vessels.<sup>60</sup> In an era where deterrence by denial may become increasingly

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54. Tom Kington, 'Italian Navy, Telecom Provider Team up to Deter Attacks on Undersea Cables', *Defense News*, 14 July 2022.

55. *Ibid.*

56. Clark, 'Undersea Cables and the Future of Submarine Competition'.

57. Elisabeth Braw, 'The Swedish Navy Asks Public to be on the Lookout', AEI, 14 April 2022, <<https://www.aei.org/foreign-and-defense-policy/the-swedish-navy-asks-the-public-to-be-on-the-lookout/>>, accessed 10 January 2023.

58. Martha Dais Ferreira, Jessica N A Campbell and Stan Matwin, 'A Novel Machine Learning Approach to Analyzing Geospatial Vessel Patterns Using AIS Data', *GIScience & Remote Sensing* (Vol. 59, No. 1, 2022), pp. 1473–90.

59. Jack Watling, 'Sharpening the Dagger: Optimising Special Forces for Future Conflict', *Whitehall Report*, 1-21 (May 2021), p. 14.

60. Frank Gardner, 'Mercer Street: Tanker Blast Evidence Points to Iran, Says US', *BBC News*, 7 August 2021.

difficult, the scale of undersea infrastructure makes protecting all of it prohibitively costly, and above-the-surface convoying may become increasingly difficult due to the aversion of commercial actors to convoys. All of this will be compounded by the limited number of hulls available to Western navies. Thus deterrence by punishment may become an increasingly important means of preventing an opponent's use of military forms of peacetime economic coercion.<sup>61</sup> Insofar as such signalling relies on both parties sharing an understanding of what is happening – lest one side interpret an action as a prelude to broader escalation – restricting retaliation in the same domain as the initial provocation may have value as a signalling tool.<sup>62</sup> Alternatively, against an opponent such as Russia, which has a number of critical assets concentrated offshore in regions such as the Arctic, deterrence by punishment might take the form of punitive sabotage.<sup>63</sup> In any case, meeting the challenge of maritime sabotage is likely to involve internalising risks of escalation – either through making attribution explicit or because covert punishment carries its own risks. This is a challenge that will need to be met at the level of policymakers as much as navies.

There is a final way in which navies can exhaust adversaries' capacity for economic sabotage – by exhausting adversary capacity. Organisations such as the GUGI – Russia's Main Directorate of Deep Sea Research – are both empowered and limited by the specialisation of their personnel. To qualify, an individual needs to have served on a submarine for five years before going through a training and fitness regimen based on cosmonaut training, followed by additional technical specialisation.<sup>64</sup> The salaries of GUGI personnel – which were 600,000 roubles a month in 2012 (around \$20,000 at the time) – reflect this, making them the highest-paid individuals in the Russian military.<sup>65</sup> However, specialisation also means limited capacity – especially as the GUGI is also responsible for surveillance, manning undersea sensor networks, staking territorial claims in areas such as Lomonosov, and acting as carriers for nuclear capabilities such as the Poseidon torpedo. There are not many people in any other country who can perform the tasks of the GUGI's personnel. The organisation asks a great deal of a limited number of people, and one can reasonably infer both a high level of stress and overwork. Western navies can exacerbate this by, for example, conducting a steady tempo of exercises near Russian sensor networks in peacetime or particularly high-intensity tracking of GUGI assets – all of which will both spread personnel thin and contribute to a risk of organisational burnout.

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61. Chris Harmer, 'Here's Why Naval Convoys are an Ideal Solution Hated by Everyone', *The Drive*, 1 December 2019, <<https://www.thedrive.com/the-war-zone/29097/heres-why-naval-convoys-are-an-ideal-solution-hated-by-everyone>>, accessed 10 January 2023; on hull numbers, see James Holmes, 'Bad News: US Navy Convoys are Not Ready for Great Power War', *National Interest*, 19 July 2019.

62. On signalling and shared understanding, see Schelling, *The Strategy of Conflict*, pp. 267–91.

63. See Sidharth Kaushal et al., *The Balance of Power Between Russia and NATO in the Arctic and High North*, RUSI Whitehall Paper 100 (London: Taylor and Francis, 2022), pp. 1–20.

64. Vladimir Ashik, 'Hydronaut', *Zhurnal Morskoye nasledie (Maritime Heritage Magazine)*, 13 December 2014, <<http://oosif.ru/ashik-v-m-gidronavt-1>>, accessed 24 November 2022.

65. Aleksey Mikhailov, 'Serdyukov nezakonno podnyal zarplatu gidronavtam do 600 tysyach rubley' ['Serdyukov Illegally Raised the Salaries of Hydronauts to 600 Thousand Roubles'], *Izvestiya*, 24 June 2013.

Beyond countering sabotage, navies can contribute to national efforts to defend against adversary economic warfare in two ways. First, they can contribute to a wider competition for influence which extends to key parts of the global economy. To use an example, the PRC currently accounts for roughly 48% of global shipbuilding and either owns or operates (via companies such as COSCO Shipping) 16 of the world's 20 busiest ports.<sup>66</sup> In principle, the PRC could pass legislation constraining Chinese companies that operate ports from servicing certain nations' vessels, or these companies could deny vessels access tacitly while relying on other pretexts. There is no historical case of China doing this, but it would mirror other cases of coercion by both China and other nations. For example, following dissident writer Liu Xiaobo's award of the Nobel prize, the PRC conducted a de facto embargo of Norwegian salmon, in the form of additional customs checks.<sup>67</sup> In effect, a de facto denial of commercial access was enacted as a punitive measure under the aegis of an administrative measure.

Similarly, the recent US legislation on semiconductor technology effectively covers not just US companies but all companies that use American technology in this area, including South Korean and Taiwanese giants. In other words, if China did use its centrality to trade networks in the way described, it would hardly be an anomaly. Denying either freight or port access to an opponent, then, could well be an offensive (and non-military) instrument in the PRC's economic toolkit – particularly if it becomes even more central to maritime trade.

While avoiding a potential rival exercising this level of control over global shipping is a diplomatic, rather than naval, concern, naval engagement can play a key role in blunting the potential for maritime power to be used coercively. Of course, navies cannot force the opening of ports. They can, however, form part of a wider diplomatic outreach intended to limit any one nation's capacity to control critical trade flows. Naval constabulary activity could be used as an extension of economic policy to incentivise commercial shipping to ports operated by friendly nations. By way of an analogue, during the Iran–Iraq War, demand for US flagging rose substantially, given the protection (and thus lower insurance costs) this provided. Western nations conducting constabulary activity at sea today could, for example, extend selective protection against key threats to vessels that chose to affiliate themselves in a wider way with the maritime networks of nations providing protection. For example, vessels transiting ports receiving investment under the competing Free and Open Indo-Pacific framework might receive priority protection against threats such as piracy compared with those using Belt and Road Initiative ports.<sup>68</sup> Similar forms of tacit issue linkage might be pursued with respect to cooperation against other non-traditional security threats such as piracy or illegal, unreported and unregulated (IUU) fishing, with cooperation on a more sustained basis with nations operating a diversified port

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66. Anthony Cordesman, 'The Other Side of Chinese Sea Power: "White Area Warfare"', Center for Strategic and International Studies, 4 April 2022.

