Julian Pawlak | André Pecher [Eds.]

Re-Learning War: Lessons from the Black Sea



N 54° 19' 81.3" E 10° 08' 77.9"

Proceedings of the 2024 Kiel International Seapower Symposium



Julian Pawlak and André Pecher (eds.)

Re-Learning War: Lessons from the Black Sea

Proceedings of the 2024 Kiel International Seapower Symposium

The German National Library lists this publication in the German National Bibliography; detailed bibliographic information is available online at http://dnb.dnb.de

ISBN 978-3-948752-03-3

This contribution is available under Creative Commons License CC BY-NC-ND 4.0 International (Attribution-NonCommercial-NoDerivatives). For further information on the license, please refer to: https://creativecommons.org/licenses/by-nc-nd/4.0/deed.en



This e-book is published by the German Institute for Defence and Strategic Studies (GIDS) – Directorate for Strategic Studies and Research.

Papers may be retrieved free of charge from the GIDS website: www.gids-hamburg.de

They reflect the personal opinions of the authors and do not necessarily represent the point of view of the GIDS.

Recommended citation: Julian Pawlak/André Pecher (eds.) (2025): Re-Learning War: Lessons from the Black Sea. Proceedings of the 2024 Kiel International Seapower Symposium (GIDS Insights 1), GIDS: Hamburg.

GIDS German Institute for Defence and Strategic Studies Bundeswehr Command and Staff College Manteuffelstraße 20 · 22587 Hamburg, Germany Tel.: +49 (0)40 8667 6801 buero@gids-hamburg.de · www.gids-hamburg.de

Table of Contents

Julian Pawlak and André Pecher Editors' Foreword

Part I: The Black Sea

Sebastian Bruns The Wet Flank of the Russia-Ukraine War – Lessons for Modern Naval Warfare?	9
Sergej Sumlenny The Russian-Ukrainian War: A New Way of War and Emerging	
Trends The Deployment of Drones in Battle and latest Developments – Impressions from the Frontline	19

Jonathan D. Caverley and Michael B. PetersenTactical Fruit Flies and a Strategic Petri Dish: The Black Sea asTesting Ground for the Future of Maritime Conflict35

Part II: The Baltic Sea

Michał Piekarski	
Maritime Critical Infrastructure and Lessons from the B	lack Sea:
Hybrid Threats from Russia to NATO's Littoral States on	the Baltic
Sea	
Observations from Poland, a frontline state	49



5

Julian Pawlak	
Re-Thinking War in the Baltic Sea	67
Niklas Granholm	
The Wider Baltic Sea Region: Strategic Challenges and	
Opportunities in the Maritime Domain	77
Part III: The Arctic	
Michael Paul	
In Times of Trump 2.0: Turning Point in the Arctic	87
Rachael Gosnell	
Worlds Collide: Diverging Interests, Provocations, Conflicts, and	
Challenges in the High North	97
Duncan Redford	
Maritime Lessons from the Ukraine-Russia Conflict: USVs and the	е
Applicability to the Baltic and High North	105
Appendix	
Authors	119
GIDS and ISPK	121



Editors' Foreword

War at sea has returned to Europe, and it is taking place in the Black Sea. In order to derive lessons from the ongoing conflict and adapt to recent developments, the German Institute for Defence and Strategic Studies (GIDS) and the Institute for Security Policy at Kiel University (ISPK) joined forces for the first time to co-host Europe's dedicated Maritime Strategy & Security conference, the 2024 Kiel International Seapower Symposium. Titled 'Re-Learning War: Lessons from the Black Sea', both the conference and the preceding workshop aimed at sharing insights and observations from the maritime domain. These findings were then captured in a number of papers by selected workshop participants.

The war in Ukraine is characterised by a high level of innovation and adaptation on both sides, acting as the driving force behind rapid developments in the technological sector. Such developments have been used successfully in military operations and thus shaped the battlefield decisively. This has also become apparent in the naval war in the Black Sea. Ukraine has achieved impressive results against the Russian Black Sea Fleet, initially superior in quality and numbers. Some analysts call it a renaissance of the Jeune École a theory of naval warfare developed by French strategists in the 19th century (see, for example: Kollakowski, Tobias [2025]. War in the Black Sea: The Revival of the Jeune École? Journal of Strategic Studies, pp. 1-33) - or, at the very least, historical proof that this theory is correct: events in the Black Sea have shown how an initially inferior navy can establish sea denial against a superior enemy and inflict heavy losses on them.

In this context, several questions arise: What are we to make of this approach? How has Ukraine achieved this success? What are the characteristics of the naval war in the Black Sea? Can this war serve as a role model for future wars? What are the lessons learned for NATO and the West? And could adaptations be made for potential conflicts between the two antagonists - NATO and Russia - in the areas of the Baltic Sea and the High North (i.e. the Arctic and NATO's northern flank)? Amongst others, these were the key questions explored during the Kiel International Seapower Symposium and its preceding expert workshop held in the summer of 2024. The intention was to examine from different perspectives the experiences and lessons learned from the Black Sea and to draw potential conclusions. This was done, among other things, with the aim to analyse although not exhaustively - the phenomenon of naval warfare in the Black Sea and to provide recommendations for action for political and military decision-makers. To this end, the workshop brought together a peer group consisting of 40 international military experts, academics and practitioners from the fields of security policy, maritime strategies and security as well as military history to practically discuss the questions raised.

The present volume is a compilation of papers arising from the 'Re-Learning War: Lessons from the Black Sea' workshop that have been revised and are now being published for the upcoming 2025 Kiel International Seapower Symposium. The papers, most of which have already been individually published following a peer review process, cover three topic areas:

First of all, the experts concentrate on the Black Sea: Sebastian Bruns gives a tour d'horizon of the naval engagements fought there, while Jonathan Caverley and Michael Petersen address potential lessons for the U.S. Navy. Furthermore, they demonstrate that the U.S. Navy is likely to benefit from the experiences gained in the Black Sea, especially by Russia. Sergei Sumlenny says that maritime drones will remain an interdiction tool for Ukraine to take action against the Russian Black Sea Fleet – but that, in reducing the threat from the Black Sea, they will continue to represent only a secondary aspect of a war largely fought on land.

The subsequent papers focus on the Baltic Sea region, where the tense relations between NATO and the Russian Federation are currently under a magnifying glass. First, Michał Piekarski shares the Polish point of view on the dangers that arise from Russian capabilities in the Baltic Sea region and draws conclusions from these findings, especially regarding critical infrastructure. Then Julian Pawlak explains the different aspects of naval warfare that would have to be considered in case of a high-intensity conflict in this region. Against the background of potential hybrid and high-end conflict scenarios, Niklas Granholm finally discusses current opportunities and strategic developments for the region resulting from Sweden's accession to NATO.

The last three papers focus on the High North, elaborating on the maritime and strategic implications for the Arctic. Michael Paul notes that, given certain activities by Russia and China, there has been a turning point in the Arctic, and warns that Germany and its partners, too, must adapt to the changed situation in the Arctic-North Atlantic region. Rachael Gosnell emphasises the importance of deterrence and points out that a clever balance of defence policy, strategic planning and operational capabilities is required for operations in the arduous conditions of the High North. In the last paper, Duncan Redford examines in particular the use of uncrewed surface vehicles in the Black Sea and critically considers possibilities and limitations of their use by NATO on its northern flank.

The contributions gathered in this volume make it clear that maritime experiences are not directly transferable to other areas of operations, but must always be considered in the context of the specific regional, political and operational situation. As part of the 2024 Kiel International Seapower Symposium, the workshop jointly organised by the GIDS and the ISPK was an example of fruitful international cooperation and evidence of a productive exchange between academics and practitioners. It has shown that scientifically sound analyses offer added value to military decision-makers - especially if they not only explain complex matters but also arrive at specific recommendations for action. For the GIDS and the ISPK, this cooperation has been an experiment in combining scientific excellence and practical relevance - and we are pleased to note that this experiment has been a success.

