Jeremy Stöhs

HOW HIGH? THE FUTURE OF EUROPEAN NAVAL POWER AND THE HIGH-END CHALLENGE

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Editors' preface

The publications of this series present new research on defence and security policy of relevance to Danish and international decision-makers.

This series is a continuation of the studies previously published as CMS Reports. It is a central dimension of the research-based services that the Centre for Military Studies provides for the Danish Ministry of Defence and the political parties behind the Danish defence agreement. The Centre for Military Studies is subject to the University of Copenhagen's guidelines for research-based services, including academic freedom and the arm's length principle. As they are the result of independent research, the studies do not express the views of the Danish Government, the Danish Armed Forces, or other authorities.

Our studies aim to provide new knowledge that is both academically sound and practically actionable. All studies in the series have undergone external peer review. And all studies conclude with recommendations to Danish decision-makers. It is our hope that these publications will both inform and strengthen Danish and international policy formulation as well as the democratic debate on defence and security policy, in particular in Denmark.

The Centre for Military Studies is a research centre at the Department of Political Science, University of Copenhagen. The centre conducts research into security and defence policy as well as military strategy. Read more about the centre, its activities, and other publications at: https://cms.polsci.ku.dk/english/.

Copenhagen, November 2020
Henrik Breitenbauch & Kristian Søby Kristensen

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List of Abbreviations

A2/AD: anti-access/area denial
AAW: antiair warfare
AI: artificial intelligence
ASBM: anti-ship ballistic missile
ASM: anti-ship missile
AsuW: anti-surface warfare
ASW: anti-submarine warfare
AWACS: airborne warning and control system
BALTRON: Baltic Naval Squadron
BFM: Battle Force Missile
BMD: ballistic missile defence
BN: billion
C2: command and control
C4ISTAR: command, control, communications, computers, intelligence, surveillance, target acquisition, and reconnaissance
DDG: guided missile destroyer
DOD: U.S. Department of Defense
EDF: European Defence Fund
EPAA: European Phased Adaptive Approach
ESSM: Evolved SeaSparrow Missile
EU: European Union
EUNAVFOR: European Naval Forces
FAC: fast attack craft
FFG: guided missile frigate
FREMM: FRegata Europea Multi-Missione; European multi-purpose frigate
FY: fiscal year
HMS: Her Majesty's Ship
INF: Intermediate-Range Nuclear Forces Treaty
IADS: integrated air defence system
ISR: intelligence, surveillance, reconnaissance
MARSUR: Maritime Surveillance (EDA project)

MCM: mine countermeasure
MoD: Ministry of Defence
MPA: maritime patrol aircraft
MSA: maritime situational awareness
MSO: maritime security operations
MW: mine warfare
NATO: North Atlantic Treaty Organization
PESCO: Permanent Structured Cooperation
PRC: People's Republic of China
SAM: surface-to-air missile
SATCOM: satellite communications
SCALP/Storm Shadow: Système de Croisière Autonome à Longue Portée, General Purpose, Long-Range Standoff Cruise Missile
SIGINT: signal intelligence
SLCM: ship-launched cruise missile
SM: standard missile
SNMCMG: Standing NATO Mine Countermeasure Group
SNMG: Standing NATO Maritime Group
SSK: ship, submersible, conventional (diesel-electric powered submarine)
SSM: surface-to-surface missile
SSN: ship, submersible, nuclear (nuclear-powered attack submarine)
UAV: unmanned aerial vehicle
UN: United Nations
USMC: United States Marine Corps
USN: United States Navy
USV: unmanned surface vehicle
UUV: unmanned underwater vehicle
U.S.: United States
VLS: vertical launch system

Abstract and Recommendations

With increased great power competition and new challenges to European security, the ability to wield naval power is becoming increasingly relevant – from the waters of Southeast Asia and the Arabian Sea, all the way to the North Atlantic and the Arctic. Particularly, challenges are emerging in the waters surrounding the European continent that underscore the importance of military power at the high end of the intensity spectrum across and beyond the maritime domain. Against this background, this study provides a forward-looking analysis of European naval power; that is, how states in Europe can conceptualize, organize, and deploy their maritime forces.

The analysis identifies two types of major challenges that follow from great powers investing in high-end warfare capabilities and the corresponding global rise of capability thresholds. The first set of demand-side challenges includes the proliferation of advanced missiles and sensors; the application of disruptive technologies in the shape of artificial intelligence (AI) and increasingly autonomous weapons systems; and the operational challenges that follow from multi-domain operations. In addition, the need to reach capability thresholds creates and accentuates a set of already existing supply-side challenges. This includes the challenge in developing the appropriate mix of capabilities for high-end as well as low-end operations; choosing between entertaining a credible naval presence close to home and projecting naval power abroad; and in addressing both the persistent difficulty to attract and retain skilled personnel as well as the ever-increasing costs for complex systems and platforms.

Finally, the report sums up the strategic implications for the different types of navies in Europe, concluding with potential considerations and recommendations for naval services seeking to address the challenges ahead. It contributes to a strategic debate on the future of naval power among European NATO and EU member states.

Recommendations

- Governments should formulate security and defence policies that clearly state their level of ambition regarding the high-end challenge. They should accurately gauge the characteristics of the challenges ahead, plan explicitly for higher-end capability profiles, and link naval concepts and planning to corresponding modernization and procurement programmes.
- Defence planners should emphasize naval policies that place national security arrangements within a transatlantic context and are closely co-ordinated with U.S. defence policies and strategies. High-end capabilities at the national and EU levels must be co-ordinated – aligned at best, complementary at worst – with the developments within NATO and the United States.
- Governments should attribute greater importance to co-ordinating their naval efforts and operational planning, to synchronizing doctrine and tactics, and to complex joint and multi-domain training and exercises.

Symmetric Considerations

- Navies should consider developing and deploying relatively well-balanced, multi-purpose fleets to gain sea control against peer competitors and to project and sustain naval power over distance.
- Navies should consider bonding together and pursuing niche-specialization and burden-sharing to achieve economies of scale and to deliver a measurable degree of warfighting capability.
- Navies should consider strengthening their offensive capabilities in order to hold a potential opponent's (A2/AD) battle networks at risk and thus deter by punishment.
- Naval forces should also consider increasing their defensive capabilities, particularly in the undersea domain (anti-submarine warfare) and with respect to missile-defence to deter potential adversaries by denial.
- Larger navies should consider increasing their fleet's magazine depth (vertical launch systems) and arsenal of battle force missiles, whereas

smaller forces should consider establishing a modest yet credible stock of sea-, air-, and land-based precision munitions.
- Navies should also consider developing more robust electronic warfare, electronic countermeasures, and cyber capabilities.
- Defence planners should consider fusing together sea-, air-, land-, and space-based sensors (including unmanned platforms) to establish more comprehensive C2 and ISTAR arrangements that allow joint, multinational forces to perform the full array of naval missions.

Asymmetric Considerations

- Defence planners should examine whether the joint and multinational approach to warfare allows them to explore new avenues of deploying military forces. Enhancing land-based aviation, missiles, sensors (including space-based assets), and cyber capabilities could potentially deliver greater effects at lower cost than do current military arrangements.
- Navies should consider emphasizing the dispersion (rather than concentration) of forces, and they should re-structure their fleets accordingly.
- Navies should consider acquiring larger numbers of small, fast, and stealthy platforms – to complement larger units – to create increasingly manoeuvrable, flexible, and lethal distributed forces.
- Small states and their navies should consider applying sea denial systems and doctrines and leveraging the potential of AI, (semi-)autonomous systems, and other disruptive technologies to deny adversaries sea control. Fleets with limited means should consider acquiring readily available (including commercial, off-the-shelf) technologies.

Resumé og anbefalinger

I en tid med øget stormagtsrivalisering og nye udfordringer for europæisk sikkerhed bliver evnen til at udøve maritim militærmagt fortsat mere relevant. Det gælder lige fra havene i Sydøstasien over Det Arabiske Hav til Nordatlanten og Det Arktiske Ocean. Nye udfordringer er i særdeleshed under udvikling i kystzonerne omkring det europæiske kontinent, og det understreger vigtigheden af militær magt, der ligger i den høje ende af intensitetsspektret, og som rækker ud over det rent maritime domæne. På den baggrund giver denne rapport en fremadskuende analyse af europæisk maritim magt, dvs. hvordan stater i Europa definerer, organiserer og anvender deres flådestyrker.

Rapportens analyse identificerer to sæt af centrale udfordringer, som bunder i stormagternes investeringer i avancerede militære kapaciteter og den deraf følgende globale forhøjelse af tærsklen for effektive maritime kapaciteter. Det første sæt af udfordringer knytter sig til efterspørgselssiden og omfatter bl.a. spredningen af avancerede missiler og sensorer, anvendelsen af disruptive teknologier i form af kunstig intelligens (AI) og stadig mere autonome våbensystemer samt operationelle udfordringer i forbindelse med multidomæneoperationer. Behovet for at nå kapacitetstærskler skaber og forstærker derudover et sæt af eksisterende udfordringer på udbudssiden. De inkluderer udviklingen af en passende blanding af kapaciteter til såvel højintensive som lavintensive operationer, en troværdig flådetilstedeværelse hjemme såvel som muligheden for at projicere maritim magt ude samt evnen til at tiltrække og fastholde kvalificeret personel – alt sammen i lyset af evigt stigende udgifter til komplekse våbensystemer og platforme.

Til sidst opsummerer rapporten analysens strategiske implikationer for forskellige typer af europæiske flåder og formulerer på den baggrund en række overvejelser og anbefalinger, som adresserer de kommende udfordringer, til beslutningstagere. Rapporten bidrager dermed til en

strategisk debat om fremtidens maritime magt blandt de europæiske NATO- og EU-lande.

Anbefalinger

- Regeringer bør formulere sikkerheds- og forsvarspolitikker, der tydeligt angiver deres ambitionsniveau med hensyn til højintensive udfordringer. De bør præcist vurdere de kommende udfordringers kendetegn, tydeligt planlægge efter mere avancerede kapacitetsprofiler samt koble flådekoncepter og planlægning til relaterede moderniserings- og indkøbsprogrammer.
- Forsvarsplanlæggere bør lægge vægt på flådepolitikker, der placerer nationale sikkerhedsforanstaltninger i en transatlantisk kontekst og er tæt koordinerede med amerikanske forsvarspolitikker og strategier. Avancerede kapaciteter på nationalt niveau og EU-niveau bør være koordinerede, så de i bedste fald er i overensstemmelse med – og som minimum er komplementære til – udviklingen i NATO og USA.
- Regeringer bør være mere opmærksomme på vigtigheden af at koordinere deres flådeindsats og operative planlægning, på at synkronisere deres doktriner og taktikker samt på vigtigheden af komplekse værnsfælles multidomæneflådeøvelser.

Symmetriske overvejelser

- Søværn bør overveje at udvikle og deployere relativt balancerede maritime styrker med flere anvendelsesmuligheder for at opnå maritim kontrol i relation til ligeværdige modstandere og samtidig gøre det muligt at projicere og opretholde maritim magt over store afstande.
- Søværn bør overveje at samarbejde med allierede om at udvikle specialiserede nichekapaciteter og benytte byrdedeling til at opnå stordriftsfordele og til at levere en betydelig del af deres militære kapacitet.
- Søværn bør overveje at styrke deres offensive kapaciteter med henblik på troværdigt at kunne udfordre en potentiel fjendes (A2/AD) kampnetværk og dermed styrke afskrækkelsen ved hjælp af en trussel om afstraffelse.

- Flåder bør overveje at øge deres defensive kapaciteter, særligt i det undersøiske domæne (antiubådskrigsførelse) og med hensyn til missilforsvar, for på den måde at kunne afskrække potentielle fjender ved hjælp af en trussel om afvisning.
- Større søværn bør overveje at øge deres flådes magasindybde (vertikale affyringssystemer) og deres beholdning af kampmissiler, mens mindre søværn bør overveje at etablere et beskedent, men stadig troværdigt, lager af sø-, luft- og landbaserede præcisionsmissiler.
- Søværn bør derudover overveje at udvikle en mere robust kapacitet til elektronisk krigsførelse, herunder elektroniske modforanstaltninger og cyberkapaciteter.
- Forsvarsplanlæggere bør overveje at fusionere sø-, luft-, land- og rumbaserede sensorer (herunder ubemandede platforme) for at etablere mere omfattende kommando- og kontrolsystemer (C2) samt efterretnings-, overvågnings-, måludpegnings- og rekognosceringsforanstaltninger (ISTAR), der vil gøre det muligt at gennemføre værnsfælles og multinationale flådemissioner i fuld udstrækning.

Asymmetriske overvejelser

- Forsvarsplanlæggere bør undersøge, hvorvidt den værnsfælles og multinationale tilgang til krigsførelse tillader dem at udforske nye muligheder inden for deployering af militære styrker. En udvidelse af kapaciteter inden for landbaseret luftmagt, missil- og sensorteknologi (herunder rumbaserede systemer) samt cyberområdet kan skabe større effekt for færre omkostninger sammenlignet med nuværende militære enheder.
- Søværn bør overveje at lægge vægt på at sprede (frem for at koncentrere) deres styrker, og de bør omstrukturere deres flåder tilsvarende.
- Søværn bør overveje at anskaffe et større antal små og hurtige platforme, som benytter stealth-teknologi, med henblik på at skabe en mere manøvredygtig, fleksibel og udbredt styrke, der kan komplementere de større enheder.
- Mindre stater og deres søværn bør overveje at anvende avancerede, søbaserede afvisningssystemer og doktriner såvel som at udnytte potentialet i kunstig intelligens, (semi)autonome systemer og andre disruptive teknologier til at forhindre fjender i at opnå maritim kon-

trol. Flåder med begrænsede midler bør overveje at anskaffe sig let tilgængelige teknologier, herunder kommercielle teknologier, som er klar til brug.

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1

Introduction

The global security order and international relations have undergone a structural transformation over the past decade.[1] According to one prominent view held in the West, revisionist states – including a rising China and resurgent Russia – are actively seeking to challenge the established global security framework upheld by the United States, its allies, and partners. This interpretation of events finds support in U.S. politics and strategies, ushering in a new period of strategic competition between great powers.[2] In order to deter peer and near-peer competitors and to prevent them from 'throwing the current international order out of balance,'[3] Washington seeks to regain its competitive edge and the ability to prevail in high-intensity conflict across all domains of warfare.[4] Against this backdrop, the United States continues to re-evaluate its defence and security priorities, its relationships with European states, as well as its role as part of security frameworks; most prominently, the NATO alliance.

1. Joachim Krause, "The Times They are a Changin': Fundamental Structural Change in International Relations as a Challenge for Germany and Europe," SIRIUS 1 (2017): 3-23.
2. Thomas Mahnken, Forging the Tools of 21st Century Great Power Competition (Washington, DC: Center for Strategic and Budgetary Assessments – CSBA) (2020).
3. U.S. Department of Defense, What Is the National Defense Strategy?, Oct. 8, 2018, https://www.defense.gov/Explore/Features/story/Article/1656414/what-is-the-national-defense-strategy/.
4. U.S. Department of Defense, Summary of the 2018 National Defense Strategy of the United States of America: Sharpening the American Military's Competitive Edge, 2018, https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf.

While the outcome and duration of this renewed great power competition remains uncertain, the increasing investments in high-end military capabilities has direct consequences for the security and defence of Europe.[5] This is particularly true in the maritime domain, where great powers are expanding their military capabilities to deter and – if that fails – to win military conflicts against powerful adversaries.[6] In this increasingly competitive maritime environment, naval forces will play a crucial role in securing access to the global commons, projecting power abroad, gaining operational control over chokepoints and sea space, and thus safeguarding national interests and preserving a nation's security and prosperity. Accordingly, navies around the world are preparing for competitive missions in highly contested environments; from the Indo-Pacific region to the waters surrounding the European continent.

In light of these developments, naval forces across Europe find themselves tossed between the horns of several vexatious dilemmas: After decades of rationalization measures, downsizing, and a preoccupation with collaborative tasks at the low end of the intensity spectrum, naval forces in Europe must again prepare for high-end warfare on, and from, the sea.[7] As Vice Admiral Keith Blount, Commander of NATO Allied Maritime Command, asserts, 'credible, demonstrable capability at the high end of joint military operations is key to deterring aggression, providing collective defence, and managing crises'.[8] However, with no diminution in the demand for constant constabulary operations (especially along the

5. Sven Biscop, *European Strategy in the 21st Century: New Future for Old Power* (Abingdon: Routledge, 2018); Daniel Fiott, "Europe and the Pentagon's Third Offset Strategy," *The RUSI Journal* 161, no. 1 (2016): 26-31, https://www.tandfonline.com/doi/pdf/10.1080/03071847.2016.1152118; Stockholm International Peace Research Institute, "World Military Expenditure Grows to $1.8 Trillion in 2018," https://www.sipri.org/media/press-release/2019/world-military-expenditure-grows-18-trillion-2018.
6. Seth Cropsey and Bryan McGrath, *Maritime Strategy in a New Era of Great Power Competition* (Washington, DC: Hudson Institute, January 2018); *U.S. Department of the Navy, A Design for Maintaining Maritime Superiority, Version 2.0* (2018), https://www.navy.mil/navydata/people/cno/Richardson/Resource/Design_2.0.pdf.
7. David B. Larter, "With Challenges Aplenty, Europe's Navies Are Coming to Grips with High-End Warfare," *DefenseNews*, June 22, 2020, https://www.defensenews.com/smr/transatlantic-partnerships/2020/06/22/with-challenges-aplenty-europes-navies-are-coming-to-grips-with-high-end-warfare/.
8. Keith Blount quoted at NATO Cooperative Strategy Forum 2019. NATO Allied Maritime Command, "NATO Maritime Commander Co-Hosts Cooperative Strategy Forum 2019," https://mc.nato.int/media-centre/news/2019/nato-maritime-commander-attends-cooperative-strategy-forum-2019.

continent's southern shores), navies must cover an increasingly broad range of contingencies and various naval missions. At the same time, navies are military organizations that develop relatively slowly, due to the time it takes to 'grow' a cadre of naval professionals and leaders as well as the character of navies' constituent capabilities, especially warships and other complex naval systems and platforms. In fact, a distinctive part of naval development occurs relatively independently of the global security environment, namely through the global evolution of defence technology. Consequently, naval forces frequently find themselves caught between the requirements of the past and the exigencies of the current and future security environment. To complicate planning further, the security guarantees provided by the American 'arsenal of democracy' can no longer be taken for granted.[9] In the future, the United States might become engaged in a major conflict in the Asia-Pacific region and have few available resources to come to Europe's rescue.[10]

These conditional factors place upward pressures on capability development and create similar, inescapable challenges for all of the navies in Europe. They 'raise the bar' in terms of the size and capabilities navies must reach and pass to conduct naval operations effectively across all domains as part of a joint, multinational force (also known as multi-domain operations).[11] Furthermore, the rising thresholds (depicted in Figure 1) entail the risk of increasing the differences between the respective European navies and widening the gaps to the U.S. naval forces. This is not least the case for the small but high-performing navies, which are

9. The term "Arsenal of Democracy" was a slogan used by former U.S. President Franklin D. Roosevelt during World War II. Chris Parry, *Super Highway: Sea Power in the 21st Century* (London: Elliott & Thompson, 2014), 262.
10. Daniel Fiott, "What if...the United States Pulls Out of Europe," in *What if...? Scanning the Horizon: 12 Scenarios for 2021*, ed. Florence Gaub (European Union Institute for Security Studies, January 25, 2019), 55-58. https://www.iss.europa.eu/sites/default/files/EUISS Files/CP_150_0.pdf.
11. Will Spears, "A Sailor's Take on Multi-Domain Operations," *War on the Rocks*, May 21, 2019, https://warontherocks.com/2019/05/a-sailors-take-on-multi-domain-operations/; Harry B. Harris Jr., Robert B. Brown, Scott H. Swift, and Richard D. Berry, "The Integrated Joint Force: A Lethal Solution for Ensuring Military Preeminence," *The Strategy Bridge*, March 2, 2018, https://thestrategybridge.org/the-bridge/2018/3/2/the-integrated-joint-force-a-lethal-solution-for-ensuring-military-preeminence.

seriously threatened by rising 'techflation',[12] a dearth of qualified personnel, and a lack of flexibility.

Clearly, the defence and naval policies of European states must account for the evolving security environment and address these novel challenges by seeking both symmetrical and asymmetrical solutions and answers. At the same time, each state and navy is informed by normative factors, including different levels of geostrategic freedom of action, political outlook, threat perception (East/North or South), as well as different institutional affiliations (NATO/EU or both). In addition, economic strength, geographic position, technical prowess, and socio-political culture represent principal conditions affecting the size, sophistication, and culture of each navy under discussion.[13] For the sake of analytical clarity, this report broadly divides navies into four categories, according to their size and sophistication, as shown in Figure 1.[14]

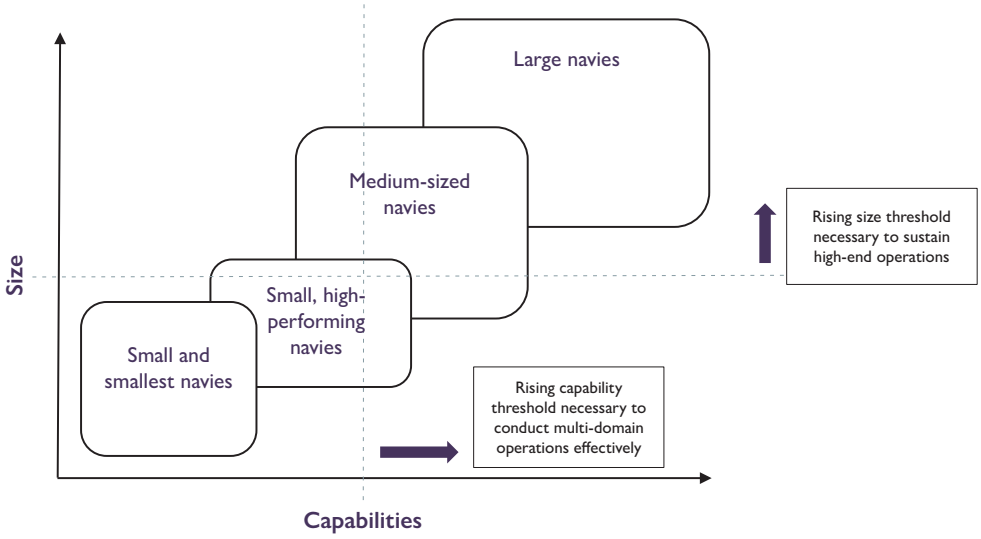
As the notion of collaborative naval policies gives way to a far more competitive vision of the future maritime environment,[15] each government must decide how it is willing to follow the global trend towards high-end (and fiendishly expensive) capabilities. In a sense, the great powers have told the European navies to 'jump', and the question that defence planners and politicians must now answer with reference to the spectrum of conflict is: 'How high?'