67. Mark Lewis, 'Norway Salmon Rot as China Takes Revenge for Dissident's Nobel Prize', *The Independent*, 6 October 2011; *Financial Times*, 'How US Chip Export Controls Have Turned the Screws on China', 1 October 2022.

68. On the Free and Open Indo-Pacific Initiative, see Ministry of Foreign Affairs Japan, 'Free and Open Indo-Pacific', <[https://www.mofa.go.jp/policy/page25e\\_000278.html](https://www.mofa.go.jp/policy/page25e_000278.html)>, accessed 10 January 2023.

infrastructure. Although navies cannot drive peacetime economic competition, therefore, they can potentially contribute to it both directly and indirectly.

Second, navies can in peacetime set the conditions for the conduct of economic warfare in situations above the threshold of conflict. Persistent engagement in peacetime will also be vital to gathering the information critical to waging economic warfare in conflict. The ability to map both one's own and one's opponents' critical offshore infrastructure and vectors of approach to it is, for example, a function of peacetime activity, forming part of mapping and research, which both support understanding. Presence also creates an opportunity for more clandestine information-gathering activity. Consider, in the latter vein, initially successful cable-tapping operations such as Operation Ivy Bells, which saw the US Navy tap Soviet military cables in the Sea of Okhotsk.<sup>69</sup> In the context of economic warfare, undersea cables which carry the vast majority of the world's financial data and 95% of all internet traffic could represent a source of information about economic networks and the flow of transactions, which could be weaponised in both peacetime and conflict.<sup>70</sup> For example, data on shipping transactions could be combined with network and pattern-of-life analysis of vessels' destinations to identify vessels of interest prior to a conflict and thus limit disruptions of trade to third parties.<sup>71</sup> Consider, for instance, the frequent use of illicit shipping networks embedded within legitimate industries to circumvent economic barriers. Mapping these networks in peacetime could set the conditions for activity to be taken against them in conflict as a pre-emptive measure.<sup>72</sup> This would need to be combined with the ability to release evidence gathered through potentially sensitive means through other avenues, with the use of open source intelligence growing in prominence as a means by which policymakers can validate their claims without revealing their sources.<sup>73</sup> Currently data-gathering activity is likely limited to landing sites of cables, which entails fewer legal complexities.<sup>74</sup> As competitors develop alternative cable networks over which Western nations have little oversight, this route may become less viable.<sup>75</sup> In this context, there may be few alternatives to more direct efforts to gather data from undersea cables. That said, the political risks of such activity will need to be weighed carefully against strategic rewards.

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69. Matt Blitz, 'How Secret Underwater Tapping Helped End the Cold War', *Popular Mechanics*, 30 March 2017, <<https://www.popularmechanics.com/technology/security/a25857/operation-ivy-bells-underwater-wiretapping/>>, accessed 10 January 2023.

70. See Nicole Starosielski, *The Undersea Network* (Durham, NC: Duke University Press, 2021), p. 1.

71. On pattern-of-life analysis in the maritime domain, see Alya Itani and Cyril Ray, 'Introducing the Pattern of Life (PoL) Concept for Maritime Traffic', Naval Academy Research Institute, 2019, pp. 1–10.

72. For a discussion of these networks in the context of North Korean sanctions evasion, see James Byrne and Joseph Byrne, 'Black Gold: Exposing North Korea's Oil Procurement Networks', RUSI, 22 March 2021.

73. *Ibid.*

74. Garrett Hinck, 'Evaluating the Russian Threat to Undersea Cables', *Lawfare*, 5 March 2018.

75. Justin Sherman, 'Beijing's Growing Influence on the Global Undersea Cable Network', *China Brief* (Vol. 21, No. 18, 2021).

Beyond this, there are also ways in which navies can contribute to the offensive dimensions of economic warfare to complement the effect of sanctions. Interdiction can be conducted both openly and legally when vessels pass a nation's territorial waters. While it is a relative rarity for a vessel to stray into the territorial waters of a hostile state, this may be difficult to avoid if they cover maritime chokepoints. The right of transit through territorial waters that extend over maritime straits is, in principle, guaranteed by Article 38 of the United Nations Convention on the Law of the Sea.<sup>76</sup> However, this right is conditional on certain factors. First, the unconditional right of transit depends on the absence of alternative avenues through a given strait.<sup>77</sup> Should this not be the case, as in the seizure of the *Grace 1*, which could have transited through the Strait of Gibraltar without transiting UK territorial waters, rights are somewhat more constrained. Secondly, nations can deny vessels transit if they pose a pollution risk, and this intersects with Western dominance over areas such as maritime insurance. An illustrative example is the recent case of insurance being denied to vessels carrying Russian oil for sale above the G7 oil cap – which denies them insurance to cover environmental liabilities, and thus permits states straddling chokepoints, such as Turkey, to deny them access.<sup>78</sup>

Moreover, as the recent seizure of the Russian cargo ship *Baltic Leader* by France in the English Channel illustrates, there is sometimes a degree of ambiguity about whether a vessel did in fact enter a nation's territorial waters.<sup>79</sup> This ambiguity can be exacerbated through tools such as Automatic Identification System (AIS) spoofing, which can obscure the exact location of a ship. For example, the spoofing of HMS *Defender's* AIS in 2021, which led to the vessel's location erroneously being reported as being off the coast of Sevastopol.<sup>80</sup> In effect, there are a number of ways in which states straddling maritime chokepoints can leverage this advantage in peacetime without contravening customary international law.

In peacetime, then, the traditional defensive function of navies will likely become more expansive as opponents seek to affect a wider range of targets. Adaptations might include the thickening of information networks, but additionally could encompass more aggressive options to erode adversary capacity and deter by punishment.

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76. 'United Nations Convention on the Law of the Sea', Article 38, <[https://www.un.org/depts/los/convention\\_agreements/texts/unclos/unclos\\_e.pdf](https://www.un.org/depts/los/convention_agreements/texts/unclos/unclos_e.pdf)>, accessed 24 November 2022.

77. 'United Nations Convention on the Law of the Sea'.