Hamburg, June 2025 Julian Pawlak and André Pecher

Part I: The Black Sea



The Wet Flank of the Russia-Ukraine War – Lessons for Modern Naval Warfare?

1 Introduction¹

Russia's brutal, illegal and devastating war against Ukraine is the largest armed conflict to break out in Europe since 1945. The conflict has important maritime and naval components, though neither of the warring parties is a sea power in a narrow or traditional sense.² Moreover, the conflict will ultimately be decided ashore. Nevertheless, military theorists and practitioners analyzing the conflict will be welladvised to study the wet flank of the war - i.e. to include military/naval as well as wider maritime security and defense aspects - along three distinct lines of enquiry:

- **1.** Which aspects of the naval and maritime confrontations of the war in Ukraine can serve to illuminate naval theory, both classic and evolving?
- 2. Given some of the dynamics of this conflict from Cold War-
- A version of this paper was presented at the side event to the Kiel International Seapower Symposium (KISS) 2024. An earlier, extended version of the essay was published in German by Sebastian Bruns and Heinz Dieter Jopp entitled "Die nasse Flanke des Russland-Ukraine-Kriegs – Lektionen für die moderne Seekriegsführung und die Marine", SIRI-US 8:1, 2024. The author is grateful for the constructive comments and peer review of this paper – and acknowledges that all mistakes remain his alone.
- 2 Lambert 2018.

era cruisers displacing ~11,500t to commercial off-the-shelf maritime drones equipped with sensors and explosives to inflict maximum damage on the enemy – what is the relationship of "old war" and "new war" in the naval clashes that have taken place so far? What are the roles of sea-borne trade and maritime infrastructure in this war?

3. Imagining the time after hostilities are over, will Ukraine, the West, and Russia have learned any lessons from the war at sea? What would such lessons imply for doctrine, tactics, force structure, and maritime strategy?

While it is beyond the scope of this paper to discuss all of these aspects at length and in the great depth that would be desirable – and given the ongoing dynamics inherent to the war itself, which at the time of writing is still raging³ – the following points hope to further inform the debate.

2 It's War!

As early as 24 February 2022, on the day Russia began its full-scale attack on Ukraine, a symbolic clash took place at sea. The Russian cruiser *Moskva*, a Cold

³ Foggo 2024.

War veteran which ironically played a major role in the Soviet Union/United States peace summit off Malta in December 1989,⁴ issued the blunt order to surrender to a small Ukrainian garrison on the strategically important Snake Island. The rocky Ukrainian territory lies off the Danube Delta and the coast of Romania, a NATO member. The defenders' iconic response - "Russian warship, go fuck yourself!" - has become a symbol of Ukrainian resistance and resilience: Although the Ukrainian defense succumbed to Russian overmatch, the island was eventually recaptured.

From the outset of the war, Russia organized a de facto blockade of the Black Sea for commercial traffic, causing serious disruptions to commercial shipping. Turkey closed the Bosporus to naval forces on February 28, 2022.⁵ This measure was taken with reference to the Montreux Convention of 1936, which offers Ankara extensive opportunities to limit and control maritime traffic in the Dardanelles strait, the Sea of Marmara, and the Bosporus strait. The closure affects all non-riparian states involved, and thus includes ships of the U.S. Navy, the British Royal Navy, and NATO's Standing Maritime Groups that entered the Black Sea quite regularly in the late and post-Cold War era.⁶ However, Turkey's invoking of the Montreux Convention turned out to be particularly disadvantageous for Russia, a riparian state of the Black Sea. It was now denied the opportunity to move ships through the Black Sea choke point - and thus to and from the

Black Sea Fleet, one of five nominal fleets that Russia maintains.7 Compared to its Ukrainian counterpart, the Russian Navy was far superior, especially since Mos-cow had taken precautions to undermine the remaining Ukrainian fleet from 2014 onwards. For Sevastopol, the instance, shared Ukrainian/Russian naval base on Crimea, was taken by Russian forces early, resulting in Ukrainian assets being either taken over, forced out, or disabled. When Russia escalated the war with brute force in 2022, Ukraine only retained a skeleton navy centered on a frigate and a few handfuls of smaller ships and auxiliaries. Ultimately, it was only logical that the frigate Hetman Sahaidachny (U130/F130), commissioned in 1993 and flagship of the remaining Ukrainian naval forces, was scuttled along with other smaller boats in early March 2022 to ensure it would not fall into the hands of advancing Russian units.

3 Turning the Tide

In the Ukrainian plains, the initial advance of Russian troops, planned by Vladimir Putin and his regime as a decapitation strike and communicated as

⁴ Shifrinson 2013; Martin 2022.

⁵ Mongilio 2022.

⁶ See Dur 2022, for reflections on late Cold War US naval operations in the Black Sea.

⁷ The others being the Baltic, Northern and Pacific fleets, as well as the Caspian Sea flotilla. Given Russia's somewhat disadvantageous geographic outlet, the ability to regroup forces by transferring warships from one fleet to another while also maintaining a projection and, in the case of the bastions of the Northern and Pacific fleets, deterrent capability is paramount for Moscow's naval strategy. It should be noted that Russia's ability to transfer major surface combatants using internal waterways remains relatively unaffected.

the "Three-Day War", soon stalled and was eventually repelled, with public and military attention remaining focused on places and events on land -Bucha, Zaporizhzhya, Kyiv, and Odesa, to name a few. A Russian amphibious assault on the port city of Odesa never did materialize. Then, at the end of March 2022, Ukraine managed to land its first effective hit on the Saratov, an Alligator-class landing ship.⁸ Presumably hit by an anti-ship missile, the warship sank while moored in the port of Berdyansk. Two Ropuchas, veterans of the Soviet-era Red Banner Fleet, were damaged and, having been further pummeled with air and naval drone strikes, were destroyed entirely.

Finally, on April 13, 2022, the Moskva made another and ultimately final appearance. Ukraine succeeded in hitting the cruiser with the help of Neptune anti-ship missiles. The Black Sea Fleet flagship, named after Russia's capital, was by far the largest warship in the Black Sea. Russian forces were unable to save the ship and salvage it. It sank a day later. Negligence in the defensive capabilities of the missile cruiser, which was commissioned in 1982, may have played a role in the loss, as did insufficient flooding control and firefighting measures by what appears to have been a completely inadequately trained crew. Ravaging corruption in the Russian military, which might have funneled money for equipment and training elsewhere, could also have contributed to the loss. Four decades after the Falklands War, until now one of the key data points for naval analysts worldwide,⁹ it is clearer than ever that missiles pose a serious threat to high-value units.¹⁰

Meanwhile, the maritime situation developed in a way that many had not anticipated. On July 27, 2022, the Black Sea Grain Initiative, brokered by Turkish President Recep Erdogan, came into force. Under the initiative, Russia and Ukraine agreed to keep a maritime corridor open that would enable the safe transit of merchant ships to export Ukrainian grain. The condition was that merchant ships bound for Ukraine would have to undergo intensive checks for arms deliveries in the Bosporus. In scenarios vaguely reminiscent of the 1987/88 "tanker war" in the Persian Gulf, civilian freighters groped their way south through shipping lanes at the risk of encountering drifting mines. Subsequently, the socalled grain deal was repeatedly called into question and ultimately terminated by Russia in the summer of 2023. While the threat to shipping through floating mines, missiles or drones has not gone away, Ukraine's advances on the battlefield have contributed to a degree of local, temporary command of the sea that has allowed Kyiv to continue its exports, thus providing fresh money for its economy and grain for markets dependent on it.¹¹

- 10 A lesson that is being re-learned in another ongoing naval conflict in the Red Sea where Houthis are attacking international commercial and military shipping with anti-ship missiles of all kinds.
- 11 It is worth mentioning that it was the People's Republic of China which benefited most from the safe passage of Ukrainian grain bulkers, because China is dependent on that grain to feed its population – while Beijing covertly and openly sides with Russia in the war. See Donnellon-May/Hongzhou 2023.