1.1. Overview

This report discusses the current challenges facing European nations in organizing naval power – individually as well as collectively – to meet the increased need for warfighting capabilities. As conceptualized here,

12. Kenneth Adelman and Augustine Norman, *The Defense Revolution: Strategy for the Brave New World: By an Arms Controller and an Arms Builder* (San Francisco: Institute for Contemporary Studies, 1990), 90-99.
13. Allan Westcott (ed.), *Mahan on Naval Warfare: Selections from the Writing of Rear Admiral Alfred T. Mahan* (Chelmsford: Courier Corporation, 1999), 21f; Eric Grove, *The Future of Sea Power* (Annapolis: Naval Institute Press, 1990), 229-32.
14. Naturally, such a typology relies on a degree of approximation, as the overlap between the categories indicates.
15. Geoffrey Till, "Small Navies in the Current Strategic Context," in *Europe, Small Navies and Maritime Security: Balancing Traditional Roles and Emergent Threats in the 21st Century*, ed. McCabe, Sanders, Speller (Abingdon: Routledge, 2019), 16.

Figure 1. Rising Threshold and European Navies[16]



these challenges are divided into a demand side and a supply side. The former set of challenges arises largely from the external strategic environment, whereas the latter set stems from (partially existing) conditional factors, which constitute the practical (but still strategic) trade-offs and dilemmas facing naval chiefs, their staffs, and political leaders when addressing the overall re-focusing towards the preparation for high-end operations.

Following the introduction, section 2 discusses the first set of strategic demand-side challenges. Three sub-chapters address the proliferation of missiles and sensors, potentially 'disruptive technologies' in the shape of AI and autonomy, as well as the operational challenge of multi-domain operations. Section 3 analyses important supply-side challenges

16. Capability thresholds are unlikely to rise in a linear fashion, but rather in exponential spurts. Introducing new platforms and capabilities (e.g. a navy going from no submarines to operating a small flotilla) would actually constitute a sizable 'jump' in capabilities. Excellent discussions on small navies can be found in Geoffrey Till, "Are Small Navies Different?," in *Small Navies: Strategy and Policy for Small Navies in War and Peace*, ed. Michael Mulqueen, Deborah Sanders, and Ian Speller (Farnham: Ashgate, 2014), 21-32; Basil Germond, "Small Navies in Perspective: Deconstructing the Hierarchy of Naval Forces," in *Small Navies*, ed. Mulqueen, Sanders, Speller, 33-50.

that are either a consequence of or are accentuated by the changing strategic environment. This includes the high-low mix, the home vs. away game dilemma, the attraction and retention of highly trained personnel, and the rising costs of complex naval systems. Section 4 outlines the strategic implications of the changing security environment for the four types of navies under discussion. The final section offers important takeaways and considerations pertaining to the future of naval power. While the planners and politicians charged with developing European navies are the primary audience of this report, other navies in comparable situations and relationships with the U.S. Navy, including the navies of small and medium-sized countries in the Middle East and South East Asia, can also find the analysis useful.

This report is produced in accordance with the guidelines laid out in the Project Manual for the Centre for Military Studies and has been subjected to rigorous internal and external peer review.[17] Its findings are based on publicly available sources, including the national security and defence guidelines issued by several states, detailed analyses and reports on the topic matter, as well as discussions with academics, practitioners, and other experts in the field. The opinions and concluding arguments presented in this report, as well as any errors pertaining to fact or judgement, are those of the author and not those of any government agency.

17. Centre for Military Studies Project Manual (Copenhagen: Centre for Military Studies, undated). https://cms.polsci.ku.dk/english/about/project-manual/CMS_Project_Manual.pdf.

2

Trends and Demand-Side Challenges in High-End Environments

As the international security environment becomes increasingly and openly competitive, Western defence and military strategies, including naval policies, must evolve. This chapter reviews naval trends and the corresponding demand-side challenges navies face at the high end. Beyond briefly discussing the complex nature of naval power in light of the changing international environment, three main areas of development stand out: weapons technology, autonomous and AI-driven capabilities, and the consequent operational challenges of multi-domain operations in and beyond the European naval theatre. While other trends also matter, these three, alone and in combination, generate serious challenges for European naval planners and their political masters, which we will discuss in turn.

2.1. Great Power Competition at Sea – Conditional Pressures for European Navies

The ongoing military competition between major powers is a key ingredient in the contemporary strategic environment. Russia and China are increasingly capable of challenging the United States, NATO, and

its partners symmetrically.[18] In areas where these competitors are unable to directly challenge Western forces, they seek to gain advanced technologies and utilize innovative forms of warfare to 'create their own asymmetric advantages in countering [Western] military superiority'.[19] Through technological advances as well as structural and doctrinal changes, they have been able to create advanced battle networks designed to deter or defeat Western military forces, thereby delivering strategic effects.[20] This particularly plays out in the maritime domain, where an array of advanced weapons systems, sophisticated sensors, and potentially diruptive technologies pose a myriad of challenges to Western naval forces writ large.

In response to these challenges, the United States is clearly reorganizing its armed forces towards deterring potential adversaries and, if necessary, defeating them in high-end scenarios.[21] By exploiting a superior degree of information, speed, and lethality, the United States seeks to 'project military force in contested areas with sufficient freedom of action to operate effectively', and thus prevail in a future armed conflict.[22] Due to the expeditionary nature of the U.S. military, the U.S. Navy (USN) and Marine Corps (USMC) play a critical role within the envisaged multi-domain battlespace and are in the process of rekindling their competitive edge.[23]

All of the European NATO and EU member states entertain close – albeit somewhat strained of late – political and military relations with

18. Sasha Ingber, "Putin to Russian Military: 'Prepare a Symmetrical Response' to US: Missile Test," *National Public Radio*, August 23, 2019, https://www.npr.org/2019/08/23/753662354/putin-to-russian-military-prepare-a-symmetrical-response-to-u-s-missile-test?t=1584043619114&t=1595274204616.
19. Jeffrey M. Reilly, "Multi-Domain Operations: A Subtle But Significant Transition in Military Thought," *The Air and Space Power Journal* 30, no. 1 (2016): 61–73.
20. Michael Kofman, "It's Time to Talk A2/AD: Rethinking the Russian Military Challenge," *War on the Rocks*, September 5, 2019, https://warontherocks.com/2019/09/its-time-to-talk-about-a2-ad-rethinking-the-russian-military-challenge/.
21. Joint Chiefs of Staff, *Joint Doctrine Note 1-18 Strategy*, April 25, 2018.
22. U.S. Department of the Navy, *A Cooperative Strategy for the 21st Century Sea Power: Forward, Engaged, Ready* (2015), 19; Sebastian Bruns, *US Naval Strategy and National Security: The Evolution of American Maritime Power* (Abingdon: Routledge, 2018), 221.
23. Joint Chiefs of Staff, *Joint Publication 3-32: Joint Maritime Operations*, June 8, 2018, https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_32.pdf?ver=2019-03-14-144800-240; U.S. Department of the Navy, *United States Marine Corps: Force Design 2030*, March (2020).

the United States. Moreover, they currently remain dependent on the security guarantees provided by America's vast nuclear and conventional arsenal. Through defence co-operation (most importantly shared membership in NATO), European defense policies are inextricably linked to the United States. Moreover, the decades-long U.S. supremacy at sea has been a central factor in shaping the naval power of European states. Consequently, their naval forces, 'like all navies, whether friends or opponents of the USN, [construct their] naval policy with the overwhelming dominance of the USN as a crucial influence'.[24]

Great power competition and the emphasis on high-end capabilities has the potential to upset previous security arrangements and significantly alter the balance of naval power. The erosion of transatlantic ties in recent years and the notion that Washington's support to its NATO allies has become conditional have given rise to the understanding that Europe needs to assume greater responsibility for its own security and defence as part of bolstering Euro-Atlantic security and defence co-operation.[25] Against this backdrop, the ambition of the EU is to achieve greater strategic autonomy; that is, to develop the capabilities to conduct foreign and security policy – including naval operations – independently of the United States.[26] Both the level of ambition and scope vary dramatically between the member states, however, and persisting divisions within the EU are hindering greater military integration.

What is more, even the aggregated naval power of all of the European states, much less that of the EU members, pales in comparison to the highly integrated U.S. naval forces. Figure 2 indicates the vast differences in size (tonnage) between the U.S. Navy and its NATO counter-

24. Christopher Martin, *The UK as a Medium Maritime Power in the 21st Century*: *Logistics for Influence* (London: Palgrave Macmillan, 2016), 62.
25. Sewell Chan, "Donald Trump's Remarks Rattle NATO Allies and Stoke Debate on Cost Sharing," *The New York Times*, July 21, 2016, https://www.nytimes.com/2016/07/22/world/europe/donald-trumps-remarks-rattle-nato-allies-and-stoke-debate-on-cost-sharing.html.
26. Ulrike Franke and Tara Varma, "Independence Play: Europe's Pursuit of Strategic Autonomy," *European Council on Foreign Relations*, July (2018), https://www.ecfr.eu/specials/scorecard/independence_play_europes_pursuit_of_strategic_autonomy; Daniel Fiott, "Strategic Autonomy: Towards 'European Sovereignty' in Defence?" *EUISS Brief*, November 2018, https://www.iss.europa.eu/content/strategic-autonomy-towards-%E2%80%98european-sovereignty%E2%80%99-defence.

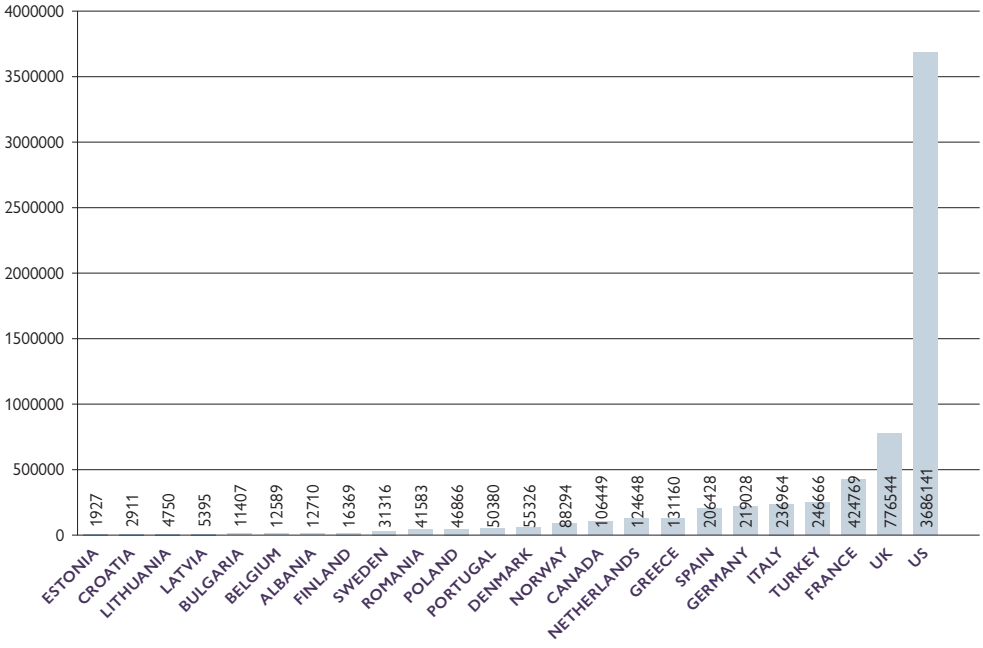
parts.[27] In their current shape and form, they cannot possibly fulfil the same range of missions or secure comparable strategic gains. Due to the lengthy time required to develop effective naval power, the prospects of European strategic autonomy at sea are decades off – whatever the political ambitions – even in the doubtful case of accelerated investment in capability developments.[28] Instead, the naval forces under scrutiny must continue to navigate and deepen their relationships with the U.S. Navy and its sister services despite potentially facing new tasks and challenges at both ends of the conflict spectrum and being supported mostly by navies from other European states.

Even if the demand for lower-end tasks for European navies may very well increase, this pressure will in no way alleviate the larger requirement for keeping up with the U.S. Navy in terms of high-end capabilities. Strategically speaking, European naval chiefs must increase their ability (alone and together) to do more without the United States. At the same time, they must also closely follow trends elsewhere and develop their high-end capabilities in co-ordination with U.S. efforts. Somewhat paradoxically, the need to catch up will increase the pressure on non-NATO members (e.g., Sweden) to deepen their respective relationships with the United States. Ultimately, European navies will perforce be more international, straddling domestic tasks while pursuing international co-operation in bilateral, 'mini-lateral', and multilateral fora, including beyond NATO and the EU.[29]

In sum, as a consequence of the evolving strategic environment, European navies share the same set of external challenges. Great power competition raises the bar in terms of the size and capabilities that navies must pass in order to contribute effectively to, and conduct high-end operations across, all domains. In the following sections, we will analyse

27. Basil Germond, *The Maritime Dimension of European Security*: *Seapower and the European Union* (London: Palgrave Macmillan, 2015), 94-5. Jeremy Stöhs, *The Decline of European Naval Forces: Challenges to Sea Power in an Age of Fiscal Austerity and Political Uncertainty* (Annapolis: Naval Institute Press, 2018), 181-82.
28. Larter, "Challenges Aplenty;" Ben Barrie et al., "Defending Europe: Scenario-Based Capability Requirements for NATO's European Members," *IISS Research Papers*, May 10 (2019).
29. 'Mini-lateral co-operation' refers to groupings of states focused around big players such as France, Germany, and the United Kingdom. Examples are the EU's PESCO initiative, NATO's Framework Nation Concept, UK-led Joint Expeditionary Force, and French-led European Intervention Initiative.

Figure 2: Total Tonnage of EU and NATO Navies[30]



In naval affairs, quantity has a certain quality of its own, whether it be to provide a physical presence in low-end environments or to signal capability and intent and thus deter potential adversaries. To understand the scope of the challenges states face and as a way to better discuss the available options to organize naval power, individually and collectively, the relative size of the navies of Europe compared to the U.S. Navy is illustrated in the graph above. Data is from IISS Military Balance 2020.

the three demand-side challenges facing contemporary navies: (1) the proliferation of advanced missile and sensor networks; (2) the development and application of potentially disruptive technologies, particularly autonomy and AI; and (3) the challenges of conducting multi-domain operations as part of joint and multinational forces in Europe's littorals and beyond.

Diverging levels of ambition in meeting these challenges will inhibit European action along all three trajectories. The COVID-19 pandemic

30. The International Institute for Strategic Studies, *The Military Balance 2020* (2020). Created by Jeremy Stöhs and Henrik Schilling.

and corresponding budgetary pressures, defence-industrial limitations, and demographic challenges are likely to complicate further prudent naval policy planning and the development of fleet architectures that would allow navies to perform a broad range of missions effectively; both close to home and over distance.

2.2. Naval Operations against Better Missiles and Sensors: Trends and Consequences

The rapid development in missile technology and the proliferation of long-range 'joint fires' pose major challenges to Western militaries. This challenge is especially pronounced in the naval domain, highlighting the vulnerability of key military assets, such as capital ships, and revealing significant shortfalls in offensive and defensive capabilities among European naval forces.[31]

Over the past decades, several states, including China, Russia, Iran, and North Korea, have pursued the development of precision munitions in increasing numbers while also providing advanced missile technology to proxies and non-state actors. This is part of efforts to offset the military advantages held by the United States, its allies, and partners.[32] They have recognized that Western militaries depend heavily on 'key assets for their way of warfare', including major command-and-control facilities, logistical hubs, airbases, and large military platforms such as warships.[33] In order to place such assets at risk and, thus, limit the adversary's access to the theatre of operation and freedom to manoeuvre within it,[34] Russia

31. Richard Weitz, "Managing Multi-Domain and Hypersonic Threats to NATO," *International Centre for Defence and Security*, April 24, 2020, https://icds.ee/managing-multi-domain-and-hypersonic-threats-to-nato/.
32. Ian Williams and Shaan Shaikh, "Report: The Missile War in Yemen," *CSIS*, June 9, 2020, https://missilethreat.csis.org/report-the-missile-war-in-yemen/; Shaan Shaikh, "Missiles and Rockets of Hezbollah," *CSIS*, last modified September 27, 2019, https://missilethreat.csis.org/country/hezbollahs-rocket-arsenal/.
33. Justin Bronk interviewed in "What's Going on with Hypersonics? We Ask the Royal United Services Institute's Justin Bronk," *Hush-Kit*, April 3, 2020, https://hushkit.net/2020/04/03/whats-going-on-with-hypersonics-we-ask-the-royal-united-services-institutes-justin-bronk/.
34. These efforts are *prima facie* aimed at limiting the opponent's freedom of manoeuvre in the respective theatres of operations. More importantly, however, they need to be understood as part of Russia's broader response to the perceived challenge that the U.S. military and those of its NATO allies pose at all levels and across the spectrums of conflict.

Figure 3. Russian Land- and Sea-Based Missile Ranges[35]

The illustration depicts Russian land- and sea-based missile ranges and the air-defence missile ranges of European warships. It also shows that Russian installations in the Kaliningrad Oblast and St. Petersburg can theoretically hold NATO and EU naval forces in the Baltic Sea at risk while submarines armed with land-attack and anti-ship missiles can cover virtually the entire European continent and its surrounding seas. (Stöhs/Librowski)

and China in particular have established powerful battle networks and military complexes. Often described as anti-access/area denial (A2/D2) 'bubbles',[36] such networks rely on an array of long- and medium-range ballistic and cruise missiles (theatre-strike weapons) and shorter-range,

35. It is important to note that these circles indicate the official maximum ranges of systems and do not necessarily equate to effective ranges in actual conflict. Also, air-launched assets are not shown. In crisis and war, targeting enemy warships in congested and cluttered maritime environment remains challenging. Hitting fixed installations on land with terrain-hugging cruise missiles or medium- and intermediate-range ballistic missiles is less difficult, not least due to the rather moderate air-defence capabilities among European states. Illustration based on Data from *Command: Modern Air /Naval Operations Wargame*. Created by Jeremy Stöhs and James Librowski.
36. Kofman, "Time to Talk A2/AD;" Robert Dalsjö, Christofer Berglund, and Michael Jonsson, "Bursting the Bubble Russian A2/AD in the Baltic Sea Region: Capabilities, Countermeasures, and Implications," *Swedish Defence Research Agency*, March 2019, https://www.foi.se/rest-api/report/FOI-R--4651--SE.

precision-guided munitions linked to equally sophisticated sensors, all of which are protected by 'advanced layered defense systems'.[37]

More frequently than at any point since the end of the Cold War, European navies find themselves operating well within the striking distance of enemy fire – be it as they safeguard international shipping through the Strait of Hormuz, in support of the UN arms embargo against Lebanon and Yemen, or while conducting freedom-of-navigation operations in the South China Sea. Yet it is along Europe's maritime approaches and littorals that the European naval forces face the most immediate threat.

From the Kola Peninsula in the High North to the Kaliningrad Oblast on the Baltic Sea and from Syria's shoreline on the Eastern Mediterranean all the way to Crimea and the Black Sea, Russia has deployed a vast array of ballistic missiles and cruise missiles to strategically important locations. These missiles can be launched from a range of mobile platforms, such as combat aircraft, land-based installations, several types of warships and submarines,[38] and they allow 'Russia's military [to] employ overwhelming firepower against any of [its] neighbours', a RAND study concluded.[39] More importantly, due to their increased range, speed, and sophistication, long-range missiles, such as the Iskander M, the Kalibr family, and the Kh-55, can potentially target key assets and critical infrastructure across Europe and its maritime approaches, as Figure 3 shows.[40]

This places NATO's forward areas and sea lines of communication across the Atlantic in jeopardy.[41] The end of the Intermediate-Range

37. William A. Perkins, "Component Integration Challenges Presented by Advanced Layered Defence Systems (A2/AD)," *NATO Joint Warfare Centre, The Three Swords Magazine* 33 (2018), http://www.jwc.nato.int/images/stories/threeswords/A2AD_2018.pdf.
38. Missiles include the 3K45 Granit (NATO SS-N-19 Shipwreck), 3K10 (NATO SS-N-21 Sampson), 9M720 and 9M723 Iskander M (NATO SS-26 Stone), 9M728 and 9M729 Iskander K (NATO SS-C-7 Southpaw and SS-C-8 Screwdriver), the 3M-52 Kalibr family (NATO SS-N-27 Sizzler and SS-N-30); the air-launched missiles Kh-101/Kh-102 and KH-555 (NATO AS-15 Kent and Kent-C), KH-59 MK (NATO AS-18 Kazoo); as well as the recently tested air-launched version of the Iskander K (the Kh-47M2 Kinzhal).
39. Scott Boston and Dara Massicot, "The Russian Way of Warfare: A Primer," *Rand Cooperation* (2017), https://www.rand.org/content/dam/rand/pubs/perspectives/PE200/PE231/RAND_PE231.pdf.
40. Megan Eckstein, "Foggo: Russia Seeking More Control of Black Sea, Mediterranean, Arctic," *USNI News*, July 17, 2020.
41. Magnus Nordenman, *The New Battle for the Atlantic: Emerging Naval Competition with Russian in the Far North* (Annapolis: Naval Institute Press, 2019); Benjamin Rhode (ed.),

Nuclear Force (INF) Treaty in 2019 has provided further incentives for Russia to intensify its efforts to develop and deploy theatre-strike capabilities.[42] While Russia's battle networks are often misunderstood – even 'woefully overhyped', according to some[43] – analyst Michael Kofman acknowledges that 'if there is one place the A2/AD conversation about Russian capabilities makes sense, it is in the maritime domain'.[44]

The Missile Gap – Addressing Defensive Capability Shortfalls

Because European militaries are part of common security arrangements, the proliferation of advanced missiles and sensor technology creates similar problems for all of the navies under consideration. Evidently, Europe's navies lack the *offensive* and *defensive* capabilities necessary to counter the above-described threat. In short, they suffer from a 'missile gap'.