78. Alex Lawson, 'Oil Tankers Queue up off Turkey as Price Cap on Russian Crude Begins', *The Guardian*, 6 December 2022.

79. Michael C Petta, 'The Seizure of a Russian Vessel Raises Questions About High Seas Freedoms', *Lawfare*, 16 March 2022.

80. Tom Bateman, 'HMS Defender: AIS Spoofing is Opening up a New Front in the War on Reality', *Euronews*, 28 June 2021.





## IV. Wartime: Naval Core Functions

**I**N WARTIME, THERE are three core economic warfare functions to which navies can make an important contribution: controlling the flow of goods; controlling flows of information; and destroying means of military production.

The first is a time-honoured naval role.<sup>81</sup> The ability to control vital resource flows, from energy to raw materials for high-end weapons such as cobalt, bauxite and rare earths, can potentially restrict an adversary's capacity for long-term conflict.<sup>82</sup> Similarly, constraining a nation's capacity to export – and thus restricting access to tradeable currency – can have a deleterious impact on its capacity to secure key inputs. It is noteworthy that in some categories, particularly rare earths, some prospective rivals, such as the PRC, are net producers. Any prospective rival, however, relies on offshore imports for some inputs, although the nature of these imports depends on the country's economic structure. To be sure, substitution can and does generally occur – consider, for example, Germany's use of synthetic fuels during the Second World War – but this typically entails an efficiency cost.<sup>83</sup> Imports can be rerouted through third parties, albeit at an efficiency cost due to longer transit routes and limitations on the port capacity of third-party states. The effect of a blockade is not exclusively measured in terms of absolute scarcity but rather substantial efficiency costs which limit an opponent's ability to efficiently marshal resources. To this one might add that states such as Russia rely on exports carried primarily at sea (at least in the case of oil, but not gas) to generate the hard currency needed to purchase inputs.<sup>84</sup>

There is also the question of neutral and allied commerce, which complicates blockades politically. For example, a distant US blockade of China in a military conflict, aimed at controlling SLOCs at chokepoints such as Malacca, would also impose hardships on nations within the

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81. See, for example, Andrew Lambert, *The Crimean War: British Grand Strategy Against Russia 1853–56*, 2<sup>nd</sup> Edition (Farnham: Ashgate, 1990); Payson O'Brien, *How the War Was Won*.

82. For a useful discussion of the raw material inputs involved in defence supply chains, see US Department of Defense, 'Securing Defense-Critical Supply Chains: An Action Plan Developed in Response to President Biden's Executive Order 14017', February 2022.

83. Tooze, *The Wages of Destruction*, p. 116.

84. Transport & Environment, 'How Russian Oil Flows to Europe', 8 March 2022, <<https://www.transportenvironment.org/discover/how-russian-oil-flows-to-europe/>>, accessed 10 January 2023.



first island chain – many of them allied to the US.<sup>85</sup> Similarly, Russian maritime access from St Petersburg can be constrained at the Denmark Strait (assuming a wartime abrogation of the 1857 Treaty of the Sounds), but at a cost to the Baltic and Nordic states.

While an obvious solution would be allowing transit selectively, precision regarding a vessel's destination is likely to be difficult to achieve in many cases. Insofar as the ownership of merchant shipping has become more diffuse – with vessels' ownership and flag registry often being held in different nations – it is difficult to identify shipping as 'belonging to' a given nation.<sup>86</sup> Moreover, vessels can conduct transactions on the high seas, transfer goods to a target nation's vessels while on the high seas after having run a cordon, and can also take measures to obscure their ultimate destinations. Tracking vessels engaged in this sort of activity is possible, but highly time and labour intensive.<sup>87</sup>

As such, a given chokepoint can be closed to all vessels – but only at the cost of imposing hardships on nations within the cordon. To be a discriminate tool of statecraft, a blockade must ideally be a close blockade, maintained near a target state's ports rather than at distant chokepoints. This, however, entails risks to vessels posed by proliferating anti-access capabilities.<sup>88</sup> This is not necessarily an insurmountable challenge, as trends in areas such as automation and new forms of offensive mining offer particular promise, as discussed in the next chapter.

The second major challenge, particularly with respect to interdicting energy supplies, is overland transit. While not particularly efficient, overland transit routes across Central Asia can meaningfully mitigate some risks for both suppliers of energy, such as Russia, and consumers, such as China. Overland energy routes do, however, have their own bottlenecks. For example, overland oil and gas pipelines typically lead to a relatively limited number of terminals. The operation of the latter also depends on compressor and control stations, which are prone to both kinetic and non-kinetic disruption.<sup>89</sup> These bottlenecks are often deep within the infrastructure of a potential target. However, emerging prompt strike capabilities, many of which will be held on naval platforms such as SSGNs and ships, given their size, can potentially target these bottlenecks at reach.<sup>90</sup> As such, blockades may retain their significance but may

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85. Gabriel Collins, 'A Maritime Oil Blockade Against China: Tactically Tempting But Strategically Flawed', *Naval War College Review* (Vol. 71, No. 2, 2018), pp. 1–20.

86. Gabriel Collins and Andrew Erickson, 'China's Efforts to Create a National Tanker Fleet', in Gabriel Collins and Andrew Erickson (eds), *China's Energy Strategy: The Impact on Beijing's Maritime Policies* (Annapolis, MD: Naval Institute Press, 2013).

87. For a discussion of the methods of evasion taken against sanctions regimes and the process of identifying offending vessels, see Byrne and Byrne, 'Black Gold'.

88. On anti-access/area-denial capabilities, see Jack Watling, Justin Bronk and Sidharth Kaushal, 'A UK Joint Methodology for Ensuring Theatre Access', *Whitehall Report*, 4-22 (May 2022).

89. S M Folga, 'Natural Gas Pipeline Technology Overview', Argonne National Laboratory, November 2007.

90. For example, the US Common-Hypersonic Glide Body, see Jen Judson, 'Next Flight Test of Hypersonic Glide Body Expected at Year's End', *Defense News*, 11 August 2021.

evolve to include a greater emphasis on close blockades than has been conducted for many years, coupled with a heavier emphasis on air and missile interdiction at depth. In addition, the defensive component of sea control – denying an adversary the capacity to disrupt one's own strategic flows of goods – will remain crucial. Against threats such as special purpose submarines designed to attack undersea infrastructure, this task may become much more simple in wartime – becoming effectively another part of an anti-submarine warfare (ASW) mission. The possibility that an opponent with a large surface fleet might use a portion of this fleet as commerce raiders, or rely on auxiliary vessels for sabotage and interdiction, might create new operational demands, however. In addition to the capacity for processing information about anomalous vessel behaviour, managing this risk would necessitate enough vessels to both operate near a theatre and police more distant SLOCs. At the strategic level, this would seem to reinforce the imperative to both expand and integrate Alliance structures. For example, in a contingency involving China, the capacity of European navies to conduct SLOC protection in the wider Indo-Pacific might free US and regional naval assets for activity in the Western Pacific.