⁸ NN 2023.

⁹ Department of the Navy 1983; Bruns 2017.

12 – Sebastian Bruns

In the second half of 2022, Ukrainian armed forces carried out further offensive actions, including the first of several attacks on the Russian naval headquarters in Sevastopol in occupied Crimea. On September 26, 2022, the attacks on the Nord Stream 1 and 2 Baltic Sea pipelines, which are generally understood in the context of the war on Europe's eastern flank, shattered the illusion of secure maritime energy infrastructure and some quiet hopes in Berlin for German-Russian reconciliation. Finally, on October 29, Ukraine launched a large-scale attack on Russia's naval assets in Sevastopol with uncrewed surface vessels (USV). Images of the attack, pixelated as they were, went around the world and signaled significant progress in the field of unmanned maritime systems. Russia subsequently withdrew its ships to safer positions farther to the east because it had to expect further attacks and losses. Since then, its naval headquarters in Sevastopol has been the repeated target of Ukrainian attacks, with considerable loss of life among the Russian naval leadership.¹²

In Kyiv's understanding of maritime strategy, the bridge over the Kerch Strait, which Russia had built after 2014 and which was the subject of sabotage attempts from the end of 2022, is also a legitimate potential target. In October 2022, an act of sabotage was performed, which severely damaged both the railway span and the road bridge. Another attack followed in August 2023. The obstruction of rail and road traffic forced the Russian Navy to use its increasingly scarce shipping space to transport goods across the Sea of Azov. But even the landing

12 Fisher/Shevchenko 2023.

GDS

ships used for this purpose were not safe from attacks. For example, the *RFS Olenegorsky Gornyak* was hit by a drone while crossing the Sea of Azov between Crimea and the Russian Federation. A Russian tanker sailing in ballast was also hit in a second attack.¹³ Both ships were badly damaged and will have to be written off.

Whereas the political and strategic focus of the warring parties as well as the international political attention and media coverage remained centered on land in 2023 and 2024, the developments at sea revealed further events worth mentioning. By the summer of 2024, the losses of the Russian Black Sea Fleet amounted to at least 15 ships, according to open-source intelligence.

"At least 15 Russian warships have been sunk or severely damaged in the war [since 2022], news reports and Ukrainian intelligence say. The attacks have come from cruise missiles, which the Russian Navy should have expected, and from advanced highly maneuverable sea drones."¹⁴

In the first three months of 2024 alone¹⁵, and even if one is to be mindful of the "fog of war" that engulfs the coverage of such events (most sources are Ukrainian and no imagery is available), Russia lost three medium-size surface

- **14** Grady 2024.
- 15 The open-source encyclopedia Wikipedia has a longer and more substantial listing of all Russian and Ukrainian ship losses (navies, border guards, etc.) since 2014: https://en.wikipedia.org/wiki/List_of_ship_losses_during_the_Russo-Ukrainian_War, last accessed on: 06-09-2024.

¹³ Barkey 2023.

combatants. On February 1, Ukraine claimed to have sunk the Russian Tarantul-III-class missile corvette Ivanovets with naval drones.¹⁶ Just two weeks later, the Tsezar Kunikov, another ageing Soviet-era amphibious landing ship, met her fate through naval drones, too.¹⁷ Even more remarkable amidst this carnage is the loss of the Russian corvette Sergey Kotov, one of the most modern warships of Putin's force. The 94m long ship had only been commissioned in July 2022 and was sunk less than two years thereafter near the Kerch Bridge by "Magura V5" uncrewed surface vessels.¹⁸ Important infrastructure was not spared either, as demonstrated by the attack on the naval base of Sevastopol on May 19, 2024. The assault by a combination of advanced ATACAMS missiles and oneway drones destroyed the light corvette Tsiklon. Notably, the ship - less than one year in service - was one of the four Kalibr-carrying surface warships that remained at the disposal of the Black Sea Fleet.¹⁹

These events illuminate some of the facets of the future – some may even say, the present – of war at sea. Uncrewed vehicles in combination with advanced anti-ship missiles provide versatility, reach, and impact to navies – even without the classic means

- **16** NN 2024a.
- **17** NN 2024b.
- 18 Vlasova/Lendon 2024.
- **19** NN 2024c. It should be noted that some Kalibr-equipped ships can be transferred using inland waterways, others are permanently operating outside of the Black Sea, and still others such as submarines remain a potential force to reckon with. The information used in this paper is a mere snapshot in time rather than a correlation of forces discussion.

of naval warfare. In addition, GPS jamming and electronic warfare activities have become a mainstay in the Northern Black Sea region, lending themselves to be a further nuisance for both military and commercial shipping in the area.²⁰ Trade shipping and loading posts continue to be a target for Russian and Ukrainian interventions, though current numbers are difficult to come by in the public domain.²¹

4 Strategic Implication

Ukrainian naval tactics have forced the Russian Black Sea Fleet onto the defensive. Russia moved some of its remaining combat-capable units from the Sevastopol area further east to get out of the range of Ukrainian cruise missiles and naval drones. The closure of the Turkish straits puts additional strain on the Russian naval presence, as damaged vessels are not allowed to leave the Black Sea and forward-deploved BSF units from the Mediterranean are not allowed to head north. The collapse of the Syrian regime under Bashar al-Assad in December 2024 and the loss of Russia's naval base at Tartus has further complicated the situation for Russian naval planners. Thus, the Slava-class cruisers and their escort ships, which had been operating temporarily in the eastern Mediterranean, have had to steam back to the Northern Fleet (with its home base in the Barents Sea) or to the Pacific Fleet in Vladivostok. However, Russian cargo

20 NATO Shipping Centre 2022.

²¹ For reference, see Risk Intelligence, "Northern Black Sea and Russia Ports Threat Assessment Port operations and security overview", last updated 29 August 2024.

ships have repeatedly managed to pass through the Bosporus with cargo declared as civilian.

As a consequence of these developments, Russia has increasingly focused on three methods of maritime warfare:

- Naval mines: Since the beginning of the escalation in spring 2022, there have been several sightings of sea mines in the Black Sea, the origin of which could not always be determined, but which caused a stir. On September 8, 2022, the Romanian minesweeper Lieutenant Dimitrie Nicolescu was damaged by a floating minJe. On August 14, 2023, a Russian sea mine apparently laid in July drifted into Costinesti, Romania, and damaged a pier when it exploded. Bucharest's naval forces have since increased their mine detection efforts, but a capability gap is becoming apparent. Modern MCM boats and sensors are rare; NATO's Standing NATO Mine Countermeasures Group (SNMCMG) 2 no longer operates in the Black Sea because the Bosporus is closed to warships. Russian mine barriers have also been placed in the Dnieper, apparently to disrupt Ukrainian riverine combat operations. However, so far, the mining threat has been contained well enough.²²
- 22 Clearly, however, along with war in Europe, mine warfare has returned. This carries important implications for the Baltic Sea and NATO navies. Whereas Belgium and the Netherlands are currently commissioning new large MCM vessels, the regeneration of such assets in other major nations such as Germany stalls, whereas the U.S. Navy is on the

- Disruption of commercial shipping and loading in ports: According to the British Foreign Office (as of October 4, 2023), Russian cruise missiles and drones have destroyed almost 300,000 tons of wheat. 130 port facilities (warehouses, piers, cranes, access roads, etc.) in Odesa, Chornomorsk, and Reni were destroyed. Upon termination of the grain deal, Russian forces in a high-profile move stopped a freighter sailing under the flag of Palau in order to search it. Furthermore, there have been indications that Russia will increasingly use sea mines, which would change the cost-benefit calculation for commercial shipping in the region.
- Engaging targets ashore: Russia is attacking targets on Ukrainian territory from surface ships and submarines using cruise missiles. In addition, unmanned aerial vehicles (drones) are being used against Ukrainian targets. The threat posed by Russia's extensive amphibious capabilities to the coast around the Ukrainian port city of Odesa has, however, diminished to a certain extent following a number of decisive hits and the resulting deployment of the fleet to the east.