In terms of *defensive* capabilities, navies must appreciate that their capital ships are likely to become increasingly vulnerable to precision fires, anti-ship missiles (ASM) in particular. In fact, while potent precision munitions are proliferating, European states find it difficult to adapt their naval capabilities to this quickly growing and evolving threat. After years of downscaling, navies retain only a limited number of frig-

"The GIUK Gap's Strategic Significance," *IISS Strategic Comments* 25, no. 29 (2018), https://www.iiss.org/~/publication/799791dd-7be1-4484-abfd-05fa3a400889/the-giuk-gaps-strategic-significance.pdf; Julianne Smith and Jerry Hendrix, *Forgotten Waters? Minding the GIUK Gap. A Tabletop Exercise* (Washington, DC: Center for New American Studies, 2017).

42. Michäel Fitzsimmons, "Russian Strategy and the End of the INF Treaty," *Survival: Global Politics and Strategy* 60, no. 6 (2018): 119-36; Frank A. Rose, "Treaty, New Start, and the Future of Strategic Stability," *Brookings*, February 12, 2019, https://www.brookings.edu/blog/order-from-chaos/2019/02/12/the-end-of-an-era-the-inf-treaty-new-start-and-the-future-of-strategic-stability/.
43. Sergey Sukhankin, "David vs. Goliath: Kaliningrad Oblast as Russia's A2/AD 'Bubble'," *Scandinavian Journal of Military Studies* 2, no. 1 (2019): 96-110, https://sjms.nu/articles/10.31374/sjms.20/; Guillaume Lasconjarias, "NATO's Response to Russian A2/AD in the Baltic States: Going beyond Conventional," *Scandinavian Journal of Military Studies*, 2 no. 1 (2019): 74-83, https://sjms.nu/articles/10.31374/sjms.18/; Sebastian Roblin, "The Bastion-P Mobile Anti-ship Missile Is Key to Russia's A2/AD in Europe," *The National Interest*, April 12, 2020, https://nationalinterest.org/blog/buzz/bastion-p-mobile-anti-ship-missile-key-russias-a2ad-europe-142832.
44. Kofman, "Time to Talk A2/AD."

ates and destroyers designed for air-defence tasks.[45] These warships are comparatively lightly-armed and lack the necessary number of Battle Force Missiles (BFM)[46] and corresponding vertical launch system (VLS) cells to conduct and sustain high-end naval operations effectively; that is, area air-defence, anti-submarine warfare, anti-surface warfare, and land attack. Figure 4 shows the comparatively small number of VLS cells (some 2,000) spread across navies in Europe.

By comparison, the U.S. Navy surface fleet has nearly 9,000 VLS cells and roughly 12,000 ship- and submarine-launched missiles, the Chinese navy's missile capacity stands at approximately 5,200 BFM, whereas the Russian navy alone possesses more than 3,300 BFM, not counting the even greater numbers of air- and land-based systems.[47] On top of this immediate numerical inferiority, the actual number of ships (and missiles) deployed by European navies at any given moment in time are far lower than the figures above might suggest. Firstly, European navies continue to struggle to put ships to sea; second, their warships have fewer VLS cells than their American, Asian, and Russian counterparts; and third, once the ships deplete their magazines, they must return to port to replenish their missiles.[48]

In future high-end scenarios, there is a concrete risk of enemy missile barrages saturating the air-defence umbrellas that the limited number of available NATO warships provide for other elements of a joint, multinational force. Moreover, the advent of hypersonic missile technology

45. Jeremy Stöhs, "Into the Abyss? European Naval Power in the Post-Cold War Era," *Naval War College Review*, 71 no. 3 https://digital-commons.usnwc.edu/nwc-review/vol71/iss3/4/.
46. Robert O. Work, *"To Take and Keep the Lead:" A Naval Fleet Platform Architecture for Enduring Maritime Supremacy* (Washington, D.C.: CSBA), December 1, 2005, 90. Footnote 309. "[B]attle force missiles are missiles that contribute to battle force missions such as area and local air defense, anti-surface warfare, and anti-submarine warfare. Terminal defense SAMs, which protect only the host ship, are not considered a battle force missile." Despite newer systems blurring the lines between terminal and local air defense missiles, BFM do not include shorter-range missiles such as Evolved Sea Sparrow, Aster 15, Crotale, Rolling Airframe Missile, and Mistral.
47. Keith Patton, "Battle Force Missiles: The Measure of a Fleet," Center for International Maritime Security, April 24, 2019, http://cimsec.org/battle-force-missiles-the-measure-of-a-fleet/40138.
48. Hunter Stires, "Exclusive: CNO Announces the Return of Vertical Launch Systems At-Sea Reloading," *The National Interest*, July 6, 2017, https://nationalinterest.org/feature/exclusive-cno-announces-the-return-vertical-launch-system-21425?nopaging=1.

Figure 4. Vertical Launch System Cells of 14 NATO Navies in 2020[49]

Country	Ship classes and approx. number of VLS cells	Total	'Strike Length' VLS cells for Sea-Launched Cruise Missiles (SLCM)
United Kingdom	6 × 48 (Type 45, Daring class) 13 × 32 (Type 23, Duke class)	704	- *Tomahawk cruise missile deployed on Trafalgar and Astute-class submarines
France	2 × 48 (Forbin class) 6 × 32 (Aquitaine class)	288	6 × 16 = 96 SLCM deployed on Aquitaine class
Spain	5 × 48 (Álvaro-de-Bazán class)	240	5 × 48 = 240 No SLCM
Denmark	2 × 36 (Absalon class) 3 × 56 (Iver Huitfeldt class)	240	3 × 32 = 96 No SLCM
Italy	2 × 48 (Andrea Doria class) 8 × 16 (Carlo Bergamini class)	224	No SLCM
Netherlands	4 × 40 (De Zeven Provinciën class) 2 × 16 (Karel Doorman class)	192	4 × 40 = 160 No SLCM
Germany	4 × 16 (Brandenburg class) 3 × 32 (Sachsen class)	160	3 × 32 = 96 No SLCM
Turkey	2 × 8 (Barbaros class) 2 × 32 (Salih Reis class) 4 × 8 (Gabya class)	112	-
Greece	4 × 16 (Hydra class)	64	-
Norway	3 × 8, 1 × 16 (Nansen class)	40	-
Belgium	2 × 16 (ex-Karel Doorman class)	32	-
Portugal	2 × 16 (ex-Karel Doorman class)	32	-
Albania Bulgaria Croatia Estonia Finland Iceland Ireland Latvia Lithuania Malta N. Macedonia Poland Romania Slovenia Sweden	Several navies in Europe, including those of 'front-line states', altogether lack the ability to deploy battle force missiles from vertical launch systems.	0	
Europe total:		***2328***	***688***
Canada	12 × 16 (Halifax class)	192	-
United States	67 × 90/96 (Arleigh Burke class) 22 × 122 (Ticonderoga class) 2 × 80 (Zumwalt class)	8900	8700+ Arsenal of SLCM Not included are VLS and BFM on submarines.

49. Finnish vessels are fitted with the South African Umkhonto Block 2 short-range SAM launched from eight-cell VLS on its four Hamina-class FAC and two Hämeenmaa-class MW vessels. However, these missiles cannot be considered BFM.

adds a new – and not yet fully understood – dimension to future battles at sea. The sea-launched Zircon and aeroballistic Kinzhal missiles have the potential to reduce the detection and reaction time of NATO air-defences systems to mere seconds.[50] Thus, they could become 'game changers in taking out high value ships'[51] and might 'allow the generally weaker Russian air and naval forces to carry out decisive pre-emptive strikes against advanced U.S. warships and other NATO military systems'.[52] Meanwhile, a new generation of hypersonic glide vehicles creates further challenges to the sea and land-ballistic missile defence (BMD) efforts of the United States and its allies.[53]

The apparent relative weakness of European navies in holding their own in contested environments and, thus, deterring potential adversaries by denial, suggests that the offensive/defensive balance of military technology is shifting further in favour of the attacker. The consequent first-mover advantage increases the risk of potential adversaries resorting to the use of military force to achieve their goals.[54]

The Missile Gap – Addressing Offensive Capability Shortfalls

European naval forces also suffer from significant capacity and capability shortfalls in contributing *offensive* firepower to military operations against militarily advanced competitors. The best way to address the missile threat is to break one or more links in the opponent's kill chain[55] or to prevent the 'archer from releasing his arrows' in the first place. However, significant firepower is necessary to deal with the threat posed by Russian submarines, to intercept tactical aviation, and to overcome

50. Thomas Withington and Stefan Nitschke, "Clouded Vision: Is Plasma Stealth Reality?" *Naval Forces* 40, no. 6 (2019): 32-4. For the moment, the extent to which hypersonic glide vehicles such as the Chinese DF-ZF or the Russian Avangard will alter the nuclear equation remains unclear.
51. As Kofman notes, this assumes "that Russia could work out the complex kill chain necessary to strike uncooperative targets at long range;" Kofman, "Time to Talk A2/AD."
52. Weitz, "Hypersonic Threats."
53. Kingston Reif, "Current U.S. Missile Defense Programs at a Glance," *Arms Control Association*, August (2019), https://www.armscontrol.org/factsheets/usmissiledefense#exec.
54. Michael C. Horowitz, *The Diffusion of Military Power: Causes and Consequences for International Politics* (Princeton: Princeton University Press, 2010); Wayne P. Hughes Jr. and Robert P. Girrer, *Fleet Tactics and Naval Operations*, 3rd ed. (Annapolis, Naval Institute Press, 2018); Monty Khanna, "Get Ready for the Next RMA at Sea," *USNI Proceedings* 146, no. 1 (2020): 47.
55. Dalsjö, Berglund, and Jonsson, "Bursting the Bubble," 46.

the multiple layers of advanced S-300 and S-400, shorter-range Pantsir-S surface-to-air missile (SAM) systems and electronic counter-measures designed specifically to defend Russia's battle networks against a U.S.-led aerospace attack.[56]

European military forces – and their navies in particular – currently lack the necessary long-range strike capability to penetrate and roll back Russia's sophisticated battle networks without U.S. assistance.[57] Merely a select few countries can conduct carrier strike operations against enemy targets, and only France (four frigates with a maximum of 16 SLCMs each) and the UK (seven attack submarines each carrying several missiles) deploy sea-launched long-range cruise missiles.[58] All of the other European navies must make do with the limited 'littoral land-attack capabilities' offered by shorter-range missiles, which are effective only in relative proximity to enemy forces.[59] This limits their ability to deter Russia and other potential adversaries by convincing them that the early heavy punishment they would have to expect for taking hostile actions would outweigh any expected gains.[60]

American and European defence planners appear to have recognized the need to address these capability gaps.[61] In an effort to deal with the growing missile threat, numerous navies are fitting their ships with new

56. The 800 cruise missiles the U.S. Navy expended in the opening stages of *Operation Iraqi Freedom* in 2003 provide an important perspective on the possible number of precision munitions needed for large military campaigns. Critics might argue that, with increasing accuracy of precision fires, such a 'show of force' might not be necessary to degrade enemy battle networks. Norman Polmar and Thomas B. Allen, "Naval Weapon of Choice," *USNI Naval History Magazine* 30, no. 1 (2016), https://www.usni.org/magazines/naval-history-magazine/2016/february/naval-weapon-choice.
57. Barrie et al., "Defending Europe," 29. "It is conceivable that some of today's holdings [of air-to-surface weapons stocks] could be exhausted within the first 48 hours."
58. The Royal Navy operates the U.S.-designed Tomahawk and relies solely on its nuclear attack submarines for this role. Meanwhile, the French Marine Nationale is the only European navy currently capable of launching a small number of cruise missiles from carrier-based Rafale combat aircraft as well as *Aquitaine*-class frigates; the latter have a maximum capacity of merely sixteen SCALP-naval stand-off weapons.
59. Omomat TESEO MK/2E (TESEO "EVO"), RBS-15, Naval Strike Missile, Roketsan ATMACA.
60. Michael J. Mazarr, *Understanding Deterrence*, Santa Monica: RAND (2018), https://www.rand.org/content/dam/rand/pubs/perspectives/PE200/PE295/RAND_PE295.pdf.
61. Leona Allesley, "NATO Anti-submarine Warfare: Rebuilding Capability, Preparing for the Future. Special Report," *Science and Technology Committee*, October 13, 2019, https://www.nato-pa.int/download-file?filename=sites/default/files/2019-10/REPORT%20150%20STC%2019%20E%20rev.%201%20fin%20-%20ANTI-SUBMARINE%20WARFARE.

defensive capabilities. Denmark is in the process of acquiring Standard Missile-2 Block 3A for its three *Iver Huitfeldt*-class frigates, while both Italy and France have selected the latest version of the Aster missile for their principal surface combatants. Meanwhile, the Belgian Maritime Component and the Royal Netherlands Navy, profiting from their exemplary naval co-operation (BeNeSam),[62] have signalled an interest in acquiring long-range missiles to contribute to ballistic missile defence as 'shooters'. Radar and combat systems are also receiving upgrades to remain effective against highly complex threats, and several European warships are receiving BMD sensor capabilities. Meanwhile, direct energy weapons may greatly reduce the cost of air and missile defence.[63] The prospect of a nearly infinite number of shots, each costing little more than the fuel needed to power these weapons (rather than several million euros for a limited number of missiles), has prompted many countries to invest in this area. While the U.S. Navy has recently introduced several types of high-energy lasers designed to counter low-end, asymmetric threats, such as UAVs, helicopters, rockets, artillery, and mortar shells, the technologies needed to engage advanced (potentially hypersonic) missiles remains several years way.[64]

These efforts go hand in hand with investment aimed at increasing offensive capabilities. Up-arming current platforms – to include aircraft, helicopters, and shore-batteries – with missiles appears to be an attractive solution for militaries to improve their ability to deter through

pdf; NATO, *London Declaration*, December 3-4 (2019), https://www.nato.int/cps/en/natohq/official_texts_171584.htm.

62. The *Belgisch-Nederlandse marinesamenwerking* (BeNeSam) can be described as a synchronized naval activity that is the result of a continued attempt to construct, maintain, and implement a shared concept of how to deal with shared security challenges. The naval cooperation was formalized in 1953 when NATO activated the Allied Command Channel and the Belgian naval staff was formally integrated with that of the Netherlands at Den Helder in 1996, effectively placing the respective naval forces under a single, joint command.
63. Jürgen Mannhart, "Sea-Based Ballistic Missile Defence: German Contribution to a Future European Capability," *The Journal of the JAPCC*, 26 (2019): 69-73, https://www.japcc.org/wp-content/uploads/JAPCC_J26_screen.pdf; Xavier Vavasseur, "EDA Studying the USE of Naval Directed Energy Weapons," *NavalNews*, November 18, 2019, https://www.navalnews.com/naval-news/2019/11/eda-studying-the-use-of-naval-directed-energy-weapons/.
64. Norman Friedman explains how, according to various sources, the direct energy weapons would likely need to produce upward of 500kW to be effective against missiles. Norman Friedman, "Technology Review: A New Age of Naval Weapons?" In *World Naval Review 2018*, ed. Conrad Waters (Barnsley: Seaforth Publishing, 2017): 174.

both denial and punishment. Far greater importance has belatedly been attributed to anti-submarine warfare in order to counter Russia's missile-slinging submarines.[65] In fact, ASW has become a catalyst for naval cooperation, ranging from joint efforts in updating hydrographic and bathymetric databases, developing and acquiring new sensors and weapons, all the way to conducting multinational training and exercises.

Problems in Closing Gaps in Defensive and Offensive Firepower

In seeking to address and close the apparent gap in offensive and defensive firepower, European navies face several problems:

Firstly, enhancing European missile capabilities has a political dimension. Deterrence by punishment constitutes an important criterion in dissuading Russia from resorting to using military force in pursuit of its strategic goals. However, greater offensive missile capabilities among European states would likely increase the Russian perception that it suffers strategic vulnerability and therefore entails measurable risk of escalation.[66] The ability of navies to conduct long-range precision-strikes using cruise missiles remains technologically complex, expensive, and politically sensitive. It is no surprise that several among the largest and most advanced European navies, including Italy, Germany, Spain, and the Netherlands, have not acquired such capability and remain reluctant to do so. Furthermore, Moscow has repeatedly criticized NATO's ballistic-missile defence efforts for having a strategically destabilizing effect. Greater investments in these areas on the part of European navies will likely cause Russia to redouble their efforts to mitigate perceived risks.

Secondly, because of their complexity, missiles are not readily available, and they are costly to develop and procure. They must also be maintained and certified regularly, which adds further to the price tag.

65. Wayne A. Schroeder, *Filling NATO's Critical Defense-Capability Gaps*, Atlantic Council, April (2019), https://www.atlanticcouncil.org/wp-content/uploads/2019/04/NATO_at_Seventy-Filling_NATOs_Critical_Defense-Capability_Gaps.pdf.
66. Stephen R. Covington, *The Culture of Strategic Thought behind Russia's Modern Approaches to Warfare* (Cambridge, MA: Belfer Center, October 2016), https://www.belfercenter.org/sites/default/files/legacy/files/Culture%20of%20Strategic%20Thought%203.pdf; The Ministry of Foreign Affairs of the Russian Federation, *Basic Principles of State Policy of the Russian Federation on Nuclear Deterrence,* June 8 (2020), https://www.mid.ru/en/web/guest/foreign_policy/international_safety/disarmament/-/asset_publisher/rp0fiUBmANaH/content/id/4152094.

Tellingly, Finland placed an order for 100+ anti-ship and 68 air-defence missiles in 2018, which will cost around €270 million and likely first be delivered in the mid-2020s. Although payments are spread out over several years, the total investment still amounts to more than a third of Finland's annual defence procurement budget.[67] This is likely to curb the appetites of procurement planners for large stocks of precision munitions, notwithstanding current shortfalls. Investments in electronic warfare, electronic countermeasures, decoys, cyber capabilities, and 'passive defences' (armour and damage control)[68] could offer cost-effective alternatives to expensive missiles.

Third, while increasing the number of stand-alone missile systems is becoming increasingly popular, these missiles are only as good as the network of sensors providing targeting data: 'The issue is really still whether the command system which fires the missile has some way of knowing what the situation is well beyond the horizon', Norman Friedman explains.[69] The existing 'hodge-podge' of air and missile defence systems in Europe lacks interoperability and suffers from 'dangerous capability gaps and limited flexibility',[70] indicating a clear requirement to fuse sensors and effectors within multi-domain C2 and battle command architectures on the national, EU, and NATO levels.[71]

Fourth, the force structure of many European navies is not conducive to operating effectively in envisaged high-end environments. The most powerful navies under scrutiny are designed around large aviation-capa-

67. Finnish Ministry of Defence, "Breakdown of Defence Expenditure," https://www.defmin.fi/en/tasks_and_activities/resources_of_the_defence_administration/finances/breakdown_of_defence_expenditure; Fergus Kelly, "US Approves $375 Million Sale to Finland of Harpoon Anti-ship and ESSM Air Defense Missiles," *TheDefensePost*, February 6, 2018, https://www.thedefensepost.com/2018/02/06/us-finland-sale-harpoon-missiles-essm-missiles/. Finland has recently opted to purchase Israeli Gabriel V missiles.
68. "[M]easures such as armor and damage control may drive up significantly the number of scarce extended-range strike assets required to achieve a mission kill or to sink a ship." Andrew F. Krepinevich, *Maritime Competition in a Mature Precision-Strike Regime* (Washington, DC: CSBA, 2015), 6.
69. Norman Friedman, "Technological Review: Shipboard Anti-ship Missiles," in *World Naval Review 2017*, ed. Conrad Waters (Barnsley: Seaforth Publishing, 2016), 179.
70. Weitz, "Hypersonic Threats."
71. Currently, the Alliance organizes its air-defence via NATO's Integrated Air and Missile Defence System, which is a network of NATO systems that fall under the authority of Supreme Allied Commander Europe. This also includes NATO's Air Policing and Ballistic Missile Defence.

ble platforms and their escort fleet, making them particularly vulnerable to intensive barrages of enemy fire. The losses suffered by the Royal Navy at the hands of the Argentinian Air Force using 1970s-technology Exocet missiles during the Falklands War are an important reminder of the lethality of ASM.

In light of the ongoing proliferation of advanced missiles systems and sensor technology, the current lack of firepower among European naval forces must give reason for pause. In the future, navies will find themselves facing adversaries armed with increasingly lethal missiles. Given the relevance for defence planning purposes of a high-end conflict in the European theatre and beyond, naval leaders must find innovative and cost-effective ways of reducing the vulnerabilities of their own forces to enemy fire in a possible 'battle of the first missile salvo',[72] while at the same time increasing the ability to hold opposing forces at risk.

Missiles and sensors are one area of defence technological development that constitutes a major challenge to naval forces across Europe. It is largely a familiar one, however, with navies having spent much of the Cold War facing and adapting to the steadily evolving missile threat. There are currently several other technological areas that, instead of evolving gradually, appear to be revolutionary, having the potential to dramatically change how wars are fought.