The second function navies can play is the control of information flow and denying this control to an opponent. The reliance of nations on undersea cables for access to the global internet creates threats, but also opportunities – for both blunt force information denial (by severing the cables themselves) and more subtle forms of control, such as tapping them to both monitor and control information flows. In this function, naval assets will likely join other instruments of information warfare, such as cyber capabilities, and the organisational frameworks needed to ensure deconfliction will need to be considered (although this is beyond the scope of this paper). It has been argued that concerns about the collapse of the global internet as a result of undersea cables being severed are overblown, given the sheer number of cables and the redundancies within the system.<sup>91</sup> This is not to say that individual nations cannot have their access to undersea networks severed.<sup>92</sup> Britain, for example, did precisely this to German telegraph cables during the First World War.<sup>93</sup> Notably, this was helped by the fact that German cables, like German ships, ran through chokepoints that Britain controlled. Although undersea cables are often described as a Western and Allied vulnerability, the exterior lines of communication and redundant cables within communications networks straddling the Atlantic and Pacific suggest the opposite may be true. Western rivals such as Russia and China are linked to the global economy by a much narrower subset of undersea cables that often run through chokepoints that they do not patrol – mirroring the flow of goods.<sup>94</sup> Western navies do not,

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91. Garrett Hinck, 'Evaluating the Russian Threat to Undersea Cables', *Lawfare*, 5 March 2018, <<https://www.lawfareblog.com/evaluating-russian-threat-undersea-cables>>, accessed 23 December 2022.

92. *Ibid.*

93. Jonathan Reed Winkler, 'Telecommunications in World War I', *Proceedings of the American Philosophical Society* (Vol. 159, No. 2, 2015), pp. 162–68.

94. For a useful (though incomplete) open source map of the world's submarine cables, see TeleGeography, 'Submarine Cable Map', <<https://www.submarinecablemap.com/>>, accessed 31 August 2022.

unlike their Chinese and Russian counterparts, need to run the gauntlet of a chokepoint to impact the operation of these cables.

Even a temporary loss of connectivity can have substantial ramifications at a national level – for example, in 2006 earthquake damage to Taiwan’s undersea cables temporarily impacted 60% of telecommunications traffic.<sup>95</sup> As noted above, one study has suggested that the economic cost of a temporary loss of connectivity in a digitised economy is more than \$23 million for every 10 million people per day.<sup>96</sup> While the Taiwanese damage was fixed in due course, a more concerted effort at disruption by a conscious actor – aiming, for example, at disrupting cables at depths that make repair difficult and targeting repair vessels – would have had a more consistent effect.

The severing of cables will not, in all likelihood, entirely isolate a nation from global information flows by itself. Cable networks have multiple redundancies, and nations such as China have also invested in terrestrial networks such as the TEA-3, which connects the Chinese and Russian domestic backbone networks.<sup>97</sup> This being said, terrestrial alternatives have drawbacks, including a lack of standardisation among national backbone networks, which means that they can only operate on a bilateral basis.<sup>98</sup> Moreover, the loss of access to avenues for communications would still substantially slow the pace of data transfer if more limited terrestrial architectures had to be relied on. Given the importance of temporal concerns in areas such as finance, this is economically significant. Consider, for example, the severing of the main cable linking Egypt and Europe in 2013, which impacted 60% of Egypt’s traffic even though it did not stop information flows entirely.<sup>99</sup> Moreover, in a conflict scenario control over cable chokepoints could be combined with cyber attacks on financial institutions and sanctions. It could, in effect, be one of multiple dilemmas imposed on an adversary’s economic defences.

More subtle forms of control might entail leveraging the fact that many cable networks converge on islands, such as Guam, Singapore and Great Britain.<sup>100</sup> Needless to say, rival states such as China are building alternative cable networks to circumvent these chokepoints.<sup>101</sup> The selective targeting of these safe networks could have the effect of forcing a nation’s data through island chokepoints where a number of means of control might be applied (so long as the political authorities controlling the island agree). For example, a reconfigurable optical add/drop multiplexer might be used to block wavelengths on specific channels which correspond

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95. Jon Herskovitz and Rhee So-eui, ‘Taiwan Quake Shakes Confidence in Undersea Links’, *Reuters*, 21 January 2007.

96. Deloitte, ‘The Economic Impact of Cable Disruptions to Internet Connectivity’.

97. China Academy of Information and Telecommunications Technology, ‘White Paper on China International Optical Cable Interconnection (2018)’, August 2018, pp. 10–12.

98. China Academy of Information and Telecommunications Technology, ‘White Paper on China International Optical Cable Interconnection (2018)’.

99. Clark, ‘Undersea Cables and the Future of Submarine Competition’.

100. Starosielski, *The Undersea Network*, pp. 400–10.

101. Sherman, ‘Beijing’s Growing Influence on the Global Undersea Cable Network’.

to a given nation's traffic.<sup>102</sup> Or, data from a given nation could be harvested at these landing points to enable blockades or sanctions by identifying relevant institutions and actors with greater granularity.<sup>103</sup>

A more extreme approach might entail a convergent effort to sever all of a nation's subsea cables and interdict its terrestrial alternatives. In principle, terrestrial cable networks converge on stations which are vulnerable to cyber attacks or physical destruction.<sup>104</sup> They are highly liable to environmental damage (one of the reasons submarine cables are preferred), meaning that if friendly local actors can be cultivated in a target state, they can potentially damage cables at limited risk to themselves.<sup>105</sup> Indeed, such damage often happens in peacetime – for example, a pensioner in Georgia temporarily cut Armenia's internet in 2011 while scavenging for copper.<sup>106</sup> Alternatively, should cable networks through third-party states, such as the China–Pakistan Economic Corridor, run through politically volatile areas, available partners may be used in a similar capacity.<sup>107</sup> The planning requirements and effects of such an approach require further study.