Ukraine, in turn, is concentrating its efforts in the following directions:



verge of phasing out most of its mine warfare capabilities altogether. For a potentially large mine-clearing operation after the cessation of hostilities in the Black Sea, this suggests some trouble ahead.

- Focus on critical infrastructure: The recapture of the aforementioned Snake Island in July 2022 was not only a success in propaganda terms, but also meant the recovery of a centrally located group of rocks. In 2023, Ukraine focused on recovering critical infrastructure – the landings on the Boyko Towers oil and gas drilling platforms in August and September are worth recalling.
- Massive use of naval drones and cruise missiles: As already mentioned, Ukraine has lost most of its means of naval warfare - and has apparently made a virtue out of necessity. The combination of reconnaissance, target acquisition and strikes has, to put it somewhat crudely, led to Russia's navy being hit hard by a country that no longer has a real navy. This could even be interpreted as an evolution of the "Fleet-in-Being" concept that reigned German Imperial naval thinking at the turn of the 19^{th} and 20^{th} century. In the 21^{st} century, Ukraine is seeking not only to weaken the Russians' operational capabilities but also to create powerful symbols. The sinking of the cruiser Moskva is worth mentioning here, as are the grainy video clips as part of Ukrainian efforts to influence public opinion. The fact that Russian warships were hit in their docks (another central part of critical infrastructure) also suggests that the unequal fight with maritime methods currently offers advantages for Kyiv through the rigorous use of in-

telligence and focused capabilities.

While this entire matter is very much a moving target (no pun intended), some key lessons do emerge. At the time of writing, the situation in the maritime theatre remains dynamic enough for analysts to do both: study and try to understand implications for naval warfare AND point out that many lessons from past conflicts - from the Falklands Sound in 1982 to the Red Sea in 2024 - still apply.²³ For Ukraine, the war can hardly be won at sea, but it can certainly be lost. For Russia, there are wider implications - with the army and the air force decimated in the bloody land battles, the navy might emerge as relatively unscathed and thus eventucreate the most dominant allv headache for Ukrainian and Western planners.²⁴ For both parties, the maritime theatre also plays a significant role in terms of strategic identity construction, which needs to be taken into account as well.

It has become clear in this essay that naval theory is being modified through the events in the Black Sea.

- 23 There has been a significant uptick of studies, symposia, and lessons identified reports in recent months. For European and Transatlantic perspectives, see inter alia Huminski 2024; Katsman 2024; Rishko 2024. It should be taken for granted that Russia, China, and others are also studying events in the Black Sea closely.
- 24 The fighting power of the Russian Navy is subject to heated discussion. Russia's heavy reliance on hybrid and gray-zone maritime means could indicate that the "Russian Bear" will not be able to deploy as many naval assets as Western strategists anticipate.

Such confined bodies of water are somewhat overlooked in the blue-water, high seas theories of Alfred Thayer Mahan, Alfred Tirpitz, or Samuel Huntington. The writings of strategists such as Julian Corbett appear more useful in this respect - although specialists should ask whether in light of modern warfare and the experiences in the Black Sea a new hybrid theory might be evolving. There are many lessons for doctrine, tactics, force structure, and maritime strategy that need to be studied not just be the warring parties but also by NATO allies. They will be multifaceted and cover the entire spectrum of conflict. They will also once again connect tactics and operations to policy and strategy; hence it is imperative that opera-tors and military and civilian strategists identify and learn these lessons together.

The challenge of mirror-imaging is real, and the events of the Black Sea cannot and should not be transferred 1:1 onto similar theatres such as the Baltic Sea. However, as long as Russia remains a spoiler in the international system, its actions will provide tasks that trickle down at Europe's flank as well – right onto the task list of the German Navy. It should draw on the expertise and experience of the Black Sea littoral states to explore implications for Western navies, academia, and policymakers.²⁵

List of References

Barkey, Sophie (2023): Nach Drohnen-Attacke: Russisches Kriegsschiff versinkt im Schwarzen Meer, in: Berliner Zeitung, 04 August 2023, https://www.berliner-zeitung. de/news/moskau-ukraine-attackiert-russische-schwarzmeerflotte-erneut-mit-drohnen-angriff-abgewehrt-li.375735, last ac-cessed on: 04-09-2024.

- Bruns, Sebastian (2017): Enduring Lessons from the Falklands War, for the U.S. Navy, 35 years Later, in: Tidsskrift for Søvæsen No. 3-4, 2017, pp. 89–105.
- Bruns, Sebastian/Jopp, Heinz Dieter (2024): Die nasse Flanke des Russland-Ukraine-Kriegs – Lektionen für die moderne Seekriegsführung und die Marine, in: SIR-IUS 8:1, pp. 50–57.
- Department of the Navy (ed.) (1983): Lessons of the Falklands. Summary Report, February 1983, https://apps.dtic.mil/sti/pdfs/A-DA133333.pdf, last accessed on: 04-09-2024.
- Donnellon-May, Genevieve/Hongzhou, Zhang (2023): China's Food Security After the Collapse of the Black Sea Grain Initiative, in: The Diplomat, 29 Septem-ber 2023. https:// thediplomat.com/2023/09/chinas-food-security-after-the-collapse-of-the-black-sea-graininitiative, last accessed on: 04-09-2024.
- Dur, Phil (2022). Between Land and Sea: A Cold Warrior's Log, Lioncrest: Carson City.
- Fisher, Megan/Shevchenko, Vitaly (2023): Ukraine Hits HQ of Russia's Symbolic Black Sea Navy, in: BBC, 22 September 2023, https://www.bbc.com/news/world-europe-66887524, last accessed on: 04-09-2024.
- Foggo, James G. (2024): Sub Sunk! The Attack on the Rostov-on-Don, in: Center for Maritime Strategy, 6

²⁵ This version has been amended reflecting useful comments by Dr. Tobias Kollakowski, expert on the Russian Navy.

August 2024, https://centerformaritimestrategy.org/publications/sub-sunk-the-attack-onthe-rostov-on-don, last accessed on: 04-09-2024.

- Grady, John (2024): Battles in the Black Sea Changing the Character of Naval War-fare, Experts Say, in: USNI News, 13 June 2024, https:/ /news.usni.org/2024/06/13/ battles-in-the-black-sea-changing-the-character-of-naval-warfare-experts-say, last accessed on: 04-09-2024.
- Huminski, Joshua C. (2024): Learning the Right Lessons from Ukraine's Naval War. Engelsberg Ideas, 6 June.
- Katsman, Maarten (2024): Re-learning War – Lessons from the Black Sea, in: Mili-taire Spectator, 18 July 2024, https://militairespectator. nl/artikelen/re-learning-warlessons-black-sea, last accessed on: 06-09-2024.
- Lambert, Andrew (2018): Seapower. Maritime Culture, Continental Empires and the Conflict that Made the Modern World, Yale University Press: New Haven.
- Martin, Ivan (2022): Russian Flagship Damaged off Ukraine Was in Malta for Super-power Summit, in: Times of Malta, 14 April 2022, https://timesofmalta.com/article/russian-flagship-damagedoff-ukraine-was-in-malta-forsuperpower.948286, last accessed on: 04-09-2024.
- Mongilio, Heather (2022): Turkey Closes Bosphorus, Dardanelles Straits to War-ships, in: USNI News, 28 February 2022, https://news.usni. org/2022/02/28/turkey-closesbosphorus-dardanelles-straits-

to-warships, last accessed on: 04-09-2024.