2.3. Autonomy and AI from the Seabed to Space: A Naval Challenge and Opportunity

Military competition between major powers is a key ingredient in the contemporary strategic environment, which also takes the form of competition for future posture. Rather than only being about gradually improving existing capabilities, it is a struggle for who can now effectively develop and deploy the 'disruptive technologies' of tomorrow that render obsolete the policies, doctrines, and capabilities of competitors and,

72. Wayne P. Hughes Jr, *Fleet Tactics and Coastal Combat* (Annapolis: U.S. Naval Institute Press, 2000), 40-4; John Salomon, "Parrying the 21st Century First Salvo," *Center for International Maritime Security*, July 7, 2016, http://cimsec.org/parrying-21st-century-first-salvo/26444.

thus, radically tilt the balance of power in their favour.[73] Most famously, competition for future posture has been designated a key element of U.S. defence planning through the idea of the Third Offset Strategy.[74] Massive American investments place new strains on armed forces in Europe to follow suit.[75]

Two specific areas in which such innovation is taking place at increasing speed are *autonomy* and *artificial intelligence*: AI is broadly understood to mean computer systems conducting processes similar to or better than human beings, such as learning and problem-solving.[76] AI is closely linked to the concept of autonomy, which describes computers and machines conducting operations relying on 'self-governance, recognition and decision-making' with a relatively limited degree of human involvement.[77] They thus augment manned forces and human decision-making regarding the application of force, Frank Hoffman explains.[78]

Applying Disruptive Technologies in the Maritime Domain

AI and autonomy can potentially change the face of warfare, so much so that some Western defence experts believe we are on the cusp of a military-technological revolution.[79] As part of a networked 'system

73. Ben FitzGerald, Kelly Sayler, and Shawn Brimley, "Game Changers: Disruptive Technology and U.S. Defense Strategy," *Center for a New American Security*, September 27, 2013, https://www.cnas.org/publications/reports/game-changers-disruptive-technology-and-u-s-defense-strategy.
74. Robert O. Work, "Remarks by Deputy Secretary Work on Third Offset Strategy," Brussels, April 28, 2016, https://www.defense.gov/Newsroom/Speeches/Speech/Article/753482/remarks-by-d%20eputy-secretary-work-on-third-offset-strategy/.
75. Fiott, "Third Offset Strategy," 26-31.
76. AI is also referred to as 'machine intelligence'. It covers sub-fields including machine learning, big data, robotics, neuroscience, and others. Autonomy includes (semi) autonomous weapons, swarms of robotic vehicles in multiple domains, self-organizing defensive systems, and automated weapons; Robert O. Work, "Algorithmic Warfare: The Next Military-Technical Revolution?" *7th Annual SAP NS2 Solution Summit*, October 30, 2018, https://www.youtube.com/watch?v=HcXMW2jNJXU.
77. Dave Chesebrough and Matt Dooley "Defense Department Struggles to Define Autonomy" *National Defense*, September 13, 2018, https://www.nationaldefensemagazine.org/articles/2018/9/13/defense-department-struggles-to-define-autonomy.
78. Frank Hoffman, "The Western Way of War," interview by Peter Roberts, *RUSI*, July 16, 2020, https://rusi.org/multimedia/western-way-war-professor-frank-hoffman.
79. Work, "Algorithmic Warfare"; Frank Hoffman, "Will War's Nature Change in the Seventh Military Revolution?" *Parameters* 47, no. 4 (2017-18): 19-31. However, some pundits contend that we are currently witnessing a process that is evolutionary rather than revolutionary;

of system', disruptive technologies can provide decision-makers with greater situational awareness, allow them to apply firepower with superior speed, precision, and, thus, dramatically increase the effectiveness of military operations across all domains (sea, air, land, space, and cyberspace).[80] It is in the maritime realm, which stretches from the seabed all the way to space, that these disruptive technologies promise to yield some of the greatest benefits. Already today, AI-enhanced unmanned systems and platforms fulfil important functions in naval operations and are an integral element in air-defence, mine countermeasures, and other complex naval tasks. They are particularly vital in command and control, computers, and communication procedures (C4), and they enhance intelligence, surveillance, target acquisition, and reconnaissance processes (ISTAR).[81]

Great Powers and Disruptive Technology

The great powers have clearly signalled their willingness to invest in these novel technologies. The U.S. *National Defense Strategy* identifies advanced autonomous systems as one of the 'key capabilities' necessary to succeed in future conflict.[82] In order to hold the high ground against its potential challengers, the United States plans to increase its budget significantly in this area – spending a total of approximately US$ 4.6 billion in the fiscal year (FY) 2020.[83] This funding includes several platforms for the US Navy, such as carrier-launched drones, large unmanned undersea vehicles, and even a corvette-sized unmanned warship.[84]

Daniel Egel, Eric Robinson, Charles Cleveland, and Christopher Oates, "AI and Irregular Warfare: An Evolution, Not a Revolution," *War on the Rocks*, October 31, 2019, https://warontherocks.com/2019/10/ai-and-irregular-warfare-an-evolution-not-a-revolution/.

80. Franz-Stefan Gady, "What Does AI Mean for the Future of Manoeuvre Warfare?" *IISS*, May 5, 2020, https://www.iiss.org/blogs/analysis/2020/05/csfc-ai-manoeuvre-warfare.
81. Tuneer Mukherjee, "Securing the Maritime Commons: The Role of Artificial Intelligence in Naval Operations," *Observer Research Foundation Occasional* Paper 159, July 16, 2018, https://www.orfonline.org/research/42497-a-i-in-naval-operations-exploring-possibilities-debating-ethics/.
82. U.S. Department of Defense, *Summary of the 2018 National Defense Strategy*.
83. Michael Klare, "Pentagon Asks More for Autonomous Weapons," *Arms Control Association*, April 2019, https://www.armscontrol.org/act/2019-04/news/pentagon-asks-more-autonomous-weapons.
84. The budget for large, unmanned platforms (UUVs) is slated to grow from US$49 million in 2019 to $447 million in 2020, an additional $670 million earmarked for the MQ-25 Stingray. Additional funding is reserved for several USVs. This includes

Similarly, the Chinese government believes that AI and (semi-)autonomous systems will be crucial to winning economic and military competition against the West.[85] In an attempt at closing the gap to the United States, the People's Republic of China (PRC) is comprehensively applying these novel technologies across all military domains. Importantly, AI-enabled sea-, land-, air-, and space-based sensors are understood to be quintessential in creating the kill chains necessary to engage U.S. forces over greater distances from the Chinese homeland.[86]

Russia shares some of China's views on its unfavourable position vis-à-vis the United States and its allies, and it has faith in the value of AI-enabled operations.[87] In the recent past, Moscow has shown its ingenuity in using disruptive technologies to achieve its aims and is currently pursuing the ambitious goal of replacing a sizable portion of its force with robotics and partly autonomous systems.[88] Accordingly, the navy has introduced several new types of unmanned platforms, of which the nuclear-powered and nuclear-armed *Status-6* unmanned underwater vehicle (NATO: Kanyon) undoubtedly has received the most attention. However, within the context of high-intensity warfare, some of the

a small Common Unmanned Surface Vehicle mine hunter. David B. Larter, "US Navy Makes a Major Breakthrough in Autonomous Weaponry," *DefenseNews*, September 10, 2019, https://www.defensenews.com/digital-show-dailies/dsei/2019/09/10/the-us-navy-just-had-a-major-breakthrough-with-autonomous-weapons/.

85. Gregory C. Allen, "Understanding China's AI Strategy" *Center for New American Security*, February 6, 2019, https://www.cnas.org/publications/reports/understanding-chinas-ai-strategy; Karen Hao, "Yes, China Is Probably Outspending the US in AI – but Not on Defense," *MIT Technology Review*, December 5, 2019, https://www.technologyreview.com/s/614842/china-us-ai-military-spending/.

86. Lyle J. Goldstein, "China Hopes UUVs Will Submerge Its Undersea Warfare Problem," *TheNationalInterest*, March 28, 2020, https://nationalinterest.org/blog/buzz/china-hopes-uuvs-will-submerge-its-undersea-warfare-problem-138597. In addition to potentially disruptive technology, between 2015 and 2017, China commissioned roughly twice as many warships as did the United States and now operates what is the numerically largest navy in the world. To put these efforts into perspective; between 2014 and 2018, a greater tonnage of warships has left the Chinese slipways than that of the entire Royal Navy.

87. "Whoever Leads in AI Will Rule the World': Putin to Russian Children on Knowledge Day," *Russia Today*, September 1, 2017, https://www.rt.com/news/401731-ai-rule-world-putin/.

88. The use of drones in Ukraine and its indiscriminate application of information operations aimed at undermining the cohesion of Europe and NATO being but two prominent examples. Samuel Bendett, "Red Robots Rising: Behind the Rapid Development of Russian Unmanned Military System," *The Strategy Bridge*, December 12, 2017, https://www.ausa.org/sites/default/files/publications/SL-17-2-Integrating-Army-Robotics-and-Autonomous-Systems-to-Fight-and-Win.pdf.

less-conspicuous platforms could act as relatively cheap force multipliers within the Russian network of sensors and offensive fires.[89]

Europe and Disruptive Technology

In keeping pace with the technological innovation and the corresponding increase in the capability threshold among the great powers, disruptive technologies have the potential to shape the future of naval power in Europe: Both NATO and the EU have called several initiatives to life that focus on applying disruptive technologies in the maritime domain. NATO has launched the Maritime Unmanned Systems Initiative[90] to enhance the Alliance's capabilities, particularly in the areas of anti-submarine warfare and mine countermeasures.[91] Within the EU's Permanent Structure Co-operation (PESCO), three projects aim to achieve similar effects,[92] while the OCEAN2020 project, financed by the European Union's Preparatory Action on Defence Research, seeks to enhance 'situational awareness in a maritime environment'.[93]

In parallel, states are developing and fielding remotely controlled, AI-enhanced systems and platforms in greater numbers. Particularly Britain and France seek to leverage these technologies according to a vision of future warfare that is similar to that of their U.S. ally.[94] These technologies are primarily understood to serve C4ISTAR; that is, to

89. On Kanyon, see Joshua M. M. Portzer, "Kanyon's Reach: Rethinking the Nuclear Triad in the Autonomous Age," *USNI Proceedings* 146, no. 7 (2020), https://www.usni.org/magazines/proceedings/2020/july/kanyons-reach-rethinking-nuclear-triad-autonomous-age. Less conspicuous systems might offer a greater return on investment, such as the Sea Shadow glider and the Harpsichord-2P-PM UUV carried by submarines or other vessels.
90. NATO, "NATO Maritime Unmanned Systems" (2019), https://www.nato.int/nato_static_fl2014/assets/pdf/pdf_2019_09/20190909_190909-NMUS.pdf.
91. NATO, "Thirteen Allies to Cooperate on the Introduction of Maritime Unmanned Systems," October 3, 2018, https://www.nato.int/cps/en/natohq/news_158672.htm. This includes capability development and multinational exercises: NATO, "Portugal Hosts Maritime Exercise in Support of NATO's Maritime Unmanned Systems Initiative," September 11, 2019, https://www.nato.int/cps/en/natohq/news_168925.htm?selectedLocale=en.
92. European Union, "PESCO Projects: Maritime Unmanned Anti-Submarine System (MUSAS)," https://pesco.europa.eu/project/maritime-unmanned-anti-submarine-system-musas/.
93. The project is conducted within the framework of the Preparatory Action on Defense Research, led by Italy. European Defence Agency, "Ocean Twenty," https://ocean2020.eu/.
94. Phil Clare, "The Answer Is Multi Domain Operations: Now What's the Question?" *Wavell Room*, February 13, 2020, https://wavellroom.com/2020/02/13/the-answer-is-multi-domain-operations-now-whats-the-question/.

collect, analyse, and disseminate information across joint forces of the future. The British *Defence Innovation Initiative* highlights the need for such technologies to 'project military power against sophisticated opponents'.[95] Accordingly, the Royal Navy intends to introduce quickly a range of unmanned platforms as part of its NavyX programme.[96] According to the French *Defence and National Security Review*, AI and autonomous systems are 'expected to play a central role in the defence systems, where it will make a significant contribution to operational superiority'.[97] The French naval leadership has set a goal for themselves of deploying more than 1,000 drones by 2030.[98] The two countries are also collaborating on a programme to deliver a new autonomous mine countermeasure system.

Large and medium-sized navies could profit from the maturation of disruptive technologies on the condition that they are able to recognize their potential and to integrate them into their armed forces. However, many navies, including the Italian Marina Militare, remain in an early stage of effectively deploying many types of sea-based unmanned platforms. As such, similar to the Spanish navy, the Italian Navy operates only a modest number of small shipborne unmanned aerial vehicles.[99] While more complex missions still need to mature in many areas, sev-

95. Ministry of Defence of the United Kingdom, "Advantage through Innovation: The Defence Innovation Initiative," (2016), 8, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/553429/MOD_SB_Innovation_Initiative_Brochure_v21_web.pdf.
96. More than GBP 2.5 million have been earmarked for the development of an extra-large UUV. Royal Navy, "Royal Navy's Drones Trials Team Take to Sea," February 4, 2020, https://www.royalnavy.mod.uk/news-and-latest-activity/news/2020/february/05/200205-puma; David B. Larter, "British Royal Navy's Top Officer Lays Out Vision for Unmanned Surface Vessels," *Defense News*, September 20, 2019, https://www.defensenews.com/naval/2019/09/20/the-royal-navys-top-officer-lays-out-vision-for-unmanned-surface-vessels/.
97. Ministère de la *Défense, Defence and National Security Review 2017*, October (2017): 32, 77-9, 82.
98. Nathan Gain, "French Navy Aiming for 1200 Unmanned Systems By 2030," *Naval-News*, July 29, 2019, https://www.navalnews.com/naval-news/2019/07/french-navy-aiming-for-1200-unmanned-systems-by-2030/.
99. In the Italian case, since commencing technical evaluations introducing vertical take-off and launch (VTOL) drones in 2014, few signs of progress appear to have been made. Conversely, Italy has taken the lead in both the OCEAN2020 project as well as the Harbour & Maritime Surveillance and Protection PESCO project.

eral navies are currently testing and fielding rotary wing drones for use aboard their warships.[100]

From a conceptual and technological standpoint, the small yet sophisticated European navies appear to be in a somewhat promising position to develop and apply disruptive technologies. In previous periods of fiscal austerity, they have gained experience in using innovative technologies to offset numerical decline. Having shed much of their Cold War holdovers, their small forces are now largely designed for networked information-centric warfare and already rely on a high degree of automation.[101] This allows countries like Portugal to coordinate the PESCO Maritime Unmanned Anti-Submarine System project, while Belgium cooperates with several other smaller navies in delivering (semi-) autonomous underwater, surface, and aerial technologies for MCM.[102] Notably, Belgium and the Netherlands are also in the process of jointly acquiring new MCM vessels fitted with payload modules, or 'toolboxes', comprising unmanned aerial, underwater, and surface vehicles (UAVs, UUVs, and USVs).

Acquiring relatively cheap force multipliers is obviously very attractive for naval forces with limited financial means.[103] They would allow these services to overcome legacy thinking centred on large platforms (warships) rather than on weapons and sensors and, in turn, create the basis for more credible sea-denial capabilities.[104] Small navies should

100. Heiko Borchert, "Why Undersea Drones Will (Not Yet) Change Asia-Pacific's Undersea Balance," *CSIS*, May 5, 2016, https://amti.csis.org/undersea-drones-will-not-yet-change-asia-pacifics-undersea-balance/. After decades-long delays, the German navy is in the process of introducing a VTOL drone, providing an important stimulus for the current acquisition process for the Royal Netherlands Navy. Turkey, meanwhile, has become a powerhouse in developing and deploying a range of UAVs, and its navy is likely to introduce near-term domestic designs.
101. See Stöhs, *Decline of European Naval Forces*, 161f. On Sweden, see also Niklas Granholm, "A Small Navy in a Changing World: The Case of the Royal Swedish Navy," in *Small Navies*, ed. Mulqueen, Sanders, Speller, 174.
102. European Union, "PESCO Projects: The Maritime (semi-) Autonomous Systems for Mine Countermeasures (MAS MCM)," https://pesco.europa.eu/project/maritime-semi-autonomous-systems-for-mine-countermeasures/.
103. Joe Gould, "Romania Eyes New Maritime Drone to Counter Russia," *DefenseNews,* May 7, 2019, https://www.defensenews.com/digital-show-dailies/navy-league/2019/05/07/romania-eyes-new-maritime-drone-to-counter-russia/.
104. According to one view, currently, these "navies are deficient in building integrated capabilities, ensuring common operating procedures, projecting battlespace awareness, and accomplishing interoperability in all maritime combat domains." Thomas-Durell Young, "NATO's

therefore focus on developing 'drones, new sensors and networks, ISR, cyber-capabilities, non-traditional platforms, and targeting, all of which should take place across air, sea, and land domains', Thomas-Durell Young proposes.[105]

Challenges in Applying Technologies

Several limiting factors arise in applying disruptive technologies in the naval domain: Firstly, despite the potential to save time and money by using readily available commercial components and systems, defence planners must be aware of how off-the-shelf technologies might not suffice to support complex military missions. In some instances, the military applications 'contemplated for unmanned vehicles are unlikely to materialize without substantial targeted investment and development', as one study warns.[106] Ethical questions regarding the use of armed drones and the use of lethal force via unmanned systems pose another possible roadblock in developing high-end capabilities and remaining apace with developments elsewhere in the world.[107] A further challenge arises from the fact that all of the European navies are relatively new to the use of AI and (semi-)autonomous technologies.[108] The learning curve will remain steep, as fleet architectures (with the exception of mine countermeasure forces) are not aligned with the use of unmanned (much less autonomous) systems.

What is more, in contested environments, information will be a key resource in future military operations. However, much like energy and munitions, combat forces must expect to have limited access to this fi-

Selective Sea Blindness: Assessing the Alliance's New Navies," *Naval War College Review* 72, no. 3 (2019): 13.

105. Young, "NATO's Selective Sea Blindness." However, chronic underfunding, legacy concepts, and the lack of qualified manpower and training to operate this equipment will continue to place qualitative and quantitative constraints on many small navies in effectively using disruptive technologies.
106. Bradley Martin et al., *Advancing Autonomous Systems: An Analysis of Current and Future Technology for Unmanned Maritime Vehicles*, Santa Monica: RAND (2019), x, https://www.rand.org/pubs/research_reports/RR2751.html.
107. Oliver Pieper, "German Military Considers Using Armed Drones," *Deutsche Welle,* May 5, 2020, https://www.dw.com/en/german-military-considers-using-armed-drones/a-53395829.
108. Tellingly, during the Libyan War in 2011, not a single European warship was fitted with a reconnaissance drone. Almost a decade later, French Navy Chief-of-Staff Admiral Christophe Prazuck lamented that the navy only had 50 unmanned systems, none of which were operational prior to the integration of the first VTOL UAVs on the assault ship *Dixmunde* in late 2019.

nite resource. Navies will face the challenge of 'storing and accessing a massive volume of data, hosted on multiple and disparate sources in a common environment, and providing the tools to extract meaning, to correlate data from multiple domains, using big data techniques and artificial intelligence in particular'.[109]

Finally, the success of developing and fielding disruptive technologies relies on conscious conceptual thinking and prudent planning. In order for technology to become truly disruptive, European naval services must avoid unreflectively mimicking developments elsewhere. Rather, states must leverage the potential of these technologies in correspondence with national and alliance needs while simultaneously exploiting the weaknesses of potential adversaries. The apparent scarcity of conceptual guidelines issued across Europe suggests that most militaries and political leaders have not yet pursued deliberate strategic analysis on the matter to provide the basis for future defence planning.[110]

With great powers signalling their willingness drive forward the 'autonomous revolution', European navies are presented a narrow window of opportunity: Disruptive technologies could provide relatively cheap force multipliers that create necessary redundancies, augment and increase the respective warfighting potential, and offer navies an opportunity to explore asymmetric avenues to address high-end security challenges. By enabling lower-level commanders to use AI and autonomous systems on their own authority, European navies can potentially exploit disruptive technologies to a greater extent than Russia and China with their highly rigid and inflexible, top-down command structures. At the same time, the ubiquitous use of these technologies raises numerous im-

109. Philippe Gros, "The 'Tactical Cloud', a Key Element of the Future Combat Air System," *Foundation pour la Recherche Stratégique*, October 2, 2019. https://www.frstrategie.org/en/publications/notes/tactical-cloud-key-element-future-combat-air-system-2019.

110. William Combes, "Maritime Security Strategies for Very Small States: The Baltic States," in *Europe, Small Navies and Maritime Security*, ed. McCabe, Sanders, Speller, 128. Even states with relatively sizable navies currently appear unable to determine the role of these systems within future naval concepts and, therefore, are unable to translate theses plans into actionable policy. The woefully few official publications on future force on this disruptive technology by the German *Planungsamt* of the German Ministry of Defense is a case in point. See Bundesministerium für Verteidigung, "Planungsamt der Bundeswehr. Abteilung I – Zielbildung und Innovation," https://www.bundeswehr.de/de/organisation/weitere-bmvg-dienststellen/planungsamt-der-bundeswehr-/die-vier-abteilungen/zielbildung-und-innovation-planungsamt. Also Kommando Heer, "Thesenpapier Digitalisierung von Landoperationen" (2018). https://www.dwt-sgw.de/fileadmin/redaktion/SGW-Veranstaltungen/2018/8F7_Landoperationen/Thesenpapier_II_Digitalisierung_Landoperationen.pdf.

portant ethical, technological, and operational questions that defence planners and their policymakers must answer in the future.

2.4. Multi-Domain Operations in Contested Waters – The Operational Challenge

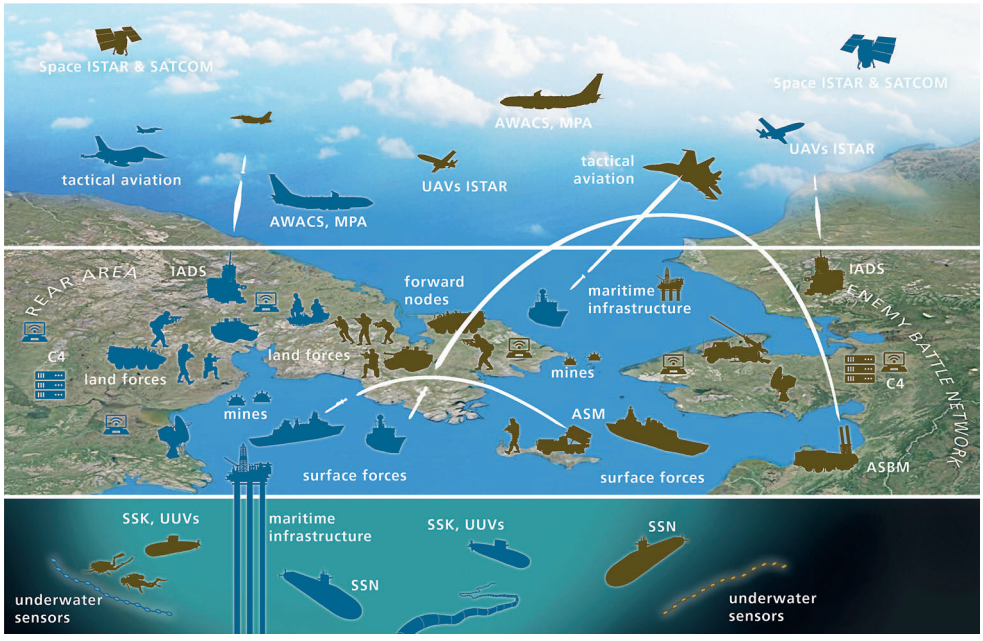
In the future, naval services in Europe will need to be prepared to wage high-intensity warfare against powerful opponents across the full spectrum of operations. In such scenarios, the growing arsenal of guided-munitions and sophisticated sensors (and Europe's relative lack thereof) allows adversaries to strike targets at increasing range, with greater precision, and at greater speed. Disruptive technologies, including AI-enhanced and increasingly autonomous systems, further raise the lethality of enemy fire and complicate decision-making processes. Meanwhile, informationalized warfare and non-kinetic attacks would have 'near instantaneous impacts with little concern for geographic space and political boundaries'.[111] This vision of the future battlefield poses a significant operational challenge to European navies.[112] In particular, it creates pressure on command and control procedures as well as intelligence, surveillance, target acquisition, and reconnaissance arrangements (C4ISTAR), as well as highlighting the need for interoperability and capability integration between European navies and their U.S. ally.