On the one hand, there is no precedent for a national economy being rapidly laid low in the way described. On the other, consider the comment of a British Naval Intelligence Division officer discussing the Ballard report, which similarly envisioned blockades serving as a means of rapid war termination in Germany. As the officer had it, 'It is a historical fact that no war has hitherto been brought to an end by such means ... but on the other hand it must be remembered that the modern industrial situation is unprecedented'.<sup>108</sup> Further work involving tools such as complexity theory might illuminate the scale and speed of the contagion effects such an approach could produce in a target economy. This approach would likely be far more escalatory and potentially risk relations with neutrals, but in the context of a great power war – which necessarily entails both risks in any case – it could be considered viable, if it held out the prospect of rapid victory. It would necessarily entail broad-based coordination among not only navies but agencies that hold national cyber assets such as the UK's GCHQ and the US Cyber Command, as well as special forces. This level of coordination would likely entail substantial pre-planning, given that many tools such as cyber attacks and the use of friendly non-state actors are slow-moving tools that can only be activated if preparatory work is done years in advance, as one former GCHQ official

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102. Michael Sechrist, 'New Threats to Old Technology: Vulnerabilities in Undersea Communications Cable Network Management Systems', Harvard Kennedy School Belfer Center, February 2012.

103. *Ibid.*

104. China Academy of Information and Telecommunications Technology, 'White Paper on China International Optical Cable Interconnection (2018)', pp. 10–12.

105. On environmental damage, see *ibid.*

106. *BBC News*, 'Pensioner in Georgia Cuts Armenia Off from Internet', 6 April 2011.

107. Shazar Shafqat, 'CPEC and the Baloch Insurgency', *The Diplomat*, 12 February 2017.

108. Nicholas A Lambert, *Planning Armageddon: British Economic Warfare and the First World War* (Cambridge, MA: Harvard University Press, 2012), p. 112.

has noted.<sup>109</sup> In effect, this would entail the existence of a body empowered to coordinate the conduct of economic warfare.

A final way in which maritime power can support economic warfare is through the strategic interdiction of production. Emerging maritime prompt strike capabilities can perhaps deliver their greatest value against large concentrated defence industrial clusters held in areas presumed safe by opponents. Defence clusters such as China's 210,000-acre Factory 211 (which produces the bulk of the DF-21 missile series) and Russia's Sevmash at Severodvinsk and the Uralvagonzavod factory at Nizhny Tagil are all geographically concentrated to rationalise production.<sup>110</sup> They are generally held at depth and are likely to be heavily defended in a conflict scenario. This places them beyond the reach of many air assets while others (such as strategic bombers) will likely be able to operate against them only at great risk. Targeting means of production may, however, be a potentially highly useful wartime function for emerging families of hypersonics, such as the US's emergent prompt strike capability or, potentially, the envisioned UK hypersonic capability.<sup>111</sup> Although typically envisioned as assets to target anti-access/area-denial systems, these capabilities will combine the qualities of range and a high likelihood of survival against air defences needed to strike defence industrial targets at depth. Strategic bombing delivers limited effects against some things, such as machine tools, which are generally very resilient. That being said, it can deliver results in other areas by, for example, eliminating skilled human capital or more fragile machinery. Consider, to use one example, the fragile lithography machinery on which the manufacture of the semiconductors needed for smart munitions depends.<sup>112</sup> Currently, even China struggles to produce these machines, and when it is able to do so will likely have limited numbers.<sup>113</sup> Where technology is non-substitutable, strategic bombardment may have significant effects.<sup>114</sup>

Although unlikely to halt production in any category, the risk of destruction will force inefficient adaptations – such as dispersing facilities – or costly defence measures such as diverting air and missile defence platforms from front-line functions to ensure rear area security. It is notable

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109. Sally Walker, former director of Cyber, GCHQ, remarks given at RUSI Missile Defence Conference, London, 24 February 2022.

110. On China's missile production, see Peter Wood and Alex Stone, *China's Ballistic Missile Industry* (Montgomery, AL: China Aerospace Studies Institute, 2021), pp. 50–60; on Russian facilities, see Johan Engvall, 'Russian Military R&D Infrastructure: A Primer', Swedish Defence Research Agency, April 2021, pp. 20–26.

111. See Lee Willett, 'HALO Programme Accelerates US Navy Hypersonic Capability Drive', *Naval News*, 5 September 2022; George Allison, 'Royal Navy Aiming to Become a Global Leader in Hypersonic Weapons', *UK Defence Journal*, 12 February 2022.

112. ASML, 'EUV Lithography Systems', <<https://www.asml.com/en/products/euv-lithography-systems>>, accessed 24 November 2022.

113. Justin Feng, 'Lithography: The Achilles Heel of China's Semiconductor Industry', *The Diplomat*, 1 August 2022.

114. Steven Lobell, 'A Granular Theory of Balancing', *International Studies Quarterly* (Vol. 62, No. 3, September 2018), pp. 593–605.

that even Russia and China, while they have heavily emphasised air defence, do not have an endless supply of defensive systems. Russia, for example, is likely to field five S-500 surface to air missile brigades – meaning that resource trade-offs will be felt.<sup>115</sup> Moreover, the need to produce additional air defence systems can draw resources from other vital tasks. This need to develop air defences imposed significant costs on the wartime German economy during the Second World War and forced the reallocation of resources from other tasks. Given the rise in the complexity of modern air and missile defence systems relative to older analogues, this would likely be the case today.<sup>116</sup> To use an example, a Patriot battery costs nearly \$1 billion.<sup>117</sup>

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115. Major General Valeri Saar, remarks given at RUSI Missile Defence Conference, London, 23 February 2022.

116. Payson O'Brien, *How the War Was Won*, pp. 250–305.

117. Jen Judson, 'Poland Has Sticker Shock Over "Unacceptable" Cost for Patriot Buy', *Defense News*, 6 December 2017.



# V. Tactical and Operational Dimensions of Economic Warfare at Sea

**H**AVING DISCUSSED THE strategic dimensions of economic warfare, this chapter focuses on the tactical and technical factors at play. It examines how changes in the current operating environment will shape the tools and procedures used by navies as they wage economic warfare.

## Blockades in an Anti-Access/Area-Denial Context

While the adroit exploitation of data in peacetime may allow for some interdiction to occur at reach at maritime chokepoints, significantly impacting the scale of an opponent's imports without damaging Allied and neutral trade will likely require close blockades. One of the challenges facing blockading powers as the 20th century progressed was the difficulty of maintaining a close blockade. Torpedo boats, mines, coastal artillery and a range of other threats combined to make the maintenance of a cordon around enemy ports exceedingly risky.<sup>118</sup> In the contemporary operating environment, this challenge has only become more complex as ground-based cruise and ballistic missiles with enabling ISR networks, UAVs and submarines join the range of capabilities that can hold vessels at risk in littoral spaces.<sup>119</sup> The challenge is not that vessels cannot operate at close distances to hostile shores, but that the longer they remain the greater the risks, especially as the maintenance of a cordon by necessity implies the surrender of at least some tactical mobility.