- NATO Shipping Centre (2022): Situation in the Black Sea and the Sea of Azov, https://shipping.nato.int/ nsc/operations/news/-2022/situation-on-the-black-sea-andthe-sea-of-azov,last accessed on: 04-09-2024.
- NN (2023): One Year Later, Russian Navy Confirms Loss of the Amphib Saratov, in: The Maritime Executive, 28 March 2023, https://maritime-executive.com/article/ one-year-later-russian-navyconfirms-loss-of-the-amphibsaratov, last accessed on: 04-09-2024.
- NN (2024a): Ukraine will weiteres russisches Kriegsschiff versenkt haben, in: Spiegel online, 01 February 2024. https://www.spiegel.de/ ausland/ukraine-will-weiteresrussisches-kriegsschiff-versenkthaben-a-0464299f-a359-46e9-9004-29da25ef4552, last accessed on: 04-09-2024.
- NN (2024b): Ukraine: Russisches Kriegsschiff zerstört, in: ZDF, 14 February 2024, https://www.zdf.de/ nachrichten/politik/ausland/ kriegsschiff-zerstoert-ukrainerussland-krim-caesar-kunikow-100.html, last accessed on: 04-09-2024.
- NN (2024c): Russian Sources Confirm Tsiklon Karakurt-Class Missile Ship Was Sunk by US-supplied ATACMS Missiles, in: Army Recognition, 22 May 2024, https:/ /armyrecognition.com/news/ navy-news/2024/russiansources-confirm-tsiklonkarakurt-class-missile-ship-wassunk-by-us-supplied-atacms-

missiles?utm_content=cmp-true, last accessed on: 04-09-2024.

- Rishko, Vitalii (2024): Untergrabung der russischen Seeherrschaft. Die strategische Kampagne der Ukraine im Schwarzen Meer und in der Krym, in: Transatlan-tic Dialogue Center, 25 July.
- Risk Intelligence (2024): Northern Black Sea and Russia Ports Threat Assessment Port operations and security overview, last updated 29 August, Hellerup (DK), 2024.
- Shifrinson, Joshua (2013): The Malta Summit and US-Soviet Relations: Testing the Waters Amidst Stormy

Seas, in: Wilson Center CWIHP e-Dossier No. 40, https://www. wilsoncenter.org/publication/ the-malta-summit-and-us-soviet-relations-testing-the-waters-amidst-stormy-seas, last accessed on: 04-09-2024.

Vlasova, Svitlana/Lendon, Brad (2024): Ukraine's Drones Sink Another Russian Warship, Kyiv Says, in: CNN, 06 March 2024, https://edition.cnn.com/2024/03/05/europe/russian-warship-destroyed-ukraine-intl-hnk-ml/index.html, last accessed on: 04-09-2024.



The Russian-Ukrainian War: A New Way of War and Emerging Trends

The Deployment of Drones in Battle and latest Developments – Impressions from the Frontline

1 Introduction

The Russo-Ukrainian war has introduced the mass usage of drones in most battlefield situations. From surveillance drones used at squad level, kamikaze drones hitting strategic targets hundreds of kilometres behind enemy lines and naval drones capable of destroying a modern naval vessel to surveillance drones used to guide artillery strikes – Ukraine has turned into a testing ground for a variety of technological advancements and new strategic ideas.

While many experts, enthusiasts, and soldiers like Ukraine's former Commander-in-Chief Valery Zaluzhny see drones as a game changer, a whole new type of weapon paving the way for a qualitatively new style of warfare¹, others, including Ukraine's prominent head of military intelligence (HUR) Kyrylo Budanov, do not believe in the decisive character of drones, in spite of all their advantages.²

Apart from addressing the question whether drones can become a decisive weapon on the battlefield, this paper discusses the limitations associated with this type of weapon, depending on factors such as the deployment scenario (land or naval warfare), the operating environment, the technological level of the adversary, production capacities, etc. The paper also considers the assumption that drones will 'only' serve as an addition, albeit a powerful and extremely efficient one in terms of cost-damage ratio, to other weapon systems from ATMGs to SS missiles, and as a technical support tool for ground forces in general, as well as for recce groups and other specialised units.

Starting with an analysis of the origins of drone usage in Ukraine, this paper then goes on to describe relevant developments in drone technology and to examine the current state of drone usage as well as political, economic, and practical aspects of drone production in Ukraine. It does not address any aspects of Russian drone warfare.

2 Naval Drone Warfare: Sea Denial vs. Full Sea Control

One of the most spectacular examples of Ukraine using unmanned weaponry is its naval drone warfare against Russia's Black Sea fleet. The idea to use naval unmanned vehicles to hit larger naval vessels is not new, however, and was not developed by the Ukrainians. In the 1930s and 1940s, the U.S. had already worked on developing aerial un-

¹ Cf. Zaluzhny 2024.

² New Voice 2024.

manned systems able to hit enemy vessels.³ In the 1980s, the Tamil Tigers tried to use naval drones (basically speedboats with explosives on board) to hit vessels of Sri Lanka's Navy.⁴ In 2017, Houthi rebels hit the Saudi frigate Al Madinah with a kamikaze naval drone, although without sinking the ship.⁵ Yet, even though the Ukrainians have not developed anything new, they have significantly improved the tool. Ukraine's success can be attributed to three factors: a) much better communication; b) the mass production of drones; c) the creative use of drones, including wolf-pack attacks and coordinated attacks of aerial drones.

The path to Ukraine's naval drone fleet was not without challenges. Through the 1990s and 2000s, Ukraine strove to create a classical fleet of naval vessels. Notable examples for these aspirations include the corvette Volodymyr Velykyi, announced in 2011 to be delivered in 2016, never to be finished⁶; seven Gyurza-class gunboats, designed by Mykolaiv shipyards and produced in Kyiv until 2020⁷, mostly known for their unsuccessful engagement with Russian vessels in the Kerch Strait in 2018⁸; and two Ada-class corvettes built in Turkish shipyards that should have provided Ukraine with some additional firepower⁹, but have been unable to deliver any successes yet.

Somewhat contrary to Ukrainian ambitions, a massive fleet of naval drones was key to effectively pushing

- 3 Mizokami 2020.
- 4 Freeze 2009.
- **5** Lagrone 2017.
- 6 Offshore-Energy 2011.
- 7 Grotnik 2023.
- 8 Ukrayinska Pravda 2018.
- 9 Defense Express 2024.

the Russian Black Sea Fleet back - at least to the eastern harbours of the sea. possibly even to the Caspian Sea.¹⁰ Two naval drone programmes were separately launched by two competing intelligence agencies in Ukraine in early 2022. First, the SBU, a civil intelligence service, developed an unmanned surface vehicle nicknamed 'Sea Baby', a remote-controlled speedboat carrying a warhead with up to 800 kg of explosives. The other contender, the Main Directorate of Intelligence (HUR), answered with their 'Magura' drone, with a very similar design, capable of carrying 320 kg of explosives for up to 450 nautical miles. Both drones can reach a speed of 20 knots (cruise speed) and 45 knots (top speed).¹¹ In 2022, Ukrainian drones had already started hitting Russian naval vessels, oil tankers, but also infrastructure objects such as the Kerch bridge, or the Novorossiysk oil terminal.¹² In 2023, Ukraine increased the intensity of its attacks, damaging even the most modern Russian signals intelligence gathering vessel Ivan Khurs¹³ and a Karakurt-class missile corvette.¹⁴ The latter had only entered service with the Russian Black Sea Fleet in July 2023.

Until early 2024, when Russia withdrew its Kalibr-capable vessels to the Caspian Sea, Ukrainian drones participated in several video-footage-confirmed strikes against Russian vessels.¹⁵ The videos confirm key components of the successful tactics employed by Ukrainian drones. The successful sinking of a vessel usually requires multiple

- **10** Nikolov 2024.
- **11** Dovgan 2023.
- **12** Yann 2023.
- **13** Stavskaya 2023.
- 14 Radio Svoboda 2024.
- **15** Novyny.LIVE 2023; TSN TV 2024.



hits by several drones. Given its relatively low speed and the limited amount of explosives it carries (300-500 kg), the impact of a single drone is difficult to compare with the damage that can be inflicted by a missile with its high speed and massive warhead (as evidenced by the destruction of Russian Black Sea Fleet flagship *Moskva* by two Neptune hits¹⁶). And, unlike torpedoes, drones hit vessels above sea level, not below. Thus, a combined attack by a pack of drones is required.