Multi-Domain Operations in the European Theatre

In the event of armed conflict with Russia, European naval forces would be heavily engaged from the outset of hostilities, conducting multi-domain operations within geographically confined European littorals, as Figure 5 indicates. This concept can be understood as deploying military formations 'that possess the capacity, endurance and capability to access

111. Kelly McCoy, "The Road to Multi-Domain Battle: An Origin Story," *Modern War Institute*, October 27, 2017, https://mwi.usma.edu/road-multi-domain-battle-origin-story/. This transforms the European continent, including its surrounding littoral waters, into a single theatre of operation.
112. Krepinevich, *Maritime Competition*; David G. Perkins and James M. Holmes, "Multidomain Battle: Converging Concepts toward a Joint Concept," *Joint Forces Quarterly* 88, no. 1 (2018); Department of the Navy, *Naval Doctrine Publication 1, Naval Warfare*, April (2020).

Figure 5. Naval Perspective of Multi-Domain Operations



This figure provides a perspective on multi-domain operations, illustrating the complexity of naval forces engaging enemy battle networks.

and employ capabilities across all domains [land, air, sea, space, and cyber] to pose multiple and compounding dilemmas on the adversary'.[113] By operating as part of a joint, multinational force, these formations seek to 'penetrate and disintegrate anti-access and area denial systems', to defeat enemy battle-networks, and thus to return to competition on terms that favour the United States, its allies, and partners.[114]

European naval forces would play an integral role in such operations. They would fight from within Europe's littoral waters outwards, holding the line while reinforcements try to gain access to the theatre – either hoping that the United States comes to their aid or, should Europe need

113. U.S. Department of the Army, *The U.S. Army in Multi-Domain Operations, TRADOC Pamphlet 525-3-* (2018), iii, https://www.tradoc.army.mil/Portals/14/Documents/MDO/TP525-3-1_30Nov2018.pdf.
114. U.S. Department of the Army, *The U.S. Army in Multi-Domain Operations*, vii.

to go it alone, to gain time to mobilize forces across the continent.[115] From a U.S. perspective, European militaries must act as a blunting force capable of preventing Russia from conducting a quick and decisive assault against NATO/EU territory and presenting European governments with a *fait accompli*.[116] This creates a conundrum for European navies, between attaining greater capabilities independent of the United States while at the same time becoming more integrated with U.S. forces.

Either way, a greater degree of integration and interoperability among European naval forces and with their North American allies becomes paramount. In an operational context, they must seek to 'seamlessly and synergistically mesh together to perform the full array of naval functions'.[117] In order for national forces to achieve a high degree of interoperability and jointness, they must develop (national and multinational) ISTAR capabilities that allow for a common recognized battlespace picture and a higher degree of cross-domain awareness. Furthermore, command and control structures, operational procedures, command authorities, and rules of engagement need to be harmonized prior to conflict to the extent that is politically possible. The sharing of data across the network of platforms, systems, and formations is both the key to success as well as the greatest challenge in future high-end warfare. As operations become more complex and the 'fog of war' thickens,[118] the failure to gain maritime domain awareness and to control or direct military measures against potential adversaries increases the likelihood of the latter resorting to armed aggressions and winning the possible military contest of the future.

115. "Should an open conflict come, the aim is to hold the line for long enough to make time for outside forces to arrive in theatre," as Niklas Granholm explains; Granholm, "Small Navies and Naval Warfare in the Baltic Sea Region," in McCabe, Sanders, Speller, *Europe, Small Navies and Maritime Security*, 84.
116. Granholm, "Small Navies and Naval Warfare," 79; David L. Goldfein, Stephen Bresset, and Lynn Haack, "WOTR Podcast: How is the Air Force Adapting to Great Power Competition," interview by Ryan Evans, *War on the Rocks*, June 5, 2019, https://warontherocks.com/2019/06/wotr-podcast-how-is-the-air-force-adapting-to-great-power-competition/.
117. In the European context, this idea has been discussed in an article from the early post-Cold War period. Donald Daniel and Bradd Hayes, "Towards a West European Navy: Organizational and Operational Issues," in Gert de Nooy (ed.), *The Role of European Naval Forces after the Cold War*, 21 (New York: Springer, 1996), 81.
118. Carl von Clausewitz, *Vom Kriege* ([1832] 2012), Chapter 2, 123.

Naval Co-operation and Capability Integration

Fortunately, naval forces already enjoy several advantages in terms of interoperability compared to other service branches; for one, navies are inherently 'joint', as they exercise influence from the sea across all domains. Due to the nature of their operational environment, they spend a considerable amount of their time together with the sea services of foreign nations.[119] NATO's common planning, standards, and procedures have benefited interoperability, while the Alliance's standing maritime and mine countermeasure groups (SNMG 1+2, SNMCMG 1+2) have been deployed continuously for decades.[120] On the EU level, there is the *European Maritime Force*, 'a non-standing, pre-structured, multinational maritime force', and the *Spanish-Italian Amphibious Battlegroup*. The latter, however, has yet to contribute actively to military operations.[121] Co-operation and capability integration on bi- and mini-lateral levels has also matured, including maritime domain awareness regimes such as *Surveillance Co-operation Finland-Sweden*, the *Sea Surveillance Co-Operation Baltic Sea*, the European Defence Agency's long-running *Maritime-Surveillance Project*, as well as comprehensive naval arrangements such as the UK-led *Joint Expeditionary Force*, the Swedish-Finnish *Naval Task Group*, the Belgian-Dutch *BeNeSam* naval integration, and others.

Challenges to Co-operation and Integration

Despite the above-describe cooperative efforts, even the most basic operations frequently pose challenges to European forces and raise uncomfortable questions regarding possible high-end operations in the European theatre, the Persian Gulf, and the South China Sea. These challenges have three distinct dimensions:

Politically: distrust, differences, protectionism, and populist tendencies within the transatlantic community and across Europe currently impede the ability to realize closer alignment among NATO and EU member states. While there are numerous examples of ongoing military

119. Geoffrey Till, *Seapower: A Guide for the Twenty-First Century* (Abingdon: Routledge, 2013), 245.
120. NATO, *Alliance Maritime Strategy* (2011), http://www.nato.int/cps/on/.
121. EUROMARFOR: History, "EUROMARFOR (EMF) – A Non-standing, Pre-structured, Multinational Maritime Force, Born on 15 May 1995," http://www.euromarfor.org/overview/3.

convergence and the harmonization of defence planning and capability development, national industrial policies and offset programmes create unnecessary redundancies, which drives up costs. Furthermore, reservations concerning the sharing of information has a direct impact on information-dependent capabilities and, in turn, impairs the ability to conduct complex military operations.

Organizationally: In order to establish the C4ISTAR capabilities on which the future joint, multinational forces rely in the multi-domain battle, the nature of the challenge ahead must be properly conceptualized and acted upon. However, as a recent article published by NATO's Joint Air Power Competence Centre argues, the Alliance is ill-prepared for peer-competition, because it has 'endemically shunned the Joint perspective'.[122] The re-emergence of great power competition appears to encourage some military services to relapse into narrow-minded, service-centric thinking. Exercises such as *Defender 2020* aptly illustrate the continued reluctance to exercise the joint fight and the tendency to push the 'fast-forward button to accelerate further into the campaign so that the Land fight becomes the predominant focus'.[123] For the aforementioned reasons, naval forces in Europe are challenged to reach the levels of interoperability needed for high-intensity campaigns – even within the NATO framework. However, there are no alternatives to the NATO command structures. In fact, a recent IISS study concluded that 'it does not seem feasible at this point for Europeans to attempt to run demanding operations'.[124] At best, it will take years for the appropriate EU PESCO projects to materialize.[125]

122. William A. Perkins and Andrea Olivieri, "On Multi-Domain Operations: Is NATO Today Sufficiently 'Joint' to Begin Discussions Regarding Multi-Domain Command and Control?" *The Journal of the JAPCC* 26 (Spring/Summer 2018): 19.
123. 'Based on observations in many different exercises, it is the authors' opinion that none of the Components fully understand our AD [air defence] doctrine. This is reflected in a lack of awareness between the Maritime and Air components staffs about terms such as Combined Air Sea Procedures [...] which define the Tactical Control [...] relationship between the Air and Maritime component of the AD capable ships, and is further manifested by friction between the Land and Air component about the location, use and control over advanced AD systems (such as Patriot) which are frequently miss-classified as Army Organic [air defense], contrary to NATO doctrine'; Perkins and Olivieri, "On Multi-Domain Operations," 20-21. See also Perkins, "Component Integration Challenges."
124. Barrie et al., "Defending Europe," 3.
125. In fact, the EU still relies on ad-hoc command and control frameworks for crisis management and does not have a permanent framework to conduct operations and missions at the

Technology: Capability shortcomings exist in both qualitative and quantitative terms. More mature C4 models, including a greater number of secure nodes and (stealthy) ISTAR platforms (in tandem and with better information-sharing) are required to gain and maintain sufficient situational awareness in degraded environments. Incompatible hardware and software standards are currently preventing greater interoperability. Notably, not even all NATO vessels are fitted with the same data link (Link 11, 16, 22) to exchange a tactical picture in near-real time.[126] What is more, military planners must reconcile the contradictory nature of these networks; namely, that they must be at the same time open, adaptable, and secure.

Multi-Domain Challenge for European Navies

Notwithstanding financial and material shortcomings, the largest of navies in Europe, particularly those of the two nuclear powers, appear to be in a position to formulate strategic, doctrinal, and operational guidelines, to develop comprehensive concepts of their future force architecture, and to procure the technology necessary to hold their own in multi-domain operations. Decades of operating alongside and integrating with U.S. forces have provided invaluable lessons to these navies. However, they have also exposed the shortcomings in their ability to conduct complex military operations without U.S. assistance, not least due to the lack of command and control, ISTAR, strike, and resupply capabilities.[127]

These shortfalls also beset several medium-sized navies and are pronounced especially among fleets that have suffered from years of downsizing and a focus on tasks at the low end of the mission spectrum.[128] The shift back to warfighting in a contested environment compels these

strategic level; to no small degree because several states have reservations to replicate NATO C2 structure and arrangements. European Union, "PESCO Projects: Strategic Command and Control (C2) Systems for CSDP Missions and Operations," https://pesco.europa.eu/project/strategic-c2-system-for-csdp-missions-and-operations/.

126. Norman Friedman provides a succinct overview of NATO communication links. Norman Friedman, "Modern Naval Communications," in *World Naval Review 2019*, ed. Conrad Waters (Barnsley: Seaforth Publishing, 2018), 178-9.
127. Bishop Scott, "Libya and the Lessons of Naval Power," *Canadian Naval* Review 8, no. 4 (2013): 14-18.
128. Stöhs, "Into the Abyss?"

navies to shoulder greater responsibility, to take the helm of multinational naval initiatives,[129] and to undertake preparations to lead possible military operations in the North Atlantic, the Baltic, the Mediterranean, and the Black Sea – a tall order in light of uncertain funding in the COVID-19 world. For others, notably along Europe's southern flank, political and organizational factors stand in the way of achieving capability thresholds and more effectively contributing to joint and combined multi-domain operations, despite having maintained a relatively competitive naval outlook in the past.[130]

For small navies, bonding together with more powerful fleets – above all the U.S. Navy – is more a necessity than a choice if they wish to survive in high-end scenarios. In some notable cases, years of austerity have led to cautious risk assessments, innovative planning, resourcefulness, and prudent policy.[131] While they have suffered numerical decline, the technological sophistication of their remaining forces and the quality of their naval concepts and personnel provide a promising basis for expansion and integration as part of a networked force operating in a multi-domain conflict.

The smallest of navies suffer from a dearth of sophisticated platforms and C4ISTAR capabilities to bond together with others and thereby perform demanding operations effectively.[132] Moreover, they frequently lack the personnel and institutional capacities necessary for comprehensive conceptual planning. One example of the lack of co-ordination among small navies is the 'seeming inability of [the] three Baltic States' governments to agree on something as simple and important as developing a common regional recognized maritime picture, and each apparent-

129. Sebastian Sprenger, "German Navy Returns to Treating the Baltic Sea as a Potential Theater of War," *DefenseNews*, January 23, 2019, https://www.defensenews.com/global/europe/2019/01/23/german-navy-returns-to-treating-the-baltic-sea-as-a-potential-theater-of-war/.

130. This applies in particular to Greece and Turkey. The strained relations between the two countries have led to military standoffs in the past. Consequently, both navies place emphasis on territorial defense tasks, including sea control and sea denial. Stöhs, *Decline of European Naval Forces*, 107-24.

131. Jeremy Stöhs, "European Small(er) Navies: Failure and Success in Doing More with Less," in *Europe, Small Navies and Maritime Security*, ed. McCabe, Sanders, Speller, 91-103.

132. Young, "NATO's Selective Sea Blindness;" Till, "Are Small Navies Different," 21-32.

ly is on its way to developing its own unique intelligence, surveillance, and reconnaissance [...] capabilities'.[133]

As the United States pushes towards the concept of multi-domain operations to counter the increasingly complex threats that peer and near-peer competitors pose across the high seas and along the global littorals, the majority of European navies struggle to keep pace. They face political, organizational, and technological hurdles in establishing the more mature C4ISTAR capabilities necessary to co-ordinate, integrate, and interoperate effectively across all of the domains of conflict. This fact impedes the EU's ability to gain greater strategic autonomy (particularly in the high end) and can potentially undermine the ability of NATO to deter aggression in the European theatre as well as to increase the capability gap between the U.S. and its European allies.

133. Young, "NATO's Selective Sea Blindness," 23. "The fact that these countries cannot yet exchange real-time radar or sensor data with Allied Maritime Command (MARCOM), let alone among themselves, needs to be addressed at the appropriate political level."

3

Supply-Side Challenges and Opportunities for Europe's Navies

Great power competition places European navies in a dilemma as they attempt to respond to a number of confluent demand-side challenges. In the preceding chapter, we discussed three of the most significant challenges which navy planners must consider and address when shaping their future national navies. In this chapter, we discuss a number of important supply-side challenges that follow from (or are accentuated by) the changing strategic environment.

The first challenge stems from the need to identify the most promising high-low mix of naval capabilities in order to perform a broad range of missions effectively in the future. On the one hand, governments must invest in warfighting capabilities to deter potential adversaries and to prevail in the unlikely event of inter-state war. At the same time, European navies will remain busy conducting ongoing maritime security operations, be it to protect sovereign rights or in supporting collaborative maritime efforts.

The second challenge stems from choosing between creating a credible naval presence close to home and projecting naval power abroad. After several decades of expeditionary operations and safeguarding the

global maritime common,[134] European navies are again placing greater emphasis on their immediate seaward approaches. However, it can be expected that naval forces will continue to be called upon to address threats (including high-end threats) to overseas territories and international security far from home.

Lastly, naval chiefs and political leaders alike must be acutely aware of the impact of the lack of specialized personnel and the increasing techflation on long-term defence planning. These challenges are discussed in greater detail in the following chapters.

3.1. The High-Low Mix: Challenges for Capability Development and Defence Planning

Under the current conditions, all of the naval forces across Europe must place greater emphasis on deterrence and warfighting capabilities. At the same time, the continued relevance of low-end operations[135] forces naval planners to revisit the current balance between high-end and low-end capabilities, creating several challenges: Firstly, naval forces that lack credible offensive and defensive capabilities (and which are therefore unable to hold their own in high-end operations) inevitably translate into a less credible deterrent posture. Potential adversaries might be inclined to take advantage of this circumstance which, in turn, increases the likelihood of conflict.[136] Secondly, investments in high-end capabilities are a prerequisite for European navies to co-operate effectively with their most important military ally and security guarantor: the United States. Falling further behind increases the divide between America's naval forces and its European counterparts. Because NATO is by definition a maritime alliance, this would also result in a 'multi-speed' transatlantic security architecture governed by actors that are less well synchronized

134. Ronald Ratcliff, "Building Partners' Capacities: The Thousand-Ship Navy," *Naval War College Review* 60, no. 4 (2007): 44-58.
135. "The International Commanders Respond," *USNI Proceedings* 146, no. 23 (2020): 33-48.
136. Raphael S. Cohen, Nathan Chandler, Shira Efron, Bryan Frederick, Eugeniu Han, Kurt Klein, Forrest E. Morgan, Ashley L. Rhoades, Howard J. Shatz, and Yuliya Shokh, *The Future of Warfare in 2030: Project Overview and Conclusions*, Santa Monica: RAND (2020), 17, 27f.

and unable to act in a coherent manner. Bi- and mini-lateral arrangements perforce would become the level of ambition, further undermining the collective defence and security concept. Thirdly, the re-emergence of great power competition highlights the EU's self-perception as a soft-security actor and accentuates the role of the United States in European security.[137]

Meanwhile, there are no indications that the requirement for operations at the lower end of the intensity spectrum will diminish in the future. Regardless of whether naval leaders consider constabulary operations in support of sovereign rights or multinational efforts as nuisances that detract from more important duties, maritime security operations will remain an important aspect of the mission portfolio of any fleet.[138] However, navies that prioritize high-end missions are often not inclined to deploy their few expensive and sophisticated assets to low-end missions, and advanced air-defence destroyers and attack submarines are not particularly efficient or effective at constabulary duties.[139] One way to achieve a better return on investment and to allow navies to focus on the training, readiness, and capability development necessary to address more credible threats might be to delegate more low-end duties to coastguards and law-enforcement agencies.[140] At the same time, it is important to remember that the 'proliferation of modern weapons requires a greater high-end capability to be deployed even for maritime-security operations'.[141] Benign environments can quickly turn threatening, posing the gravest of risks to ships tailored to constabulary duties.

137. The current capability shortfalls and gaps between the respective navies are equally problematic and sap the ability of the EU to become a more comprehensive maritime actor. Marianne Riddervold, *The Maritime Turn in EU Foreign and Security Policies: Aims, Actors and Mechanisms of Integration* (Cham: Palgrave Macmillan, 2018).
138. The appetite of politicians for maritime security operations is easily explained: They carry little risk, are not as politically sensitive as the use of air power or land forces, and often receive positive public reception.
139. General Sir David Richards aptly described this problem: "[Y]ou get to this ridiculous situation where in Operation 'Atalanta', off the Somali coast, we have £1 bn. (Type 45) destroyers trying to sort out pirates in a little dhow with (rocket propelled grenades) costing $50, with an outboard motor (costing) $100 . . . That can't be good." Sir David Richards quoted in Richard Beedall, "The Royal Navy: Mind the Gaps," in *World Naval Review 2014*, ed. Conrad Waters (Barnsley: Seaforth Publishing, 2013), 80.
140. Ian Bowers and Swee Lean Collin Koh, *Grey and White Hulls: An International Analysis of the Navy-Coastguard Nexus* (Singapore: Palgrave Macmillan, 2019).
141. Barrie et al., "Defending Europe," 14.

In their effort to develop more comprehensive warfighting capabilities, European navies are struggling to create balanced and financially sustainable forces. Many find it difficult to increase the size of their fleets while maintaining the desired level of sophistication – a telling example being the Royal Navy's decision to replace several Type-23 *Duke*-class ASW frigates with the relatively less capable Type 31 light frigates.[142] Oftentimes, the hollowed-out fleets find themselves lacking the numbers, readiness, and manpower to fulfil required duties. As the prospect of war at sea has returned, decisions of the past, such as depending on offshore patrol vessels and lightly armed 'second-rate' frigates as front-end forces, have come back to haunt navies.[143]

Small navies face the most painful choices. Unlike the heyday of the Cold War, they can no longer focus solely on deterring adversaries by operating fleets designed to deny a potential aggressor the sea as room to stage an invasion. They must also provide a sustained naval presence in low-intensity missions close to home and frequently address challenges to maritime security abroad. In this vein, the financially least fortunate navies have little ambition beyond conducting maritime security operation; not least because the necessary platforms to establish sea control and conduct naval projection operations (i.e., large warships) are 'outside of the budget constraints of very small nations'.[144] However, because they are most at risk, they too need to aspire to measurable warfighting capabilities and to achieve a better high-low mix. In all likelihood, they cannot achieve this by competing symmetrically, but rather by bonding together with others and seeking asymmetric responses.

All around, the high-end challenge creates significant pressure for European naval planners to identify the most promising capability mix to be able to address high-end threats while also satisfying low-end demands.

142. Jon Rosamond, "Arrowhead Wins Cost Battle in U.K. Type-31 Frigate Competition," *USNI News*, September 23, 2019, https://news.usni.org/2019/09/23/arrowhead-wins-cost-battle-in-u-k-type-31-frigate-competition.
143. Examples of warships designed for operations at the lower end of the threat spectrum include the Dutch *Holland*-class offshore patrol vessel, Germany's F-125 *Baden Württemberg*-class frigates, and the French Lafayette-class frigates. All three constitute a sizable element of their fleet but are arguably too lightly armed to be put in harm's way against peer and near-peer competitors.
144. Combes, "Maritime Security Strategies," 130.

3.2. The Home Game vs. the Away Game: Challenges in Capability Development, Defence Planning, and Operational Deployment

As the Western-inspired international rule-based order comes under pressure globally, European navies are torn between providing a credible naval presence close to home and sending their forces abroad. In both cases, naval forces must be fashioned to address a host of complex challenges: from upholding the good order at sea and countering hybrid threats, all the way to the possibility of deploying under the spectre of nuclear war. This circumstance creates distinct challenges for the navies under scrutiny.