This being said, the 20th century also provided insights into how the challenge might be overcome. In particular, an oft-unstated lesson of this era is the promise of offensive mining, if backed by appropriate air and naval assets. Examples including Operation *Pocket Money* (the Nixon administration's mining of Haiphong harbour during the Vietnam War) and Operation *Starvation* during the Second World War illustrate the potentially devastating impact that mine warfare can have.<sup>120</sup> The former substantially reduced North Vietnam's access to military resupply from its allies, while the latter imposed significant shortages on Imperial Japan in a number of areas, including food. Mines are, by virtue of their price and persistent presence, an effective

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118. Andrew Lambert, *The British Way of War: Julian Corbett and the Battle for a National Strategy* (London: Yale University Press, 2022), p. 196.

119. Milan Vego, 'On Littoral Warfare', *Naval War College Review* (Vol. 68, No. 2, 2015), pp. 1–39.

120. On Operation *Pocket Money*, see Spencer Tucker, *Naval Blockades During the Vietnam War* (Abingdon: Routledge, 2005); on Operation *Starvation*, see US Strategic Bombing Survey, *The War Against Japanese Transportation, 1941–1945* (Washington, DC: Government Printing Office, 1947).



barrier to operating near an opponent's ports which need not necessarily impact vessels not transiting them. The de facto Russian blockade of Odesa, which was maintained even after the Russian Black Sea Fleet lost its freedom of action near Ukrainian shores due to Ukraine's possession of domestic and Western anti-ship missiles, is an example.<sup>121</sup> In a contemporary context, traditional categories of naval mine such as rocket-propelled or moored mines are joined by newer categories of 'smart' mine such as the US Navy's Hammerhead, which has its own sensor-processing and communications suites.<sup>122</sup> This, notably, makes the mine capable of target discrimination and, moreover, allows for it to be legally emplaced in peacetime.<sup>123</sup> To this we might add the potential for the weaponisation of gliders and unmanned underwater vessels as de facto smart torpedoes, which a number of nations such as Iran have already done.<sup>124</sup> Of course, emplacing mines near contested shores is likely to be highly risky. However, mitigations exist, including the use of submarines as minelayers (as Russia does with the *Kilo*-class) or launching mines from aircraft at standoff ranges (as the US plans to do with the Quickstrike mine<sup>125</sup>). Unmanned capabilities – both UAVs and unmanned surface and underwater vessels (USVs/UUVs) – could also be risked in minelaying functions where other assets might not. USVs could also serve as a means of enforcing close blockades against shipping in hostile ports if used as suicide boats, much as the Yemeni Houthis have used them.<sup>126</sup> That said, this requires coordination with fleet assets. For example, during Operation Pocket Money, US destroyers were needed to stave off the risk posed to minelaying US Air Force aircraft by the North Vietnamese air force.<sup>127</sup> Using more disposable capabilities to exercise sea control near hostile shores might raise the threshold of tolerance for losses, but ensuring they are not entirely eliminated still requires manned vessels and aircraft to provide support, albeit at reach. For example, a guided missile destroyer's long-range air defences might provide cover to air assets taking part in a mining operation, or an aircraft equipped with an anti-ship cruise missile might engage a ship that could otherwise eliminate a number of USVs. This might result in a dynamic whereby sea

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121. Sam Mednick, 'Concerns Rise as Russia Resumes Grain Blockade of Ukraine', *AP News*, 30 October 2022, <<https://apnews.com/article/russia-ukraine-biden-europe-black-sea-crimea-4d00fd0378175a7f73b4778ca71cb045>>, accessed on 23 December 2022.

122. David Hambling, 'With Hammerhead Mine, US Navy Plots New Style of Warfare to Tip Balance in South China Sea', *Forbes*, 22 October 2020.

123. *Ibid.*

124. T X Hammes, 'Expeditionary Operations in the Fourth Industrial Revolution', *MCU Journal* (Vol. 8, No. 1, 2017), pp. 82–107.

125. Richard Burgess, 'Navy Orders Extended Range Glide Kits for Sea Mines', *Seapower*, 23 July 2021, <<https://seapowermagazine.org/navy-orders-quickstrike-extended-range-glide-kits-for-sea-mines/>>, accessed 23 December 2022.

126. Caleb Weiss, 'Houthis Increase Use of Suicide Drone Boats in Recent Weeks', *Threat Matrix*, 11 March 2020, <<https://www.longwarjournal.org/archives/2020/03/houthis-increase-use-of-suicide-drone-boats-in-recent-weeks.php>>, accessed 10 January 2023.

127. William Greer, 'The 1972 Mining of Haiphong Harbour: A Case Study in Naval Mining and Diplomacy', Institute for Defence Analysis, 1997, pp. 1–5.

control is exercised by relatively cheap capabilities, while the modern analogue to a battlefleet exists to keep an opponent's own main force in check.<sup>128</sup>

The durability of a mining campaign depends on the capacity to restrict an opponent's ability to de-mine waters. Iran, for example, would use standoff capabilities like the Noor cruise missile in the Strait of Hormuz to target mine-clearing vessels and other naval assets contributing to mine clearing.<sup>129</sup> The manned component of a fleet should have the capacity, then, to either eliminate or limit the freedom of operation of mine countermeasure vessels, which can be provided in principle by both standoff capabilities and naval aviation.<sup>130</sup> Unmanned mine-clearing assets like UUVs might be a more challenging capability to disrupt, although they would likely depend on host vessels and control centres to operate.<sup>131</sup> Ultimately, any system of mining would likely not hermetically seal hostile ports. Minefields would be partially cleared and likely need to be reseeded. However, given that shipping depends on factors such as the availability of insurance, raising risks to sufficient levels may be enough to drastically reduce activity in hostile ports.

Ground-based standoff, such as the assets planned for the US Marine Corps' amphibious littoral regiments, could also in principle support a close blockade by targeting naval vessels from offshore positions. It has also been suggested that amphibious raider units operating from offshore positions like Gotland Island in the Baltic are costly to suppress and could contribute to the enforcement of a close blockade through the seizure or interdiction of vessels at a point where their ultimate destination is known.<sup>132</sup>

While the focus of this chapter has been on close blockades, due to the informational costs of distant interdiction, it is important not to make too totalising an argument here. Bottlenecks in information gathering can be circumvented through the use of anomaly detection software, and vessels that have entered a hostile port can be tracked and interdicted on subsequent voyages. Open source intelligence analysis has also demonstrated the potential for actors outside the state to gather information on irregular vessel activity, including bunkering within the context of sanctions evasion, and leveraging both tools and human capital from beyond the state might be a way for navies to increase their capacity in wartime.<sup>133</sup>

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128. Lambert, *The British Way of War*, p. 197.