A successful drone attack also requires a highly reliable fast-speed communication system, preferably satellite communication. In 2022, Ukraine's first attack on the harbour of Sevastopol reportedly failed after Elon Musk had unexpectedly denied Ukraine the use of his Starlink communication system.¹⁷ Several drones lost connectivity and washed ashore, giving the Russians time to prepare for further Ukrainian attacks.¹⁸

The final part of Ukraine's success with naval drones is related to their low costs and the possibility to produce the vehicles from available components without risking shortages. Most drones are produced using engines and other parts from commercial scooters (e.g. the South Korean Sea-Doo).¹⁹ The fuses used in these drones are standard contact fuses from Soviet-era high explosive aerial bombs.²⁰ Combined with a price of USD 250,000 up to 350,000 per unit, drone production is highly resilient to attempts to undercut it. With spare parts being available on the global market, low production costs,

16 Guardian News 2022.

18 Talmazan 2023.

and given the fact that the technological level of the product allows it to be assembled at any workshop capable of working with speedboats, the production of naval drones cannot be stopped neither by economic means nor by targeted strikes against production facilities.

It seems the only functional way for Russia to fight naval drones is having helicopters constantly patrol the sea surface, destroying drones by gunfire. Their small size and low profile make them invisible to radars, transforming the fight against drones almost into a close combat operation. With their tactics of countering Russian defence strategies (e.g. by sending swarms of aerial drones), Ukrainian troops challenge Russian air defence systems and endanger Russian helicopters. Reportedly, in June 2024, friendly air defence fire destroyed a Russian Kamov helicopter while the latter was engaged in repelling naval drones.²¹

Nevertheless, alongside the strengths of drone warfare there are also weaknesses. While being a cheap and effective means of destruction of larger vessels and thus able to prevent the enemy's navy from using contained waters, drones cannot fully control the sea. They are also limited in their distance and highly dependent on intelligence data providing them with target coordinates. This probably explains the high number of attacks on the Russian navy within or close to harbours - a free hunt for vessels on the open sea is not possible for naval drones (yet). It is also (as yet) unrealistic to expect drones to be able to operate in harsh conditions such as storms and large waves common on the high seas. Still, new

¹⁷ Chiappa 2023.

¹⁹ Yann 2023.

²⁰ Dovgan 2023.

²¹ The Insider 2024.

ways of utilizing naval drones are currently being developed in Ukraine. Examples include arming naval drones with anti-air and surface-to-surface MLRS missiles.²² This can transform naval drones into mobile artillery or air defence platforms, using the sea surface to manoeuvre, especially in coastal areas and relatively calm waters.

The latest developments in drone warfare are proof of this inherent limitation in the capabilities of naval drones. While new features and ways of application are constantly developed for land warfare drones, naval drones have almost disappeared from the news. Now that Russia has moved most of its fleet from the Black Sea to the Sea of Azov, and even to the Caspian Sea, Ukrainian drones are left without targets to hunt. This might seem paradoxical: since Ukraine effectively pushed the Russian fleet from the Black sea. there have been no more naval victories for Ukraine, and neither has a follow-up land operation been launched. There is, however, a very logical explanation: Ukrainian naval drones are unable to penetrate the Russian defences placed in front of the Kerch bridge, which guards the entrance into the Sea of Azov, and therefore the drones cannot hit Russian vessels north of the Kerch bridge. Ukraine is also incapable of conducting a landing operation in Crimea, or elsewhere, as it lacks conventional vessels such as cruisers, corvettes, and frigates to suppress Russian land forces and to provide air defence, and of course landing vessels to carry out the landing operation itself. The destiny of Crimea will be decided

by a land operation, without involving naval drones.

It is for the same reason – the lack of conventional vessels - that Ukraine has also been unable to expand its control over the Black Sea by other means, for example by sending conventional vessels to key zones of the sea, using them for air defence (for example, protecting Ukraine from Russian cruise missiles flying over the Black sea). With drones alone, this type of control is impossible to achieve. Of course, this does not mean that Ukraine's deployment of naval drones has had no impact - the destruction of Russian naval vessels capable of carrying Kalibr missiles alone has saved countless Ukrainian lives. The coasts of Ukraine's Odesa and Mykolaiv regions are also safe from Russian landing operations. But in contrast to the drones used in land warfare, naval drones have demonstrated very clear limits in terms of usability: they only serve to deny the enemy control of a limited maritime area, within reasonable distance from the shore, and only in calm waters and with enough reconnaissance support. The stunning success of Ukrainian naval drones in the Black Sea can be partly explained by the very unique character of that theatre of operations. While there is no limit to Ukraine's drone supply (they are easily produced in Ukraine and released into the waters of the Black Sea), Russia cannot simply add more naval vessels to the Black Sea by transferring assets from other fleets (i.e. the Northern, Baltic or Pacific Fleets), since Türkiye controls – and limits – access to the Black sea via the Straits. This renders the Black Sea a very special battlefield, characterised by confined waters, short distances to the shore, a lack of



high waves, and other aspects favourable to drones.

3 From Bayraktars to Mavics

Since Russia began its full-scale invasion of Ukraine, the Ukrainian Army's use of aerial drones has seen a number of changes. Between 2015 and 2021, Ukraine had used small surveillance drones to localize targets for their own artillery, without using drones for direct strikes.²³ During the first weeks and even months of the full-scale war, Ukrainian troops relied on the classic ways of fighting the invading army. They used ATGMs, artillery, and Turkish-built Bayraktar TB2 drones²⁴ for their sneak attacks on Russian convoys, defensive actions against advancing Russian troops, and larger-scale counterattacks. These drones had already demonstrated their efficiency in the Azerbaijani-Armenian conflict over Nagorno-Karabakh in 2021.

As the Bayraktar drones started to lose their efficiency amid strengthened Russian air defences²⁵, the Ukrainians embarked on a journey into unknown waters of drone utility. The first peak in google searches for 'дрони', the Ukrainian word for 'drones', occurred in October 2022²⁶, and since then Ukrainians have searched for information about drones more often than ever before. In December 2023, Ukraine's President

25 Ibid.

Volodymyr Zelenskvv announced plans to produce 1 million FPV drones within the next year.²⁷ In June 2024, Ukraine even created a separate branch of the armed forces for drone operations - the 'Unmanned Systems Forces', with their first commander Colonel Vadym Sukharevskyi, who is also the deputy Commander-in-Chief of the Ukrainian Army. On the occasion of the presentation of the new branch and its commander, Deputy Defence Minister Ivan Havryliuk stated that with these forces, Ukraine 'will get the opportunity to strike Russian targets at every possible depth, from battle formations in direct proximity to our [Ukrainian] units to the Ural mountains'.28

Drone tactics have evolved since early 2022. The first wave of drone warfare came in late 2022 with the mass usoff-the-shelf commercial of age drones, mostly produced by the Chinese DJI company under the Mavic trademark, including the Mavic 3T thermal night vision drone, which is able to take video and photo footage even in the harsh environments of the high seas. From non-thermal to night vision systems, these drones cost between € 1,500 and 5,400 and provided the Ukrainian artillery with exceptional image quality, up to 28x zoom. They were especially useful for guiding mortar fire, and even to coordinate attacks of infantry units. The entire liberation of Robotyne in the Zaporizhzhya region by the famous 47th mechanised brigade in August 2023 was coordinated using Mavic drones donated by the European Resilience Initiative Cen-

²³ Zhirokhov 2021.