On the one hand, European navies must safeguard strategic lines of communication together with maritime approaches by addressing the increasing pressures caused by migration, illicit activities at sea, and the competition over resources and influence. They must also demonstrate robust naval warfighting capabilities to prevent a potential military confrontation with Russia in the European theatre. Consequently, naval forces need to be prepared to deploy across the entire range of their inherent functions, of which the military dimension must occupy the most prominent position.[145] A more substantial naval presence across Europe's littoral region, as well as the North Atlantic and Arctic, are a necessary response to Russian activities aimed at cowing its neighbours and undermining Western solidarity.[146] Such presence contributes to the West's deterrent posture and signals that European states are willing and able to incur costs that will outweigh any gains an attack might promise. This becomes all the more important as the Russian military, despite remaining inferior to the collective power of NATO, can challenge the Alliance directly on the strength of its battle networks, as well as asymmetrically through actions below the threshold of armed conflict. In both high-end scenarios and the so-called 'grey-zone', 'endurance and staying power' are pivotal, Niklas Granholm stresses.[147]

145. Ken Booth, *Navies and Foreign Policy* (Abingdon, Routledge [1977], 2015), 15f.
146. Marc Lanteigne, "The Changing Shape of the Arctic Security," *NATO* Review, June 28, 2019, https://www.nato.int/docu/review/articles/2019/06/28/the-changing-shape-of-arctic-security/index.html.
147. Granholm, "Small Navies," 81.

Conversely, naval forces will continue to deploy overseas frequently. While some have immediate security interests to secure (e.g., overseas territories), all of the European countries depend on 'an open and fair international economic system and sustainable access to the global commons' for their security and prosperity.[148] As one of the most flexible instruments in a state's foreign policy toolkit, naval forces are especially well-suited to safeguarding the sea-based trading system, preventing and managing crises and their spill-over effects.[149] 'Operating in international waters, [navies enjoy] the unique advantage of being able to signal menace without violating sovereignty, and once the need is past, of being able to sail over the horizon without signalling retreat', as Admiral Carlisle Trost so eloquently put it.[150] Despite mounting threats close to home (and a shortage of platforms), several European navies have recently demonstrated their willingness to increase their naval footprint abroad.[151] By participating in international exercises, establishing a more robust forward presence, and deploying to the Indo-Pacific Region and elsewhere, they seek to reassure their allies and partners in the region while at the same time hedging against the growing influence of potentially hostile actors. The governments of the small and smallest European states also have much to gain by showing the flag and making port calls abroad, and they will wish to contribute to international naval activities.[152]

148. European Union External Action Service, *Global Strategy for the European Union's Foreign and Security Policy: Shared Vision, Common Action: A Stronger Europe* (European Union External Action Service, 2016), 8.
149. Peter D. Haynes, *Towards a New Maritime Strategy: American Naval Thinking in the Post-Cold War Era* (Annapolis: Naval Institute Press, 2015).
150. Carlisle, A.H. Trost, "Looking Beyond the Maritime Strategy," in *U.S. Naval Strategy in the 1980s*, ed. John B. Hattendorf and Peter M. Swartz (Newport, Naval War College Press, 2008), 263.
151. Michael Tachum, "Turkey's String of Pearls: Turkey's Overseas Naval Installations Reconfigure the Security Architecture of Mediterranean-Red Sea Corridor," *AIES Fokus*, 4 (2019), https://www.aies.at/download/2019/AIES-Fokus-2019-04.pdf; J. Vitor Tossini, "The UK in the Persian Gulf: Historical Involvement and Military Presence," *ukdefencejournal*, July 26, 2019, https://ukdefencejournal.org.uk/the-uk-in-the-persian-gulf-historical-involvement-and-military-presence/.
152. Denmark's contribution to the European-led surveillance mission in the Strait of Hormuz being a case in point; Ciarán Lowe, "A Comparative Analysis of Policy and Practice within Three Small Navies: Croatia, Ireland and Malta," in *Europe, Small Navies and Maritime Security*, ed. McCabe, Sanders, Speller, 185-98.

In practical terms, the choice between the home game and the away game has become increasingly difficult, and the risks associated with getting the balance-point wrong grow. Unsurprisingly, naval forces designed for territorial defence duties tend not to be well suited to projection operations. As the post-Cold War experiences of Sweden, Finland, and Germany have demonstrated, such forces suffer from limitations in prolonged operations on the high seas and in unfamiliar climates and environments.[153] Conversely, naval power projection and expeditionary operations require forces comprised of large warships, support vessels, and corresponding logistical arrangements.[154] But such capabilities are difficult – if not impossible – to develop in the short term due to their technical complexity, long lead-times to delivery, and corresponding costs. While this challenge is felt acutely across Europe, it is most pronounced among navies with small budgets, limited naval industrial capacities, and a small pool of skilled personnel.

What is more, while the general trend appears to indicate an overall increase in warship size, Western navies no longer enjoy unimpeded access to the world's littorals, and large warships have become increasingly vulnerable as they operate within the striking range of enemy battle networks. In sum, the need to deploy naval forces with increased frequency to address security challenges both near and afar creates pains for which there is no simple cure. Decisions must be made regarding strategic interests, the corresponding force structure development, and operational priorities, all of which amplifies the already existing supply-side challenges.

3.3. Personnel and Technology: Challenges of Recruitment, Retention, and Techflation

The shifting security environment and corresponding global naval developments exacerbate several other challenges common to most of the navies on the continent. Great power competition, novel technologies,

153. Tellingly, during the 1990s and 2000s, several European navies faced major difficulties as they began to deploy further afield. Jeremy Stöhs, "The Evolution of European Naval Power 1989-2019: Strategy – Force Structure – Operations," unpublished Dissertation (2019), 157f.

154. Ian Speller, *Understanding Naval Warfare* (Abingdon: Routledge, 2014), 129.

and multi-domain operations are changing the role and shape of military manpower.[155] As navies introduce new platforms, increase the size and sophistication of their respective fleets, and thereby seek to regain their warfighting potential, the lack of manpower and highly-trained, specialized personnel has become most alarming.[156] In particular, in light of the growing importance of naval presence, there are calls for greater numbers of service members to support 'front-end' forces.[157] On the supply side, the struggle to attract and retain skilled personnel is a consequence of multiple compounding factors, including the shift towards professional armies, injudicious cuts to personnel levels in the past, outsourcing responsibilities to civilian contractors, as well as changing demographics and attractive alternatives offered by the more lucrative careers in the private sector.

Several navies are affected by the dearth of manpower as they seek to maintain or build balanced blue-water fleets designed around a nucleus of power projection vessels. The Royal Navy, for example, is currently several hundred people short and will need significantly more recruits to reach the personnel levels necessary to operate new carriers and their escorts effectively.[158] Similarly, the warships, submarines, and aircraft of other navies (including those of Germany, Norway, and Spain) are repeatedly confined to their bases due to personnel shortages, difficulties related to speeding up training processes, and the lack of spare parts.[159]

155. In this context, the term 'manpower' is shorthand for personnel. Harrison Schramm, "Three Postcards for Military Manpower," *USNI Proceedings* 146, no. 1 (2020), 42.
156. "A high number of missions combined with better-paying jobs outside the military has resulted in a number of sailors and officers leaving the force," Søren Nørby explains; Nørby, "The Royal Danish Navy: From the Baltic to the Horn of Africa – And Back Again," in Conrad Waters (ed.), *World Naval Review 2016* (Barnsley: Seaforth Publishing, 2015), 92-103.
157. Schramm, "Three Postcards," 43.
158. "A high number of missions combined with better-paying jobs outside the military has resulted in a number of sailors and officers leaving the force." Nørby, "The Royal Danish Navy," 92-103; "Has the Royal Navy Solved Its Manpower Problems?" *Save the Royal Navy*, March 18, 2019, https://www.savetheroyalnavy.org/has-the-royal-navy-solved-its-manpower-problems/; Lee Berthiaume, "'I Need People': Canadian Navy, Coast Guard Need Hundreds to Man New Ships," *The Canadian Press*, February 29 (2020). https://globalnews.ca/news/6613120/canadian-navy-coast-guard-sailor-shortage/.
159. "Frigate Berthed for Its Spare Parts," *News in English.no,* September 30 (2013). http://www.newsinenglish.no/2013/09/30/frigate-berthed-for-spare-parts/.

In addition to large crews, the effective operation of larger forces depends on a robust defence industrial base to design, develop, and build capital ships; or – at the very least – a sizable shipyard capacity and critical mass of ships to sustain the skilled workforce necessary for maintenance. The smaller that the pool of qualified personnel from which a state and its navy can draw becomes, the more difficult it is for navies to maintain a broad range of naval proficiencies. This complicates the balance between sailors' various sea and shore deployments, and it limits the influence of the cadre of naval professionals on policymakers and the general public.[160] Consequently, most navies find it difficult to muster enough personnel to fulfil standing commitments and maintain a measurable degree of readiness in times of relative peace. Novel models of recruitment, crewing, and deployment, as well as new technologies, might provide solutions for navies suffering from personnel shortages. Increasing wages, a reformed service culture, and improving the conditions of service, together with opening recruitment to citizens from other European states, are all measures well worth considering.

At the same time, the rising costs of military technology constitute a major challenge to Western militaries in general and European navies in particular. To hold their own against powerful military competitors, European states must invest in technologically advanced platforms and systems. Because size (both in terms of numbers and tonnage) remains an important indicator of naval power, they will be inclined to continue procuring 'big-ticket items', such as warships, submarines, and aircraft. This development could prove to be fiscally unsustainable for several smaller countries. Military modernization in Europe continues to be particularly affected by the combination of rising costs of new equipment that exceed inflation (techflation) and the corresponding increase in per-unit costs due to the relatively small numbers being procured, which creates diseconomies of scale. In combination, these two factors have resulted in a drastic decline in the number of platforms. The likely

160. Oftentimes they must choose between international maritime missions, participating in exercises to hone warfighting skills, undergoing training and certification (e.g. Flag Officer Sea Training), responsibilities ashore, and the necessary time off duty. Anders Puck Nielsen, "Why Small Navies Prefer Warfighting over Counter-Piracy," in Edward R. Lucas et al. (ed.), *Maritime Security: Counter-Terrorism Lessons from Maritime Piracy and Narcotics Interdiction* (Amsterdam, IOS Press, 2020), 97-109.

pressure on defence spending in the COVID-19 world adds credence to worries that small- and medium-sized states are nearing the 'end of the line' regarding naval modernization and the ability to afford the next generation of military technology.[161]

Defence planners across Europe must realize that no single navy can remain oblivious to the ongoing shift towards a more competitive maritime future. Because each country arranges its military capabilities in their own unique fashion, the supply-side challenges have different strategic effects and outcomes. In the subsequent chapter, we will discuss these according to the four general types of navies.

161. Tim Sweijs, Frank Bekkers, and Stephan De Spiegleire, *Playing to Your Strengths: A Different Perspective on Future Capabilities* (The Hague: The Hague Centre of Strategic Studies, 2018), 11.

4

Implications for European Navies

Without exception, all of the European countries are affected by the strategic competition between great powers. Individually and together, they face numerous major challenges and difficult choices as they devise their respective force architectures of tomorrow and formulate corresponding defence policies. After several years of efforts aimed at arresting and partially reversing the downward drift of European naval power, the economic fallout following the outbreak of the COVID-19 pandemic will once again increase the political pressure to seek shortcuts and to postpone or curtail defence investments.[162] The failure to close or lessen the apparent gaps and shortcomings in naval capabilities would directly impede deeper structural integration and inevitable lead to an even greater qualitative and quantitative chasm between the U.S. and the respective naval forces in Europe. This creates vulnerabilities and undermines national, European, and transatlantic security and defence.

The largest navies in Europe operate relatively well-balanced, multi-purpose forces designed to cover a broad range of missions across the naval spectrum.[163] Despite suffering from capability shortfall (relatively speaking), they still find themselves in the most favourable position to adjust to the changing security environment. From a conceptual, technological, and operational perspective, these navies will likely be able

162. Daniel Fiott, "Will European Defence Survive Coronavirus?" *Real Instituto Elcano*, March 27, 2020.

163. They comprise: ASW, AAW, ASuW, MCM capabilities, have auxiliary fleets, fixed-wing aircraft, amphibious warfare capabilities, and are able to sustain forces over distance as well as for longer periods of time without assistance.

to increase their warfighting potential and, thus, continue to remain in the wake of U.S. high-end naval capability development – provided they receive the necessary funding. Importantly, they can rely on mature defence industries in their countries to deliver most of the technological solutions necessary to keep pace. However, this does not mean that reversing the effects of budget cuts and changing the mission priorities of the past (at the low end) will be easy, nor that maintaining and expanding naval capabilities across all warfare areas will be cheap. Large navies must expect to do even more than before – particularly to take the lead in possible high-end scenarios and to be able to conduct multi-domain operations against peer competitors. National ambitions and international obligations are likely to complicate the decision-making regarding the high-low mix of forces and the appropriate naval presence necessary to 'win both the home and away games', so to speak. Finally, as large navies again operate large platforms in increasing numbers, they will encounter new personnel troubles while at the same time deploying forces that are increasingly vulnerable to enemy attack.

Within the European context, several states operate what can best be described as medium-sized navies: These either lack the balanced force structure or have significantly fewer naval platforms and personnel than their larger counterparts.[164] Because the maritime domain and, consequently, naval power are becoming increasingly important in supporting political and economic interests, medium-sized navies are also expected to shoulder greater responsibility.[165] For this heterogenic group of navies, the prospect of high-end conflict at sea has major implications due to critical capability shortfalls, as well as inherent political and conceptual constraints and caveats, which stand in the way of devising effective strategies, doctrines, and tactics. Due to the rising costs and complexity of naval technology together with the corresponding need for qualified personnel, naval planners must be aware of the many difficult choices ahead.

164. This includes the fleets of the German Navy, the Royal Netherlands Navy, the increasingly capable Turkish Navy, and the Hellenic Navy.
165. Rose George, *Ninety Percent of Everything: Inside Shipping, the Invisible Industry that Puts Clothes on Your Back, Gas in our Car, and Food on Your Plate* (New York: Henry Holt & Co., 2013); Parry, *Super Highway*.

The final two categories cover the naval forces of smaller states that have more 'limited means and aspirations', in Geoffrey Till's words.[166] For these types of navies, the return to a competitive vision of the maritime future has the most significant implications, as the rising capability thresholds depicted in the introduction suggest. The first category – referred to here as small, high-performing navies – includes fleets that operate advanced naval platforms, have the ability to conduct relatively complex naval operations close to home, and can effectively deploy over long distances as part of international missions. The global increase in warfighting capabilities throws into stark relief the comparatively small defence budgets and modest industrial capacities from which such navies can draw as they modernize. Consequently, they suffer disproportionately from techflation and diseconomies of scale; which, in turn, creates even greater dependencies on foreign training, support, and technological assistance. These compounding sets of challenges limit choices in balancing national and international obligations, as well as force structure options to conduct a broad range of naval missions.

Meanwhile, the smallest and least well-developed navies not only lack 'critical mass' but also the most basic naval capabilities necessary to make measurable contributions to multi-domain operations.[167] They are plagued by financial problems, face conceptual and institutional challenges, and hardly have the means to establish maritime domain awareness and a measurable degree of sea control in their adjacent waters. Lacking the modern naval platforms and C4ISTAR capabilities necessary to bond together effectively with allied forces, these small, geographically exposed navies in the Baltic and Black Sea are at risk of quickly being outgunned and outmanoeuvred in any high-end scenario.

Having outlined the strategic implications for the different types of navies, the final section will discuss what naval policymakers need to consider and which responses might succeed in tackling the challenges to each service and European naval power more broadly.

166. Till, "Are Small Navies Different," 23.
167. Till, "Are Small Navies Different," 23.

5

Conclusion and Recommendations

This report took its starting point in the re-emergence of strategic competition between great powers together with the renewed focus on high-end warfare. It analysed the challenges facing European states, individually as well as collectively, in conceptualizing, organizing, and deploying their naval forces to meet rising capability thresholds. To this end, we posited two sets of challenges: Firstly, demand-side challenges arising from the changing strategic environment, including the proliferation of advanced missiles and sensor technology; AI and increasingly autonomous systems; and operational challenges in multi-domain operations. Secondly, supply-side challenges that are created or accentuated by the external environment and which naval planners and their political leaders must address to increase their warfighting potential. This includes finding the right balance in terms of the high-low mix of forces; between having a strong naval presence close to home and projecting power over distance; as well as finding answers to the persistent problems of attracting and retaining skilled personnel and the ever-increasing costs for complex naval systems and platforms.

Overall, life is unlikely to get any easier for naval chiefs and their political masters. The interacting dynamics of the abovementioned challenges create new perils for all of the types of maritime forces under consideration; perils that are particularly acute among the small(est) navies. In addition to emphasizing the gaps in terms of size and capability between navies in Europe and those of great powers, this report has also posed the question as to whether several navies will be able to reach suffi-

cient capability levels that allow them to co-operate effectively with the largest, most sophisticated naval forces – above all the U.S. Navy – and thus contribute to high-end operations in the future.

The changing external conditions of naval power in Europe mean that navies are challenged to 'jump' in order to reach capability thresholds. The first key policy question with reference to the high-end tasks is, then, 'How high?' What are the impediments and conditions for developing European navies in that direction – as a symmetric response? A second, related policy question becomes: Can European navies develop asymmetric responses to the challenge? In this final section, we explore the strategic implications and identify the options and takeaways regarding the future of European naval power.

5.1. Naval Rejuvenation and International Co-operation

As navies across Europe face these daunting challenges in adapting to a new security environment, the bottom line is that navies need rejuvenating.

- At the strategic level, security and defence policies should clearly state their level of ambition regarding the high-end challenge in order to derive an understanding for the capabilities necessary to satisfy demand- and supply-side challenges. For example, NATO members have committed to the Readiness Initiative, aimed at having thirty battalions, squadrons, and warships ready to use within thirty days (30/30/30/30). The EU's ambitions[168] also have a maritime focus and emphasize the need for full-spectrum capabilities (surface superiority, power projection, and anti-submarine warfare). However, they are less specific regarding concrete capability requirements and face challenges in terms of capability development.[169]

168. This includes the EU Global Strategy and its implementation plan, the Common Security and Defence Strategy, the EDF's Capability Development Plan, the Permanent Structured Cooperation, and the Coordinated Annual Review on Defence. European Defence Agency, *2018 CDP Revision: The EU Capability Development Priorities* (2018), https://www.eda.europa.eu/docs/default-source/eda-publications/eda-brochure-cdp.
169. Daniel Fiott, "EU Defence Capability Development: Plans, Priorities, Projects," *EUISS*, June (2018).

- Among the respective nations, levels of ambition vary significantly. Still, policies must accurately gauge the characteristic of the high-end challenges and link naval concepts and planning to corresponding modernization and procurement programmes. Governments, cabinets, and ministries should direct defence officials to plan explicitly for higher-end capability profiles while also discussing and acknowledging the particular national needs to balance the high/low mix, the portfolio of home and away tasks, and finally the joint operational challenge from multi-domain operations. This should also include defence institutions taking a hard look at how current budgets are being spent and where efficiencies can be won. Clearly, robust defence policies must be supported by higher budgets.

International co-operation will remain a central criterion to naval rejuvenation – a necessity rather than a choice for even the largest naval forces in Europe. However, national political prerogatives, defence industrial considerations, and operational caveats influence the process of defence integration and capacity development in Europe.[170]

- On the political level, policymakers should recognize the continued centrality of the transatlantic relationship for European security. Due to the nature of the threats that navies expect to face close to home as well as abroad, the importance of co-operation with the U.S. military is unlikely to wane anytime soon.[171] Planners should therefore emphasize naval policies that place national security arrangements within a transatlantic context. High-end capabilities at the national and EU levels must be co-ordinated – aligned at best and complementary at worst – with the developments within NATO and the United States. These realities should entail further upstream efforts in terms of harmonizing defence planning and the alignment of force structure processes; they should inform the deliberations regarding multinational fora; and they ought to be reflected in in-

170. They prevent it from reaching the degree of maturity that would be necessary to deal with high-end challenges described in this report and that would allow the EU to become an effective defence framework anytime soon.

171. Evidently, once the principal naval power, the United States, or NATO is not present along Europe's maritime borders, Russia becomes the regional power by default. Farther afield, particularly in the Asia-Pacific region, the high-end challenge (in the form of the PRC) is greater still, which renders the role of the United States even more pertinent. Combes, "Maritime Security Strategies," 128.

dustrial co-operation, including R&D. Downstream developments, such as co-operation in terms of education, training, exercises, and operations, will be equally important to reach capability thresholds.

- National and European defensive industries have a major role to play in future capability development and influencing the direction that naval integration will take.[172] As the United States pushes forward in the development of advanced and disruptive technologies, European states must avoid national industrial policies and wasteful offset programmes that create duplicate efforts, increase costs, and limit interoperability.[173]
- From an operational perspective, the increasing likelihood of conflict erupting at sea, as illustrated by the tension in the Eastern Mediterranean, calls for states to co-ordinate better their naval efforts and operational planning. Important elements of an approach that prioritizes warfighting include readiness, communication, speed, movement, dispersion, deception, redundancy, and lethality. Greater value should be attributed to synchronizing doctrine and tactics as well as to exercises and naval drills focusing specifically on complex joint and multi-domain scenarios.[174] In sum, European navies not only

172. Converging financial pressures coupled with the increasing cost of military technology will create significant challenges for the defence industry across the continent. Paul Taylor, "A Minefield of Opportunity: Transatlantic Defence in the Trump Era," *Friends of Europe*, January 28, 2020, https://www.friendsofeurope.org/insights/a-minefield-of-opportunity-transatlantic-defence-in-the-trump-era/. Another consequence will be the further consolidation of the defence industrial sector; the joint ventures and mergers in the shipbuilding industry on the continent support this claim. Naval Group, "Naviris, the JV between Fincantieri and Naval Group Is Now Fully Operational," *Naval Group*, January 14 (2020), https://www.naval-group.com/en/news/naviris-the-jv-between-fincantieri-and-naval-group-is-now-fully-operational/; Navaltoday, "Germany: Lürssen, German Naval Yards Unveil Merger Plan," May 14, 2020, https://www.navaltoday.com/2020/05/14/germany-lurssen-german-naval-yards-unveil-merger-plan/.
173. They should consider capitalizing on the growing willingness on the part of the U.S. military to cooperate with foreign companies and draw upon European technology to satisfy capability needs. The most prominent examples are the FGG(X) frigate program, purchase of the Norwegian Strike Missile, and choice of the Leonardo TH-73A training helicopter. David B. Larter, "The US Navy Selects Fincantieri Design for Next-Generation Frigate," *DefenseNews*, April 30, 2020, https://www.defensenews.com/breaking-news/2020/04/30/the-us-navy-selects-fincantieri-design-for-next-generation-frigate/?utm_source=twitter.com&utm_campaign=Socialflow+DFN&utm_medium=social.
174. Such as the ASW exercises Dynamic Mongoose and Dynamic Manta. NATO, "Dynamic Mongoose," *MARCOM*, https://mc.nato.int/DMON18. For lessons to be learned, these exercises must also include greater margins of error.

need to prepare to react to quickly escalating situations; they must also be able to fight 'day two' of a multi-domain battle.