129. Mark Gunzinger and Christopher Dougherty, *Outside In: Operating From Range to Defeat Iran's Anti-Access Area Denial Threats* (Washington DC: CSBA, 2014).

130. Caitlyn Talmadge, 'Closing Time: Assessing the Iranian Threat to the Strait of Hormuz', *International Security* (Vol. 33, No. 1, 2008), pp. 82–117.

131. Tony Carruthers, 'Risky Business? The Royal Navy Goes All in on Autonomous Mine Warfare', *Navy Lookout*, 13 August 2021, <<https://www.navylookout.com/risky-business-royal-navy-goes-all-in-with-autonomous-mine-warfare/>>, accessed 24 November 2022.

132. Bryan Clark and Jesse Sloman, 'Advancing Beyond the Beach: Amphibious Operations in an Era of Precision Weapons', Center for Strategic and Budgetary Assessments, 2016.

133. See, for example, Byrne and Byrne, 'Black Gold'.

Ultimately, any wartime blockade would face two challenges. First, the mission of close blockade would compete with other missions which likely require the use of unmanned assets and the means of delivering them. Circumventing this might require a heavier focus on reducing the cost of unmanned assets – and perhaps a reliance on auxiliary vessels for delivery and sustainment so as not to draw capacity from other missions. The second challenge is political – even close blockades are somewhat indiscriminate against vessels that choose to run them if executed with mines and unmanned capabilities. While this is true, basing plans around political limitations that may evaporate in wartime may be incorrect. To use an example, most US interwar plans for using submarines were based on the presumption of rigid legal limitations on commerce raiding – the vast majority of which were discarded when war with Japan actually came.<sup>134</sup>

## Information Warfare

In some regards, the defensive component of information warfare at sea is relatively simple. Tracking special purpose submarines is, in the final instance, an ASW task and likely not the most complex one navies will need to contend with. Tracking and controlling auxiliary vessels may pose a greater challenge – and one that may require the integration of a range of capabilities. This will encompass elements of maritime forces, such as marine units, needed to conduct boarding operations as well as the capabilities required to maintain situational awareness. This is likely to overlap significantly with the capabilities which execute maritime constabulary activity. An implication of this may be that constabulary activity ought to be conducted with an eye to developing the competencies needed to protect strategic lines of communication against a state.

A number of factors will be critical to the conduct of the defensive and offensive components of maritime information warfare. First, the ability to map undersea cable networks and other critical infrastructure. Understanding not just the networks but the bathymetry and hydrography of their surrounding waters will be vital to devising vectors of approach. Nations such as Russia have invested heavily in special purpose vessels such as the *Yantar* – ostensibly a research ship – which will fulfil this function.<sup>135</sup> The UK made multipurpose surveillance vessels a priority in the 2021 Defence Command Paper.<sup>136</sup> Persistent engagement under the aegis of research will likely be critical to wartime success. To be sure, international law may constrain this activity within nations' exclusive economic zones, as it can be framed as research in pursuit of economic exploitation. In these instances, as the recovery of a Chinese UUV in Indonesian waters illustrates, such activity can sometimes be conducted on a more covert basis.<sup>137</sup>

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134. Frank Hoffman, *Mars Adapting: Military Change During War* (Annapolis, MD: Naval Institute Press, 2021), p. 62.

135. H I Sutton, 'Russian Spy Ship Yantar Loitering Near Trans-Atlantic Internet Cables'.

136. Ministry of Defence, *Defence in a Competitive Age*, CP 411 (London: The Stationery Office, 2021), p. 69.

137. Kristin Huang, 'China's Underwater Drones Seized in Indonesia Expose Tech, Routes and Potential Submarine Plans', *South China Morning Post*, 10 January 2021, <<https://www.scmp.com/news/>

Second, decisions regarding the placement of payloads in peacetime may need to be made. Although politically fractious if discovered, pre-positioning payloads will likely quickly be critical to any form of maritime information warfare if conflicts escalate. As historical examples such as Operation Ivy Bells illustrate, this is not entirely infeasible.<sup>138</sup> Moreover, smart payloads over which the operator retains command and control can be emplaced in peacetime without contravening international law.<sup>139</sup>

Third, the use of unmanned capabilities as both a means of interdicting cables and a surveillance tool will create both a requirement to leverage these capabilities and to integrate them with other platforms. Given their limited range, they will require a host platform – likely an SSN/SSGN.<sup>140</sup> This requirement will in turn shape both the design principles and underpinning CONOPS of future submarines if information attack at sea is made a key naval function.

## Strategic Interdiction

A core feature of the naval contribution to economic warfare is likely to be strategic bombardment. A number of nations have hedged against the risk of bombardment by traditional means through locating critical defensive facilities within their interiors and the construction of layered integrated air and missile defence systems. This has allowed for the construction of more efficient consolidated facilities such as China's Factory 211 and Russia's Uralvagonzavod's main tank manufacturing facility at Nizhny Tagil.<sup>141</sup> While opponents like Iran occasionally rely on expedients such as dispersing facilities or burying them, there appears to be an understandable preference for consolidated infrastructure near existing transportation networks among those nations with robust air defences and depth.<sup>142</sup> This also means, however, that these concentrated facilities represent points of failure in wartime should it become viable to target them. Similarly, flows of critical resources such as oil and gas depend on storage terminals and facilities capable of effective temperature control, which are typically large concentrated facilities that are limited in number. To use an example, China's capacity to store and move oil depends on eight oil reserve facilities, along with around 200 terminals in coastal regions.<sup>143</sup> The

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[china/military/article/3117076/chinas-underwater-drones-seized-indonesia-expose-tech-routes](https://china/military/article/3117076/chinas-underwater-drones-seized-indonesia-expose-tech-routes)>, accessed 10 January 2023.

138. Sherry Sontag and Christopher Drew, *Blind Man's Bluff: The Untold Story of American Submarine Espionage* (London: Arrow Books, 1999) pp. 182–250.

139. David Hambling, 'With Hammerhead Mine, U.S. Navy Plots New Style of Warfare to Tip Balance in South China Sea', *Forbes*, 22 October 2022.

140. Commander Justin Codd, remarks to RUSI Sea Power Conference 2022, London, 5 April 2022.

141. Engvall, 'Russian Military R&D Infrastructure', pp. 20–26.

142. See Parisa Hafezi, 'Iran Says it Has Built Third Underground Missile Factory', *Reuters*, 25 May 2017. On a more typical distribution of facilities, see Peter Wood and Alex Stone, *China's Ballistic Missile Industry* (Montgomery, AL: China Aerospace Studies Institute, 2021), pp. 50–60; Engvall, 'Russian Military R&D Infrastructure', pp. 20–26.