²⁴ Gosselin-Malo 2023.

²⁶ Google-Trends service, search for 'Дрони' word (drones), last accessed on 25-11-2024: https://trends.google.de/trends/ e x p l o r e ? d a t e = t o d a y % 2 0 5 - y & g e o = U A & q = % D 0 % B 4 % D 1 % 8 0 %D0%BE%D0%BD%D0%B8&hl=en.

²⁷ Romanenko 2023.

²⁸ Militarnyi 2024b.

ter, a German NGO, according to soldiers of the brigade.²⁹

The use of DJI Mavic drones had its issues, though. Being a commercial drone, the Mavic, if used with pre-installed software, allowed any person, including Russian artillery units, to easily localize the drone's starting position and the current position of its pilot.³⁰ This led to losses amid drone operators, which is why - starting in early 2023 - the Ukrainians developed their own software for this type of commercial drones. Another challenge was related to the fact that the Chinese drone manufacturer DJI officially obliged its dealers in Europe to undertake all possible steps to prevent the selling of the drones into Ukraine or to Ukraine-related European clients. These complications led to criticism against the use of these drones by Defence Minister Ryeznikov, who derogatorily named them 'wedding drones',³¹ pointing out the fact that they are often used for taking footage of large weddings, claiming that Ukraine's Army did not have the need for such civilian technology. Still, the DJI Mavic - with and without thermal imaging - remains the most reliable and popular surveillance drone for Ukraine. The Ukrainian army uses Mavic drones (and drones produced by other companies, e.g. Autel) for different types of operations starting from the infantry squad level, but a special focus lies on the needs of artillery units.

This gap between the living reality of Ukraine's army and Western military tradition has resulted in disappointments during military training in Germany. The use of drones is not part of the training programme established for the Ukrainian army. In September 2023, I conducted interviews with soldiers of Ukraine's 47th mechanised brigade who had participated in the EUMAM UA training mission in Germany.³² They expressed their disappointment that their trainers did not have any knowledge of drone warfare (besides a basic knowledge of the existence of winged drones) and that Ukrainian soldiers were not even allowed to use their own commercial quadcopter drones, which they had brought with them to Germany to test different battle situations. This ban was based on security rules that prohibited them from bringing non-certified electronic equipment into training areas. As a result, Ukrainian artillerists earmarked to use drones to guide mortar shells had no chance to train for the daily situations they would face in Ukraine.

4 FPV Kamikaze Drones: A Long-Expected Gamechanger?

The most significant development on the drone battlefield in Ukraine came with the appearance of FPV (first-person view) aerial drones. FPV drones have been developed as cheap and short-range weapons allowing to precisely hit not only infantry or other soft targets, but also armoured vehicles and tanks. A typical FPV drone is a light quadcopter built around a 7-inch or a 10-inch frame produced out of carbon



²⁹ Interview with soldiers of the 47th mechanised brigade, September 2023, Zaporizhzhya.

³⁰ Flesh 2024.

³¹ Censor 2023.

³² Interview with soldiers of the 47th mechanised brigade, September 2023, Zaporizhzhya.

or aluminium, or even printed on a 3D printer and hardened later. It has a fixed-focus camera (this dramatically reduces its optical capacities compared to commercial Mavic drones) and, depending on the size of its frame (7 or 10 in), can carry an explosive device weighing 1.5 kg or 3 kg, respectively, making it an ideal platform for carrying anti-personnel shrapnel IEDs or anti-tank RPG grenades. FPV drones are normally used together with an offthe-shelf surveillance drone that provides pilots with an aerial overview of the battlefield, helps to identify targets, and also documents the success or failure of the attack.

In the middle of 2023, the Ukrainian army began to constantly increase the use of FPV drones. From autumn 2023, due to the shortage of artillery shells, the deployment of FPV drones has turned into the only available substitution of firepower for Ukrainian units. When Ukraine experienced a severe shortage of 155 mm shells in December 2023, President Zelenskyy proposed an initiative of producing 1 million FPV drones within a year. In January 2024, I delivered new drones to Ukrainian units fighting at Avdiivka in the Donetsk region. Some of the soldiers expressed the opinion that with FPV drones, they would be able to efficiently repel Russian attacks even if they had only 15-20% of the artillery shells they actually needed. The situation became even more dire in late January and early February, as fighting units had to rely almost exclusively on FPV drones, resulting in the loss of Avdiivka. This notwithstanding, FPV drones had already proven to be a highly efficient anti-artillery, anti-tank, and anti-personnel weapon.

Marking this success, starting from early 2024, several brigades added an

FPV company to their structure, a unit exclusively with working FPV kamikaze drones. In addition to this FPV company, some brigades also added FPV kamikaze drone squads to each of their battalions. Such an extensive use of FPV drones, originally caused by a lack of 155 mm shells, has since gained its own momentum and has significantly influenced the philosophy of the Ukrainian army, stimulating initiative and decision-making on the lower levels of its hierarchical structure and increasing the fire range of its most basic units. Popular leaders of army-related NGOs like Serhiy Sternenko openly called for more government investment in drones and for the creation of a separate drone corps, comparing it to the creation of the air force or tank units in WW I.³³ These demands ultimately led to the aforementioned creation of the Unmanned Systems Forces in June 2024.

5 Drones as Bombers and Interceptors

Drones had been used as improvised bombers by Ukrainian units even before the mass-arrival of FPV drones. Back in 2022, commercial drones were used for dropping hand grenades. Heavy DJI Matrix drones, capable of carrying several kilograms of weight, dropped 82 mm mortar mines. Currently, dropping IEDs or hand grenades is mostly a task for FPV drones, as they are much cheaper (\in 300-400 compared to \in 2,000 for a simple Mavic or even \in 8,000 for a Matrice) and bombing missions expose drones to enemy electronic warfare (jamming) and gun-

³³ Grunt 2024.

fire, increasing the risk of losing an expensive off-the-shelf drone. Each unit using drones has its own workshop where blasters make IEDs out of automatic grenade launcher grenades or C4 packages. A 3D printer is considered standard equipment of a workshop, printing tail units for drones, or hulls for IEDs. Workshops also produce fuses of their own design, re-purposing ignition or tracer ammunition. The only warhead that is used without any modifications is the RPG grenade. Soldiers say it can be easily fitted to a drone, and does not require any adjustments.

An impressive, but rarely used way of utilizing drones is bomber operations, as they require heavy carrier drones able to transport and drop a TM-62 anti-tank mine. Such drones, with prices above $\leq 1,000$, can carry one mine and drop it on the enemy's position or on a vehicle. More expensive bomber drones, nicknamed 'Vampire' (or 'Baba Yaga' in Russian army slang, partly adopted by the Ukrainians), can carry even more weight, but cost up to $\leq 10,000$. Losing them is too expensive for any unit, so they are used with great caution.

Even though a number of experiments have been conducted involving the use of AI for FPV drones or equipping drones with other types of armament like machine guns, this has not led to the implementation of such technologies. The intended application of AI in drones is mostly limited to functions providing support to the pilot, e.g. marking objects that could be identified as targets (vehicles, tanks, soldiers, etc.), and uncovering potential camouflage. So far, however, AI is not used to help select targets, but only in a limited way to guide the drone to its target, if the signal is lost.