5.2. Symmetric Choices

Many of the policy options we propose are aimed at addressing challenges symmetrically and call for significant conceptual and financial investment:

- Navies should seek to develop and deploy relatively well-balanced, multi-purpose fleets. Continued investment in sophisticated platforms, including principal warships, submarines, and aircraft (as well as their powerful weapons and sensors) appear to be necessary to gain sea control against peer competitors and to project and sustain naval power over distance. Profiting from size and open architectures, these assets can be tailored flexibly to a broad range of missions. However, naval planners must bear in mind that operating large warships and platforms in contested littoral environments (e.g., the Black Sea and the Baltic) is becoming increasingly dangerous. In the future, politicians and naval leaders may be forced to risk either losing key assets in the opening stages of a high-intensity conflict or deploying them outside the strike range of the enemy's battle network.[175]
- Navies that are unable to procure and operate complex naval platforms in significant numbers can bond together with others to achieve economies of scale and reach desired capabilities. The Belgian-Dutch fleet integration constitutes the 'gold standard' in this regard. Another option is to pursue niche specialization; that is, to develop skills in specific areas while relegating more complex missions in which navies 'struggle to maintain a competency because of a scarcity of resources' to more powerful partners.[176] However, bi- and mini-lateral arrangements, niche-specialization, and burden-sharing should be based on the premise that they deliver a measurable degree of warfighting capability.

175. Krepinevich, *Maritime Competition*, 4.
176. Chris Pagenkopf, "Cooperation Is the Key to NATO's Future," *USNI Proceedings* (2014), https://www.usni.org/magazines/proceedings/2014/september/cooperation-key-natos-future.

- Navies should consider strengthening their offensive potential in order to hold the opponent's (A2/AD) battle networks at risk and, thus, deter by punishment.[177] Decision-makers must avoid conflict and should therefore carefully weigh the potential escalatory risk associated with acquiring and threatening the use of offensive fires.
- Naval forces should also aim to increase their defensive capabilities – particularly anti-submarine warfare and missile-defence – to deter potential adversaries by denial. This requires close co-ordination and interoperability with U.S. capabilities. Larger navies should consider increasing their magazine depth (vertical launch systems) and arsenals of battle force missiles, whereas small states and their navies can profit from a establishing a modest yet credible stock of sea-, air-, and land-based precision-guided munitions. These efforts should be complemented by robust ISTAR, electronic warfare, and cyber capabilities together with the development of direct-energy weapons.
- The prospect of multi-domain operations should encourage naval forces to develop more comprehensive C2 and ISTAR arrangements, which would allow them to communicate and interoperate seamlessly with allies and partners, even in complex environments.
- Sea-, air-, land-, and space-based sensors (including unmanned platforms) should be fused together to establish a recognized maritime picture, providing 'deterrence by detection'[178] and allowing joint, multinational forces to perform the full array of naval missions.
- Finally, some low-end activities and constabulary duties could be delegated to coastguard and law-enforcement agencies. This might be both efficient and effective, allowing investments to be made in acquisition, modernization, and training for high-end missions.

177. Thomas G. Mahnken, Travis Sharp, and Grace B. Kim, *Deterrence by Detection: A Key Role for Unmanned Aircraft System in Great Power Competition*, Washington D.C., CSBA (2020).
178. A greater degree of situational awareness can deter adversaries from taking aggressive action. See Mahnken, Sharp, and Kim, *Deterrence by Detection*.

5.3. Asymmetric Choices: Reframing the Purpose of Navies vis-à-vis High-End Challenges

As navies in Europe struggle to keep pace with global naval developments, they will often be unable to compete symmetrically with larger competitors and remain financially sustainable. European navies should therefore systematically study possible asymmetric responses to the great power competition. In light of the high-end challenges, policy planners should consider re-framing the purpose of their respective naval forces, possibly arriving at radically new ways of thinking about naval power.

- Naval planners should examine whether the joint and multinational approach to warfare allows them to explore new avenues of deploying military forces – particularly within the European theatre, where the geographical distinctions between the domains are dissipating due to long-range precision fire and possible competition across the breadth of the intensity spectrum.[179]
- Projecting power from land, air, space, and cyberspace across and beyond the maritime domain might allow European states to enjoy a greater degree of deterrence than they do today. Enhancing land-based aviation, missiles, sensors (including space-based assets), and cyber capabilities could potentially yield greater effects at lower cost than do current military arrangements. In turn, the re-shaped and rejuvenated navies could be in a position to offer a more comprehensive capability portfolio, such as in the increasingly important undersea domain.
- Navies should consider emphasizing dispersion rather than the concentration of forces, and they ought to restructure their fleets accordingly.[180] Acquiring larger numbers of small, fast, and stealthy platforms – to complement larger units – is part and parcel of creating an increasingly manoeuvrable, flexible, and lethal distributed force.[181] In the future, a navy's order of battle could encompass manned, unmanned, and semi-autonomous, armed, or unarmed platforms which

179. Krepinevich, *Maritime Competition*.
180. For a list of articles on distributed lethality, see Dmitry Filipoff, "Distributed Lethality Week," *CIMSEC*, http://cimsec.org/distributed-lethality-topic-week.
181. Thaddeus Drake Jr. "Serious About Sea Denial? Study the Iranians," *USNI Proceedings,* 14, 3 (2020), 70-3.

act as sensor nodes ('ISTAR pickets'), conduct Special Forces operations, anti-submarine and mine warfare, and serve in both scouting and striking roles.

- Unable to compete with larger powers for naval parity, navies of small states should consider skilfully applying sea denial systems and doctrines, such as submarines, UUVs, coastal missiles defence systems, fast attack craft, and mines, to deny adversaries sea control.[182] Acquiring disruptive technologies, including AI and (semi-)autonomous and unmanned vehicles, offers further options to 'outflank the quality-quantity dilemma [and deter] stronger potential enemies'.[183] However, planners must be mindful of how the application of novel technologies can require substantial targeted investment and carries risk.
- Navies, particularly those with limited means, should consider acquiring technologies that play to their strengths rather than pursuing more complex solutions that also entail greater risk. They might be well advised to wait for others to offer these capabilities and use readily available (including commercial, off-the-shelf) technologies.[184] The Danish decision to acquire towed sonar arrays from a Canadian marine technology company to plug the country's holes in ASW offers a case in point.
- Finally, in times of high-end challenges and fiscal austerity, defence planners and naval commanders alike should view naval power in terms of capabilities and not platforms. They must think creatively about how to deliver effects rather than myopically deliberating how to deploy ships, submarine, and drones.[185]

Preparing European naval forces to a competitive maritime future will require strong leadership as well as significant personnel, technological, and financial resources. As tempting as shifting the operational focus back to low-intensity operations might be in a period of economic hardship and increasing pressures on military budgets, in reference to the questions posed in the introduction, navies will need to be able to clear a high bar of capabilities that others have set for them. No matter whether

182. Till, *Seapower*, 99-100.
183. Daniel and Hayes, "Towards a West European Navy," 91.
184. Till, *Seapower*, 99-100.
185. From personal correspondence with Thomas-Durell Young.

they pursue symmetric or asymmetric strategies or a combination of the two, strategic competition has already radically altered the conditions for developing the naval power of European nations, and all of the responses are likely to require serious consideration.

Bibliography

Adelman, Kenneth, and Augustine Norman. *The Defense Revolution: Strategy for the Brave New World: By an Arms Controller and an Arms Builder*. San Francisco: Institute for Contemporary Studies, 1990.

Allen, Gregory C. "Understanding China's AI Strategy." *Center for New American Security*, February 6, 2019. https://www.cnas.org/publications/reports/understanding-chinas-ai-strategy.

Alleslev, Leona. "NATO Anti-submarine Warfare: Rebuilding Capability, Preparing for the Future. Special Report." *Science and Technology Committee*, 2019. https://www.nato-pa.int/download-file?filename=sites/default/files/2019-10/REPORT%20150%20STC%2019%20E%20rev.%201%20fin%20-%20ANTI-SUBMARINE%20WARFARE.pdf.

Barrie, Ben, Douglas Barrie, Lucie Béraud-Sudreau, Henry Boyd, Nick Childs, and Bastian Giegerich. "Defending Europe: Scenario-Based Capability Requirements for NATO's European Members." *IISS Research Papers*, 2019.

Beedall, Richard. "The Royal Navy: Mind the Gaps." In *World Naval Review 2014*, edited by Conrad Waters. Barnsley: Seaforth Publishing, 2013.

Bendett, Samuel. "Red Robots Rising: Behind the Rapid Development of Russian Unmanned Military System." *The Strategy Bridge*, December 12, 2017. https://www.ausa.org/sites/default/files/publications/SL-17-2-Integrating-Army-Robotics-and-Autonomous-Systems-to-Fight-and-Win.pdf.

Berthiaume, Lee. "'I Need People': Canadian Navy, Coast Guard Need Hundreds to Man New Ships." *The Canadian Press*, February 29, 2020. https://globalnews.ca/news/6613120/canadian-navy-coast-guard-sailor-shortage/.

Biscop, Sven. *European Strategy in the 21st Century: New Future for Old Power*. Abingdon: Routledge, 2018.

Booth, Ken. *Navies and Foreign Policy*. Abingdon, Routledge [1977], 2015.

Borchert, Heiko. "Why Undersea Drones Will (Not Yet) Change Asia-Pacific's Undersea Balance." *CSIS*, May 5, 2016. https://amti.csis.org/undersea-drones-will-not-yet-change-asia-pacifics-undersea-balance/.

Boston, Scott, and Dara Massicot. "The Russian Way of Warfare: A Primer." Santa Monica: Rand, 2017. https://www.rand.org/content/dam/rand/pubs/perspectives/PE200/PE231/RAND_PE231.pdf.

Bowers, Ian, and Swee Lean Collin Koh. *Grey and White Hulls: An International Analysis of the Navy-Coastguard Nexus*. Singapore: Palgrave Macmillan, 2019.

Bruns, Sebastian. *US Naval Strategy and National Security*: *The Evolution of American Maritime Power*. Abingdon: Routledge, 2018.

Bundesministerium für Verteidigung. "Planungsamt der Bundeswehr. Abteilung I – Zielbildung und Innovation." *Bundesministerium für Verteidigung*. https://www.bundeswehr.de/de/organisation/weitere-bmvg-dienststellen/planungsamt-der-bundeswehr-/die-vier-abteilungen/zielbildung-und-innovation-planungsamt.

Centre for Military Studies. "Centre for Military Studies Project Manual." Copenhagen: Centre for Military Studies, undated. https://cms.polsci.ku.dk/english/about/project-manual/CMS_Project_Manual.pdf.

Chan, Sewell. "Donald Trump's Remarks Rattle NATO Allies and Stoke Debate on Cost Sharing." *The New York Times*, July 21, 2016. https://www.nytimes.com/2016/07/22/world/europe/donald-trumps-remarks-rattle-nato-allies-and-stoke-debate-on-cost-sharing.html.

Chesebrough, Dave, and Matt Dooley. "Defense Department Struggles to Define Autonomy." *National Defense*, September 13, 2018. https://www.nationaldefensemagazine.org/articles/2018/9/13/defense-department-struggles-to-define-autonomy.

Clare, Phil. "The Answer Is Multi Domain Operations: Now What's the Question?" *Wavell Room*, February 13, 2020. https://wavellroom.com/2020/02/13/the-answer-is-multi-domain-operations-now-whats-the-question/.

Clausewitz, Carl von. *Vom Kriege,* [1832] 2012, Chapter 2.

Cohen, Raphael S., Nathan Chandler, Shira Efron, Bryan Frederick, Eugeniu Han, Kurt Klein, Forrest E. Morgan, Ashley L. Rhoades, Howard J. Shatz, and Yuliya Shokh. *The Future of Warfare in 2030: Project Overview and Conclusions*. Santa Monica: RAND (2020).

Combes, William. "Maritime Security Strategies for Very Small States: The Baltic States." In *Europe, Small Navies and Maritime Security: Balancing Traditional Roles and Emergent Threats in the 21st Century*, edited by Robert McCabe, Deborah Sanders, and Ian Speller, Abingdon: Routledge, 2019, 117-132.

Covington, Stephen R. *The Culture of Strategic Thought behind Russia's Modern Approaches to Warfare*. Cambridge, MA: Belfer Center, 2016. https://www.belfercenter.org/sites/default/files/legacy/files/Culture%20of%20Strategic%20Thought%203.pdf.

Cropsey, Seth, and Bryan McGrath. *Maritime Strategy in a New Era of Great Power Competition*. Washington, DC: Hudson Institute, 2018.

Dalsjö, Robert, Christofer Berglund, and Michael Jonsson. "Bursting the Bubble? Russian A2/AD in the Baltic Sea Region: Capabilities, Countermeasures, and Implications." *Swedish Defence Research Agency*, March 2019. https://www.foi.se/rest-api/report/FOI-R--4651--SE.

Daniel, Donald, and Bradd Hayes. "Towards a West European Navy: Organizational and Operational Issues." In *The Role of European Naval Forces after the Cold War*, edited by Gert de Nooy, 21. New York: Springer, 1996.

Department of the Navy. "Naval Doctrine Publication 1, Naval Warfare." April 2020.

Drake Jr., Thaddeus. "Serious about Sea Denial? Study the Iranians." *USNI Proceedings* 14, no. 3 (2020).

Eckstein, Megan. "Foggo: Russia Seeking More Control of Black Sea, Mediterranean, Arctic." *USNI News*, July 17, 2020.

Egel, Daniel, Eric Robinson, Charles Cleveland, and Christopher Oates. "AI and Irregular Warfare: An Evolution, Not a Revolution." *War on the Rocks*, October 31, 2019. https://warontherocks.com/2019/10/ai-and-irregular-warfare-an-evolution-not-a-revolution/.

EUROMARFOR: History, "EUROMARFOR (EMF) – A Non-standing, Pre-structured, Multinational Maritime Force, Born on 15 May 1995." http://www.euromarfor.org/overview/3.

European Defence Agency. *2018 CDP Revision: The EU Capability Development Priorities*, 2018. https://www.eda.europa.eu/docs/default-source/eda-publications/eda-brochure-cdp.

European Defence Agency. "Ocean Twenty." https://ocean2020.eu/.

European Union External Action Service. "Global Strategy for the European Union's Foreign and Security Policy: Shared Vision, Common Action: A Stronger Europe." *European Union External Action Service*, 2016.

European Union. "PESCO Projects: Maritime Unmanned Anti-submarine System (MUSAS)." *European Union*. https://pesco.europa.eu/project/maritime-unmanned-anti-submarine-system-musas/.

European Union. "PESCO Projects: Strategic Command and Control (C2) Systems for CSDP Missions and Operations." *European Union*. Accessed September 18, 2020. https://pesco.europa.eu/project/strategic-c2-system-for-csdp-missions-and-operations/.

European Union. "PESCO Projects: The Maritime (Semi-) Autonomous Systems for Mine Countermeasures (MAS MCM)." *European Union*. https://pesco.europa.eu/project/maritime-semi-autonomous-systems-for-mine-countermeasures/.

Evans, Ryan. "WOTR Podcast: How Is the Air Force Adapting to Great Power Competition?" *War on the Rocks*, June 5, 2019. https://warontherocks.com/2019/06/wotr-podcast-how-is-the-air-force-adapting-to-great-power-competition/.

Filipoff, Dmitry. "Distributed Lethality Week." *CIMSEC*. http://cimsec.org/distributed-lethality-topic-week.

Finnish Ministry of Defence. "Breakdown of Defence Expenditure." *Finnish Ministry of Defence*. https://www.defmin.fi/en/tasks_and_activities/resources_of_the_defence_administration/finances/breakdown_of_defence_expenditure.

Fiott, Daniel. "Europe and the Pentagon's Third Offset Strategy." *The RUSI Journal* 161, no. 1 (2016): 26-31.

Fiott, Daniel. "EU Defence Capability Development: Plans, Priorities, Projects." *EUISS*, June 2018.

Fiott, Daniel. "Strategic Autonomy: Towards 'European Sovereignty' in Defence?" *EUISS Brief*, November 2018. https://www.iss.europa.eu/content/strategic-autonomy-towards-%E2%80%98european-sovereignty%E2%80%99-defence.

Fiott, Daniel. "What If...the United States Pulls Out of Europe." In *What if...? Scanning the Horizon: 12 Scenarios for 2021*, edited by Florence Gaub. European Union Institute for Security Studies, 2019. 55-58.

Fiott, Daniel. "Will European Defence Survive Coronavirus?" *Real Instituto Elcano*, March 27, 2020.

FitzGerald, Ben, Kelly Sayler, and Shawn Brimley. "Game Changers: Disruptive Technology and U.S. Defense Strategy." Washington DC: Center for a New American Security, 2013. https://www.cnas.org/publications/reports/game-changers-disruptive-technology-and-u-s-defense-strategy.

Fitzsimmons, Michael. "Russian Strategy and the End of the INF Treaty." *Survival: Global Politics and Strategy* 60, no. 6 (2018): 119-36.

Franke, Ulrike, and Tara Varma. "Independence Play: Europe's Pursuit of Strategic Autonomy." *European Council on Foreign Relations*, July 2018. https://www.ecfr.eu/specials/scorecard/independence_play_europes_pursuit_of_strategic_autonomy.

Friedman, Norman. "Technological Review: Shipboard Anti-ship Missiles." In *World Naval Review 2017*, edited by Conrad Waters. Barnsley: Seaforth Publishing, 2016.

Friedman, Norman. "Modern Naval Communications." In *World Naval Review 2019*, edited by Conrad Waters. Barnsley: Seaforth Publishing, 2018.

Friedman, Norman. "Technology Review: A New Age of Naval Weapons?" In *World Naval Review 2018*, edited by Conrad Waters. Barnsley: Seaforth Publishing, 2017.

Gady, Franz-Stefan. "What Does AI Mean for the Future of Manoeuvre Warfare?" *IISS*, 2020. https://www.iiss.org/blogs/analysis/2020/05/csfc-ai-manoeuvre-warfare.

Gain, Nathan. "French Navy Aiming for 1200 Unmanned Systems by 2030." *Naval News*, July 29, 2019. https://www.navalnews.com/naval-news/2019/07/french-navy-aiming-for-1200-unmanned-systems-by-2030/.

George, Rose. *Ninety Percent of Everything: Inside Shipping, the Invisible Industry That Puts Clothes on Your Back, Gas in Our Car, and Food on Your Plate*. New York: Henry Holt & Co., 2013.

Germond, Basil. "Small Navies in Perspective: Deconstructing the Hierarchy of Naval Forces" In *Small Navies: Strategy and Policy for Small Navies in War and Peace*, edited by Michael Mulqueen, Deborah Sanders and Ian Speller. Farnham: Ashgate, 2014. 33-50.

Germond, Basil. *The Maritime Dimension of European Security: Seapower and the European Union*. London: Palgrave Macmillan, 2015.

Goldstein, Lyle J. "China Hopes UUVs Will Submerge Its Undersea Warfare Problem." *The National Interest*, March 28, 2020. https://nationalinterest.org/blog/buzz/china-hopes-uuvs-will-submerge-its-undersea-warfare-problem-138597.

Gould, Joe. "Romania Eyes New Maritime Drone to Counter Russia." *Defense News,* May 7, 2019. https://www.defensenews.com/digital-show-dailies/navy-league/2019/05/07/romania-eyes-new-maritime-drone-to-counter-russia/.

Granholm, Niklas. "A Small Navy in a Changing World: The Case of the Royal Swedish Navy." In *Small Navies: Strategy and Policy for Small Navies in War and Peace*, edited by Michael Mulqueen, Deborah Sanders, and Ian Speller. Farnham: Ashgate, 2014.

Granholm, Niklas. "Small Navies and Naval Warfare in the Baltic Sea Region." In *Europe, Small Navies and Maritime Security*, edited by McCabe, Sanders, and Speller. Abingdon: Routledge, 2019, 71-88.

Gros, Philippe. "The 'Tactical Cloud': A Key Element of the Future Combat Air System." *Foundation pour la Recherche Stratégique*, October 2, 2019. https://www.frstrategie.org/en/publications/notes/tactical-cloud-key-element-future-combat-air-system-2019.

Grove, Eric. *The Future of Sea Power*. Annapolis: Naval Institute Press, 1990.

Hao, Karen. "Yes, China Is Probably Outspending the US in AI – but Not on Defense." *MIT Technology Review*, December 5, 2019. https://www.technologyreview.com/s/614842/china-us-ai-military-spending/.

Harris, Harry B. Jr., Robert B. Brown, Scott H. Swift, and Richard D. Berry. "The Integrated Joint Force: A Lethal Solution for Ensuring Military Preeminence." *The Strategy Bridge*, March 2, 2018. https://thestrategybridge.org/the-bridge/2018/3/2/the-integrated-joint-force-a-lethal-solution-for-ensuring-military-preeminence.

Haynes, Peter D. *Towards a New Maritime Strategy: American Naval Thinking in the Post-Cold War Era*. Annapolis: Naval Institute Press, 2015.

Hoffman, Frank. "Will War's Nature Change in the Seventh Military Revolution?" *Parameters* 47, no. 4 (2017): 19-31.

Horowitz, Michael C. *The Diffusion of Military Power: Causes and Consequences for International Politics*. Princeton: Princeton University Press, 2010.

Hughes Jr, Wayne P. *Fleet Tactics and Coastal Combat*. Annapolis: Naval Institute Press, 2000.

Hughes Jr., Wayne P., and Robert P. Girrer. *Fleet Tactics and Naval Operations*, 3rd ed. Annapolis: Naval Institute Press, 2018.

Hush-Kit. "What's Going on with Hypersonics? We Ask the Royal United Services Institute's Justin Bronk." *Hush-Kit*, April 3, 2020. https://hushkit.net/2020/04/03/whats-going-on-with-hypersonics-we-ask-the-royal-united-services-institutes-justin-bronk/.