143. Huiqing Lan and Zhijie Zhang, 'Analyzing the Layout of China's Strategic Petroleum Reserve Base', AIP Conference Proceedings 1864, 020119, 3 August 2017.

recent Russian missile campaign against Ukraine's power grid, much of it conducted by missiles launched from naval platforms, is an example of the vulnerability of inland infrastructure to maritime platforms.<sup>144</sup>

While strategic interdiction has typically been a function of air forces, and will remain one to which they are critical, it might be considered that naval assets could have a larger role to play in this task. The basis for concentrating both defence and supporting industries in ways meant to optimise efficiency rather than survival is that a combination of distance and dense integrated air defences protect these facilities from most forms of air attack. For example, of the US Air Force's current fleet, only the B2 combines both the range and stealth to operate against targets deep within an enemy Integrated Air Defense System.<sup>145</sup> Moreover, most other states, including the UK, lack strategic bombers.

However, strategic interdiction could represent a valuable use of emerging prompt strike capabilities. Assets such as the US Army and US Navy's planned shared long-range hypersonic weapon, which has a planned range of 2,700 km, should in principle combine both range and relative survivability in contested airspace.<sup>146</sup> The relatively limited size of the target set related to the task of strategic interdiction lends itself to capabilities that are highly survivable but too expensive to be expended on a wider range of assets. While prompt strike capabilities are not an exclusively naval asset, several navies, including the Royal Navy, are prioritising their fielding. Given their size, it is likely that these assets will need to be carried on surface or subsurface vessels if they are to have intra-theatre mobility. They are likely too big to be launched from most aircraft, and while ground basing is viable, this prevents their movement between distant theatres and requires Allied sign-off, which may be sensitive. Alongside prompt strike capabilities, less expensive missiles, including subsonic cruise missiles, have also been used to good effect in recent conflict. Against some targets – particularly smaller and softer ones, such as substations – even cheaper capabilities such as loitering munitions can be used.<sup>147</sup> This is certainly not the sole preserve of the maritime domain, but the very size of large vessels makes them a particularly useful means of transporting large numbers of standoff munitions, especially for nations that do not field strategic bomber fleets.

This is not to say that strategic interdiction is a naval function per se – assets such as strategic bombers will likely play a critical role – but the capabilities navies are focusing heavily on developing are optimised to target well-defended single points of failure. While other functions for prompt strike capabilities may exist, such as unpicking anti-access bubbles, these functions

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144. Justin Bronk, Jack Watling and Nick Reynolds, 'The Russian Air War and Ukrainian Requirements for Air Defence', RUSI, 7 November 2022, p. 25.

145. Mark Gunzinger, 'Long-Range Strike: Resetting the Balance Between Stand-in and Stand-off Forces', Mitchell Institute for Aerospace Studies, June 2020.

146. David Axe, 'The US Navy is About to Pack a Dozen Hypersonic Missiles Apiece into its New Stealth Destroyers', *Forbes*, 20 November 2022.

147. Bronk, Watling and Reynolds, 'The Russian Air War and Ukrainian Requirements for Air Defence', p. 25.

could be complicated in several ways. First, completing the kill chain against a target such as a radar in complex terrain may not always be possible on a timely basis. Second, the sheer cost and complexity of the capability exceeds that of its target in many instances. Against strategic targets, by contrast, prompt strike capabilities have both a simpler kill chain and a far more justifiable use case.

It might then be considered that to leverage emergent strike capabilities to gain greatest value, strategic interdiction and not more tactical and operational functions ought to be made central to their employment.



# Conclusion

**T**HIS PAPER HAS examined the role of Western navies in the context of economic warfare at sea, and the way it will shape the imperatives of Western navies in the future. It has aimed to answer two key questions::

1. How will the defensive components of economic warfare at sea evolve as the structure of modern economies makes them increasingly reliant on physical infrastructure such as undersea cables and pipelines?
2. How can navies continue to complement non-military methods of waging offensive economic warfare, such as sanctions?

Answering the first question will be complicated by the emergence of threats to undersea critical national infrastructure. A traditional focus on SLOCs will likely expand to encompass the protection of fragile infrastructure, such as cables and pipelines. The traditional tools employed by navies, such as ASW capabilities, can be employed to track threats to this infrastructure – but their capacity to interdict them may be limited in scenarios short of conflict. That said, naval capabilities can set the conditions for deterrence by punishment by removing an element of deniability from sabotage and thus facing an opponent with the prospect that other tools (such as expanding sanctions) may be employed against them. Rapid attribution can also face an opponent with the risk of uncontrollable escalation, which can also serve a deterrent function. The task of information gathering may require new forms of public–private partnership to expand maritime situational awareness, as well as leveraging tools such as machine learning to detect anomalous behaviour by nondescript auxiliary vessels. Additionally, in certain instances, for example when auxiliary assets are operating in national waters, direct interdiction may be feasible. Alongside information gathering and interdiction, navies can also limit the capacity an opponent has for waging economic warfare through activities such as exercises.

There are also offensive functions that navies can play both above and below the threshold of war that do not merely duplicate other, non-military, tools. While Western opponents are adapting to the non-military means by which their economies can be impacted, the very nature of the economic structures and geography of potential peer adversaries makes them vulnerable to the use of maritime power. Moreover, the interdiction of goods and information flows can have a more immediate and, in some cases, decisive effect than the slower but highly important process of erosion by non-kinetic means. This is not to restate a stark dichotomy between the Treasury and Admiralty schools – both have key functions – rather, it is to suggest that navies retain a role that is complementary to those of other instruments.

In low-intensity competition, when flows of goods are dependent on a relatively limited transport infrastructure – for example, a small number of large vessels such as supertankers – physical interdiction can act as a second mechanism to interdict commerce that has escaped the remit of



sanctions. Particularly at maritime chokepoints that straddle the waters of friendly states, this can be achieved with plausible legality. Moreover, naval diplomacy can play an important role in preventing the political conditions that might allow a rival to wage its own economic warfare using non-military tools.

Above the threshold of high-intensity conflict, although the logic of economic warfare may remain unchanged, the means may well need to evolve, with a greater emphasis on tasks such as offensive mining and interdiction at strategic depth. Moreover, at least some of the approaches described here will entail legal and normative considerations that are beyond the scope of this paper.

Ultimately, there is a strong case for retaining offensive economic warfare as a core naval function, for which Western navies should actively prioritise as they contemplate their future force designs.

# About the Author

**Sidharth Kaushal** is the Research Fellow, Sea Power in the Military Sciences team at RUSI. Sidharth's research covers the impact of technology on maritime doctrine in the 21st century and the role of sea power in a state's grand strategy. 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.