Ingber, Sasha. "Putin to Russian Military: 'Prepare a Symmetrical Response' to U.S. Missile Test." *National Public Radio*, August 23, 2019. https://www.npr.org/2019/08/23/753662354/putin-to-russian-military-prepare-a-symmetrical-response-to-u-s-missile-test?t=1584043619114&t=1595274204616.

Joint Chiefs of Staff. *Joint Doctrine Note 1-18: Strategy*. April 25, 2018. https://www.hsdl.org/?abstract&did=810221.

Joint Chiefs of Staff. *Joint Publication 3-32: Joint Maritime Operations.* June 8, 2018. https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_32.pdf?ver=2019-03-14-144800-240.

Kelly, Fergus. "US Approves $375 Million Sale to Finland of Harpoon Anti-ship and ESSM Air Defense Missiles." *The Defense Post*, February 6, 2018. https://www.thedefensepost.com/2018/02/06/us-finland-sale-harpoon-missiles-essm-missiles/.

Khanna, Monty. "Get Ready for the Next RMA at Sea." *USNI Proceedings* 146, no.1 (2020).

Klare, Michael. "Pentagon Asks More for Autonomous Weapons." *Arms Control Association*, April 2019. https://www.armscontrol.org/act/2019-04/news/pentagon-asks-more-autonomous-weapons.

Kofman, Michael. "It's Time to Talk A2/AD: Rethinking the Russian Military Challenge." *War on the Rocks*, September 5, 2019. https://warontherocks.com/2019/09/its-time-to-talk-about-a2-ad-rethinking-the-russian-military-challenge/.

Kommando Heer. "Thesenpapier Digitalisierung von Landoperationen." 2018. https://www.dwt-sgw.de/fileadmin/redaktion/SGW- Veranstaltungen/2018/8F7_Landoperationen/Thesenpapier_II_Digitalisierung_Landoperationen.pdf.

Krause, Joachim. "The Times They Are a Changin' – Fundamental Structural Change in International Relations as a Challenge for Germany and Europe." *SIRIUS – Zeitschrift für Strategische Analysen*, no. 1 (2017): 3-23.

Krepinevich, Andrew F. *Maritime Competition in a Mature Precision-Strike Regime.* Washington, DC: CSBA, 2015.

Lanteigne, Marc. "The Changing Shape of the Arctic Security." *NATO Review*, June 28, 2019. https://www.nato.int/docu/review/articles/2019/06/28/the-changing-shape-of-arctic-security/index.html.

Larter, David B. "British Royal Navy's Top Officer Lays Out Vision for Unmanned Surface Vessels." *Defense News*, September 20, 2019. https://www.defensenews.com/naval/2019/09/20/the-royal-navys-top-officer-lays-out-vision-for-unmanned-surface-vessels/.

Larter, David B. "The US Navy Selects Fincantieri Design for Next-Generation Frigate." *Defense News*, April 30, 2020. https://www.defensenews.com/breaking-news/2020/04/30/the-us-navy-selects-fincantieri-design-for-next-generation-frigate/?utm_source=twitter.com&utm_campaign=Socialflow+DFN&utm_medium=-social.

Larter, David B. "US Navy Makes a Major Breakthrough in Autonomous Weaponry." *Defense News*, September 10, 2019. https://www.defensenews.com/digital-show-dailies/dsei/2019/09/10/the-us-navy-just-had-a-major-breakthrough-with-autonomous-weapons/.

Larter, David B. "With Challenges Aplenty, Europe's Navies Are Coming to Grips with High-End Warfare". *Defense News.* June 22, 2020. https://www.defense-

news.com/smr/transatlantic-partnerships/2020/06/22/with-challenges-aplenty-europes-navies-are-coming-to-grips-with-high-end-warfare/.

Lasconjarias, Guillaume. "NATO's Response to Russian A2/AD in the Baltic States: Going beyond Conventional?" *Scandinavian Journal of Military Studies* 2, no. 1 (2019): 74-83. https://sjms.nu/articles/10.31374/sjms.18/.

Lowe, Ciarán. "A Comparative Analysis of Policy and Practice within Three Small Navies: Croatia, Ireland and Malta." In *Europe, Small Navies and Maritime Security*, edited by McCabe, Sanders, and Speller. Abingdon: Routledge, 2019, 185-98.

Mahnken, Thomas. *Forging the Tools of 21st Century Great Power Competition*. Washington, DC: Center for Strategic and Budgetary Assessments, 2020.

Mahnken, Thomas G., Travis Sharp, and Grace B. Kim. *Deterrence by Detection: A Key Role for Unmanned Aircraft System in Great Power Competition*. Washington, DC: CSBA, 2020.

Mannhart, Jürgen. "Sea-Based Ballistic Missile Defence: German Contribution to a Future European Capability." *The Journal of the JAPCC* 26 (2019): 69-73. https://www.japcc.org/wp-content/uploads/JAPCC_J26_screen.pdf.

Martin, Bradley, Danielle C. Tarraf, Thomas C. Whitmore, Jacob DeWeese, Cedric Kenney, Jon Schmid, Paul DeLuca. *Advancing Autonomous Systems: An Analysis of Current and Future Technology for Unmanned Maritime Vehicles*. Santa Monica: RAND, 2019. https://www.rand.org/pubs/research_reports/RR2751.html.

Martin, Christopher. *The UK as a Medium Maritime Power in the 21st Century: Logistics for Influence*. London: Palgrave Macmillan, 2016.

Mazarr, Michael J. *Understanding Deterrence*. Santa Monica: RAND, 2018. https://www.rand.org/content/dam/rand/pubs/perspectives/PE200/PE295/RAND_PE295.pdf.

McCoy, Kelly. "The Road to Multi-Domain Battle: An Origin Story." *Modern War Institute*, October 27, 2017. https://mwi.usma.edu/road-multi-domain-battle-origin-story/.

Ministère de la Défense. *Defence and National Security Review 2017*, October 2017.

Ministry of Defence of the United Kingdom. "Advantage through Innovation: The Defence Innovation Initiative." 2016. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/553429/MOD_SB_Innovation_Initiative_Brochure_v21_web.pdf.

Mukherjee, Tuneer. "Securing the Maritime Commons: The Role of Artificial Intelligence in Naval Operations." *Observer Research Foundation*, 2018. https://www.orfonline.org/research/42497-a-i-in-naval-operations-exploring-possibilities-debating-ethics/.

NATO. "Alliance Maritime Strategy." NATO, 2011, http://www.nato.int/cps/on/.

NATO. "Dynamic Mongoose." MARCOM, https://mc.nato.int/DMON18.

NATO. *London Declaration*. NATO, December 3, 2019. https://www.nato.int/cps/en/natohq/official_texts_171584.htm.

NATO. "NATO Maritime Unmanned Systems." NATO, 2019. https://www.nato.int/nato_static_fl2014/assets/pdf/pdf_2019_09/20190909_190909-NMUS.pdf.

NATO. "Portugal Hosts Maritime Exercise in Support of NATO's Maritime Unmanned Systems Initiative." NATO, September 11, 2019. https://www.nato.int/cps/en/natohq/news_168925.htm?selectedLocale=en.

NATO. "Thirteen Allies to Cooperate on the Introduction of Maritime Unmanned Systems." NATO, October 3, 2018. https://www.nato.int/cps/en/natohq/news_158672.htm.

NATO Allied Maritime Command. "NATO Maritime Commander Co-hosts Cooperative Strategy Forum 2019". https://mc.nato.int/media-centre/news/2019/nato-maritime-commander-attends-cooperative-strategy-forum-2019.

Naval Group, "Naviris, the JV between Fincantieri and Naval Group Is Now Fully Operational. *Naval Group*, January 14, 2020. https://www.naval-group.com/en/news/naviris-the-jv-between-fincantieri-and-naval-group-is-now-fully-operational/.

Navaltoday. "Germany: Lürssen, German Naval Yards Unveil Merger Plan." *Navaltoday,* May 14, 2020. https://www.navaltoday.com/2020/05/14/germany-lurssen-german-naval-yards-unveil-merger-plan/.

News in English. "Frigate Berthed for Its Spare Parts." *News in English*, September 30, 2013. http://www.newsinenglish.no/2013/09/30/frigate-berthed-for-spare-parts/.

Nielsen, Anders Puck. "Why Small Navies Prefer Warfighting over Counter-Piracy." In *Maritime Security: Counter-Terrorism Lessons from Maritime Piracy and Narcotics Interdiction*, edited by Edward R. Lucas et al. Amsterdam, IOS Press, 2020, 97-109.

Nordenman, Magnus. *The New Battle for the Atlantic: Emerging Naval Competition with Russian in the Far North*. Annapolis: Naval Institute Press, 2019.

Nørby, Søren. "The Royal Danish Navy: From the Baltic to the Horn of Africa – and Back Again." In *World Naval Review 2016,* edited by Conrad Waters. Barnsley: Seaforth Publishing, 2015, 92-103.

Pagenkopf, Chris. "Cooperation Is the Key to NATO's Future." *USNI Proceedings*, 2014. https://www.usni.org/magazines/proceedings/2014/september/cooperation-key-natos-future.

Parry, Chris. *Super Highway: Sea Power in the 21st Century*. London: Elliott & Thompson, 2014.

Patton, Keith. "Battle Force Missiles: The Measure of a Fleet." *Center for International Maritime Security*, 2019.

Perkins, David G., and James M. Holmes. "Multidomain Battle: Converging Concepts toward a Joint Concept." *Joint Forces Quarterly*, 88, 1, 2018.

Perkins, William A. "Component Integration Challenges Presented by Advanced Layered Defence Systems (A2/AD)." *The Three Swords Magazine* 33 (2018): 52-61 http://www.jwc.nato.int/images/stories/threeswords/A2AD_2018.pdf.

Perkins, William A., and Andrea Olivieri. "On Multi-Domain Operations: Is NATO Today Sufficiently 'Joint' to Begin Discussions Regarding Multi-Domain Command and Control?" *The Journal of the JAPCC*, 26 Spring/Summer (2018).

Pieper, Oliver. "German Military Considers Using Armed Drones." *Deutsche Welle,* May 5, 2020. https://www.dw.com/en/german-military-considers-using-armed-drones/a-53395829.

Polmar, Norman, and Thomas B. Allen. "Naval Weapon of Choice." *USNI Naval History Magazine* 30, no. 1 (2016). https://www.usni.org/magazines/naval-history-magazine/2016/february/naval-weapon-choice.

Portzer, Joshua M. M. "Kanyon's Reach: Rethinking the Nuclear Triad in the Autonomous Age." *USNI Proceedings*, July 2020. https://www.usni.org/magazines/proceedings/2020/july/kanyons-reach-rethinking-nuclear-triad-autonomous-age.

Ratcliff, Ronald. "Building Partners' Capacities: The Thousand-Ship Navy." *Naval War College* Review 60, no. 4 (2007): 44-58.

Reif, Kingston. "Current U.S. Missile Defense Programs at a Glance." *Arms Control Association*, August 2019. https://www.armscontrol.org/factsheets/usmissiledefense#exec.

Reilly, Jeffrey M. "Multi-Domain Operations: A Subtle but Significant Transition in Military Thought." *The Air and Space Power Journal* 30, no. 1 (2016): 61-73.

Rhode, Benjamin. "The GIUK Gap's Strategic Significance." *IISS Strategic Comments* 25, no. 29 (2018). https://www.iiss.org/~/publication/799791dd-7be1-4484-abfd-05fa3a400889/the-giuk-gaps-strategic-significance.pdf.

Riddervold, Marianne. *The Maritime Turn in EU Foreign and Security Policies: Aims, Actors and Mechanisms of Integration.* Cham: Palgrave Macmillan, 2018.

Roberts, Peter. "The Western Way of War." *RUSI*, July 16, 2020. https://rusi.org/multimedia/western-way-war-professor-frank-hoffman.

Roblin, Sebastian. "The Bastion-P Mobile Anti-ship Missile Is Key to Russia's A2/AD in Europe." *The National Interest*, April 12, 2020. https://nationalinterest.org/blog/buzz/bastion-p-mobile-anti-ship-missile-key-russias-a2ad-europe-142832.

Rosamond, Jon. "Arrowhead Wins Cost Battle in U.K. Type-31 Frigate Competition." *USNI News*, September 23, 2019. https://news.usni.org/2019/09/23/arrowhead-wins-cost-battle-in-u-k-type-31-frigate-competition.

Rose, Frank A. "Treaty, New Start, and the Future of Strategic Stability." *Brookings*, February 12, 2019. https://www.brookings.edu/blog/order-from-chaos/2019/02/12/the-end-of-an-era-the-inf-treaty-new-start-and-the-future-of-strategic-stability/.

Royal Navy. "Royal Navy's Drones Trials Team Take to Sea." *Royal Navy*, February 4, 2020. https://www.royalnavy.mod.uk/news-and-latest-activity/news/2020/february/05/200205-puma.

Russia Today. "Whoever Leads in AI Will Rule the World': Putin to Russian Children on Knowledge Day." *Russia Today*, September 1, 2017. https://www.rt.com/news/401731-ai-rule-world-putin/.

Salomon, John. "Parrying the 21st Century First Salvo." Washington, DC: Center for International Maritime Security, 2016. http://cimsec.org/parrying-21st-century-first-salvo/26444.

Save the Royal Navy. "Has the Royal Navy Solved Its Manpower Problems?" *Save the Royal Navy*, March 18, 2019. https://www.savetheroyalnavy.org/has-the-royal-navy-solved-its-manpower-problems/.

Schramm, Harrison. "Three Postcards for Military Manpower." *USNI Proceedings,* 146, 1, 2020.

Schroeder, Wayne A. *NATO at Seventy: Filling NATO's Critical Defense-Capability Gaps*. Atlantic Council, 2019. https://www.atlanticcouncil.org/wp-content/uploads/2019/04/NATO_at_Seventy-Filling_NATOs_Critical_Defense-Capability_Gaps.pdf.

Scott, Bishop. "Libya and the Lessons of Naval Power." *Canadian Naval Review* 8, no. 4 (2013): 14-18.

Shaikh, Shaan. "Missiles and Rockets of Hezbollah." *CSIS*, September 27, 2019. https://missilethreat.csis.org/country/hezbollahs-rocket-arsenal/.

Smith, Julianne, and Jerry Hendrix. *Forgotten Waters? Minding the GIUK Gap. A Tabletop Exercise*. Washington, DC: Center for New American Studies, 2017.

Spears, Will. "A Sailor's Take on Multi-Domain Operations." *War on the Rocks*, May 21, 2019: https://warontherocks.com/2019/05/a-sailors-take-on-multi-domain-operations/.

Speller, Ian. *Understanding Naval Warfare*. Abingdon: Routledge, 2014.

Sprenger Sebastian. "German Navy Returns to Treating the Baltic Sea as a Potential Theater of War." *Defense News*, January 23, 2019. https://www.defensenews.com/global/europe/2019/01/23/german-navy-returns-to-treating-the-baltic-sea-as-a-potential-theater-of-war/.

Stires, Hunter. "Exclusive: CNO Announces the Return of Vertical Launch Systems at-Sea Reloading." *The National Interest*, July 6, 2017. https://nationalinterest.org/feature/exclusive-cno-announces-the-return-vertical-launch-system-21425?nopaging=1.

Stockholm International Peace Research Institute. "World Military Expenditure Grows to $1.8 Trillion in 2018." April 29, 2019. https://www.sipri.org/media/press-release/2019/world-military-expenditure-grows-18-trillion-2018.

Stöhs, Jeremy. "European Small(er) Navies: Failure and Success in Doing More with Less." In *Europe, Small Navies and Maritime Security*, edited by McCabe, Sanders, and Speller. Abingdon: Routledge, 2019, 91-103.

Stöhs, Jeremy. "Into the Abyss? European Naval Power in the Post-Cold War Era." *Naval War College Review* 71, no. 3 (2018): 1-29. https://digital-commons.usnwc.edu/nwc-review/vol71/iss3/4/.

Stöhs, Jeremy "The Evolution of European Naval Power 1989-2019: Strategy – Force Structure – Operations." *Unpublished Dissertation* (2019).

Stöhs, Jeremy. *The Decline of European Naval Forces: Challenges to Sea Power in an Age of Fiscal Austerity and Political Uncertainty*. Annapolis: Naval Institute Press, 2018.

Sukhankin, Sergey. "David vs. Goliath: Kaliningrad Oblast as Russia's A2/AD 'Bubble'." *Scandinavian Journal of Military Studies* 2, no. 1 (2019): 96-110. https://sjms.nu/articles/10.31374/sjms.20/.

Sweijs, Tim, Frank Bekkers, and Stephan De Spiegleire. *Playing to Your Strengths: A Different Perspective on Future Capabilities*. The Hauge: The Hague Centre of Strategic Studies, 2018.

Tachum, Michael. "Turkey's String of Pearls: Turkey's Overseas Naval Installations Reconfigure the Security Architecture of Mediterranean-Red Sea Corridor." *AIES Fokus*, 4, 2019. https://www.aies.at/download/2019/AIES-Fokus-2019-04.pdf.

Taylor, Paul. "A Minefield of Opportunity: Transatlantic Defence in the Trump Era." *Friends of Europe*, January 28, 2020. https://www.friendsofeurope.org/insights/a-minefield-of-opportunity-transatlantic-defence-in-the-trump-era/.

The International Institute for Strategic Studies. "The Military Balance 2020." *The International Institute for Strategic Studies*, 2020.

The Ministry of Foreign Affairs of the Russian Federation. *Basic Principles of State Policy of the Russian Federation on Nuclear Deterrence*. June 8, 2020. https://www.mid.ru/en/web/guest/foreign_policy/international_safety/disarmament/-/asset_publisher/rp0fiUBmANaH/content/id/4152094.

Till, Geoffrey. *Seapower: A Guide for the Twenty-First Century*. Abingdon: Routledge, 2013.

Till, Geoffrey. "Are Small Navies Different?" In *Small Navies: Strategy and Policy for Small Navies in War and Peace*, edited by Michael Mulqueen, Deborah Sanders, and Ian Speller. Farnham: Ashgate, 2014. 21-32.

Till, Geoffrey. "Small Navies in the Current Strategic Context." In *Europe, Small Navies and Maritime Security*, edited by McCabe, Sanders, and Speller. Abingdon: Routledge, 2019. 15-25.

Tossini, J. Vitor. "The UK in the Persian Gulf: Historical Involvement and Military Presence." *ukdefencejournal*, July 26, 2019, https://ukdefencejournal.org.uk/the-uk-in-the-persian-gulf-historical-involvement-and-military-presence/.

Trost, Carlisle A.H. "Looking Beyond the Maritime Strategy." In *U.S. Naval Strategy in the 1980s*, edited by John B. Hattendorf and Peter M. Swartz. Newport: Naval War College Press, 2008.

U.S. Department of Defense. *What Is the National Defense Strategy?* October 8, 2018. https://www.defense.gov/Explore/Features/story/Article/1656414/what-is-the-national-defense-strategy/.

U.S. Department of Defense. *Summary of the 2018 National Defense Strategy of the United States of America: Sharpening the American Military's Competitive Edge*. October 8, 2018. https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf.

U.S. Department of the Army. "The U.S. Army in Multi-Domain Operations, TRADOC Pamphlet 525-3-." 2018. https://www.tradoc.army.mil/Portals/14/Documents/MDO/TP525-3-1_30Nov2018.pdf.

U.S. Department of the Navy. *A Cooperative Strategy for the 21st Century Sea Power. Forward, Engaged, Ready*. March 2015. https://www.globalsecurity.org/military/library/policy/navy/21st-century-seapower_strategy_201503.pdf.

U.S. Department of the Navy. *A Design for Maintaining Maritime Superiority, Version 2.0.* December 2018. https://www.navy.mil/navydata/people/cno/Richardson/Resource/Design_2.0.pdf.

U.S. Department of the Navy. *United States Marine Corps Force Design 2030.* March 2020. https://www.hqmc.marines.mil/Portals/142/Docs/CMC38%20Force%20Design%202030%20Report%20Phase%20I%20and%20II.pdf?ver=2020-03-26-121328-460.

USNI Proceedings. "The International Commanders Respond." *USNI Proceedings* 146, no. 23 (2020): 33-48.

Vavasseur, Xavier. "EDA Studying the USE of Naval Directed Energy Weapons." *Naval News*, November 18, 2019. https://www.navalnews.com/naval-news/2019/11/eda-studying-the-use-of-naval-directed-energy-weapons/.

Weitz, Richard. "Managing Multi-Domain and Hypersonic Threats to NATO." *International Centre for Defence and Security*, April 24, 2020. https://icds.ee/managing-multi-domain-and-hypersonic-threats-to-nato/.

Westcott, Allan (ed.). *Mahan on Naval Warfare: Selections from the Writing of Rear Admiral Alfred T. Mahan*. Chelmsford: Courier Corporation, 1999.

Williams, Ian, and Shaan Shaikh. "Report: The Missile War in Yemen." *CSIS*, June 9, 2020. https://missilethreat.csis.org/report-the-missile-war-in-yemen/.

Withington, Thomas, and Stefan Nitschke. "Clouded Vision: Is Plasma Stealth Reality?" *Naval Forces* 40, no. 6 (2019): 32-4.

Work, Robert O. *'To Take and Keep the Lead': A Naval Fleet Platform Architecture for Enduring Maritime Supremacy.* Washington D.C., CSBA, 2005.

Work, Robert O. "Remarks by Deputy Secretary Work on Third Offset Strategy." *Department of Defense* April 28, 2016. https://www.defense.gov/Newsroom/Speeches/Speech/Article/753482/remarks-by-d%20eputy-secretary-work-on-third-offset-strategy/.

Work, Robert O. "Algorithmic Warfare: The Next Military-Technical Revolution?" *7th Annual SAP NS2 Solution Summit*, October 30, 2018. https://www.youtube.com/watch?v=HcXMW2jNJXU.

Young, Thomas-Durell. "NATO's Selective Sea Blindness: Assessing the Alliance's New Navies." *Naval War College Review* 72, no. 3 (2019): 13.

ABOUT THE AUTHOR

Dr. Jeremy Stöhs is the Deputy Director of the Austrian Center for Intelligence, Propaganda and Security Studies (ACIPSS) and a Non-Resident Fellow at the Institute for Security Policy, Kiel University. His research focuses on U.S. and European defence policy, maritime strategy and security, as well as public security and safety.

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