Another significant development is indicated by several confirmed interceptions of winged drones by FPV drones.³⁴ Russian winged drones are especially dangerous as they provide the Russian army with precise information, leading to attacks by artillery, ballistic missiles, or Lancet loitering munition. Russian winged recon drones of the Orlan, SuperCam, and Zala series fly above 5,000 m, and provide Russian artillery units with valuable information for strikes. Until 2024, it was nearly impossible to hit them with other means than an AA missile (except for rare cases in which a Yak-52 slow-flying propeller plane with a machine gunner on the co-pilot seat was used to hunt such drones). Since summer 2024, numerous cases of interceptions of Russian winged drones have been recorded, as Ukrainians have developed high-speed winged FPV drones.³⁵ Ukrainian drones have also intercepted at least five Russian helicopters, including a Mi-28 attack helicopter and a Ka-52 attack helicopter - a task which was seen as nearly impossible before.³⁶ The Ukrainian army has also developed new types of warheads for drones and has armed drones with incendiary weapons. In September 2024, several cases were reported of drones being used to drop burning thermite mixture on Russian positions as Ukraine's 108th territorial defence brigade presented its 'Dragon' drone.³⁷

- **35** Compare: Sternenko 2024.
- 36 Militarnyi 2024a.
- 37 Expres 2024.

³⁴ Suchomimus 2024.

6 Long-Range Drones – Filling the Cruise Missile Gap

Currently, Ukraine has up to 19 different models of long-range UAVs that can be used for reconnaissance or for kamikaze attacks on Russia's infrastructure.³⁸ The oldest models among them are the Tu-141 Strizh and the Tu-143 Reys, both old Soviet reconnaissance UAVs developed in the 1970s, which Ukrainians have modified into long-range kamikaze drones. Their most spectacular mission was an attack on Russia's strategic Engels airbase on the middle of the Volga in late 2022, damaging at least one Tu-95 Bear bomber.³⁹ Ukraine's modern reconnaissance drone Valkyrie was developed between 2015 and 2017. Most of the other long-range kamikaze drones have been developed during the last two years of the full-scale war. Examples include the winged drones Bober (Beaver) and Lyuty (Furious), developed in 2022 and 2023, respectively. Both can carry explosive warheads up to 200 kg over a distance of 800 km.40 Other kamikaze drones produced by Ukraine are more or less re-designed light airplanes, transformed into carriers of explosives. They were used in April 2024 to attack Russia's Shahed drone production site in Yelabuga, Tatarstan.⁴¹ These drones fill the gap of cruise missiles, which Ukraine lacks. Apart from a small number of Hrim-2 ballistic missiles and Neptune anti-ship missiles (capable of attacking land targets), Ukraine has no domestically produced long-range cruise missiles at its disposal, and it had not been allowed to use the Storm Shadow and SCALP missiles provided by the UK and France beyond its sovereign territory until November 2024. Contrary to cruise missiles, long-range drones produced in Ukraine lack speed and do not carry warheads powerful enough to damage even soft targets like oil refineries.

7 R&D in the Field

Ukraine has concentrated most of its production capacities, resources, and public interest on FPV drones. Despite the fact that these drones are assembled from Chinese components, production chains are mostly safe as the parts are very basic and offered by numerous companies. This secures their import to Ukraine and makes them impervious to Chinese export bans, compared to the off-the-shelf Mavic or Autel drones used before.

According to developers and producers of FPV drones I talked to between June and October 2024, Ukrainian drone production has exceeded 1 million units per year, with over 98% of them being FPV drones. The mass production of drones has led to a mass testing of drones on the battlefield, resulting in new and more effective ways of drone production. Production costs of a modern effective FPV drone have dropped from over € 400 to € 300 per unit (including batteries) within a year, and cheap and less reliable drones can be produced for even less than \in 250, according to Front Line Kit, a volunteer

³⁸ Andrusyak 2024.

³⁹ New Voice 2023.

⁴⁰ Akimova 2024.

⁴¹ BBC News Russian Service 2024.

organisation that also manufactures drones.⁴²

The most limiting factor in drone warfare is a drone's flying distance, which is currently limited to about 25 km. This distance can be increased by using a commercial winged drone as a carrier. This drone also serves as a repeater for the radio signal after it drops an FPV drone 30-40 km from the starting point, effectively increasing its flying range to 50-60 km. Increasing the distance this way does not lead to any significant lag in signal transmission. The carrier/repeater is usually a Chinese-produced hobby aircraft available for € 8,000 on Chinese online selling platforms.

Increasing drone reliability is another important factor in research and development. According to Front Line Kit, the cheapest drones with prices of € 200-250 have an efficiency rate of 10-15%, meaning that only 1 in 10 drones hits their target, often not only because of enemy electronic warfare, but because of technical malfunction during the flight. Thinking about the fact that the guaranteed kill of an armoured target often requires 2-3 hits, a unit may need up to 20-30 very cheap drones for one tank kill. High-quality drones costing € 300-350 have an efficiency rate of over 30%, which effectively leads to a better price/hit ratio. As drone-active units can use up to 3,000 drones per month (battalion level), and usually have full videos of the flights recorded by the drone itself in first-person flight view plus footage from a surveillance drone, this allows drone operators and drone producers to analyse the weak spots of their drones and to find ways to improve their quality. As a result, the guaranteed destruction of a battle tank can be achieved with only 3-6 drones spent, or a money equivalent of \notin 900-1,800.

The main problem for FPV drones remains enemy EW, which breaks radio contact between the drone and the pilot. Since increasing the signal power has its natural technical limits, the only efficient way to neutralize enemy EW is using a repeater drone. Still, as this costs up to € 8,000, the question of economic efficiency arises for many units. According to Ukrainian drone producers, over time drone prices will drop further, while technological progress will allow Ukrainian firms to produce drones of higher quality or better specification. Overall. FPV drones will continue to become more and more accessible. 'The reality is that every idiot with access to YouTube can kill you. If you do not have a jammer, you will simply die', - I was told by German Timchik, head engineer with FPV drone producer Front Line Kit. The same concerns have been expressed by the commander of a drone unit in the Ukrainian army. The lack of 155 mm ammunition has triggered the development of a new weapon in Ukraine, and this weapon is here to stay - even after this war.

8 Conclusions

The development of drone warfare in Ukraine is characterised by several aspects. In the first stages of the conflict, Ukraine used drones in order to fill



⁴² Interview with Front Line Kit head engineer & designer German Timchik and Front Line Kit founder Richard Woodruff, June 2024, Lviv. As of November 2024, Front Line Kit forms part of the newly founded company United Unmanned Systems, which is based in Ukraine and focuses on drone production.

gaps in its strike capacities, in both the naval and land theatres of war. Secondly, amid using off-the-shelf drones, Ukraine has put a lot of effort into producing its own drones, tailor-made for specific needs. Finally, these Ukrainemade drones are being developed by both government and private entities, often at grass-roots level, on a crowdfunding, trial-and-error basis. Despite this somewhat improvisational approach, drones have provided the Ukrainian army with enough firepower to achieve a significant victory over Russia's Black Sea fleet, and to hold back the Russian winter offensive of 2023/24, despite a massive lack of 155 mm artillery shells. In the summer of 2024, Ukraine achieved a significant leap in the development of drones for land and aerial warfare, having produced enough drones to start striking several Russian strategic objects deep behind the frontlines, and to use drones also for air interception missions.

As promising as drone development looks, it does have certain limitations. Drones can provide units with a significant increase in firepower, especially at squad and platoon levels. Still, drones alone cannot achieve - and sustain - control over a contested area. This aspect is not immediately obvious on the land, as infantry units using drones naturally fulfil the task of taking control, but it is more than apparent at sea. Ukrainian drones did push Russia's fleet from most parts of the Black Sea, but this did not result in any offensive naval operation on the part of Ukraine. Drones alone can only hit targets but cannot achieve sea control.

 For the 2024/2025 campaign, one can expect the following in the development of drones:

- The price per unit will drop further while reliability will increase, raising the numbers of drones used per strike drones battalion to up to 5,000 kamikaze and even more FPV drones. Any enemy target more valuable than € 1,000 identified by a drone pilot will be hit without hesitation, as this creates a favourable cost-benefit balance.
- Anti-air drones will make an important addition to MANPAD and AA guns, filling the capability gap between them and the SAM batteries, thus helping to protect the sky against enemy helicopters and reconnaissance drones at low cost. Other types of warheads will be used as well, turning drones into standardized carriers of goal-specific warheads.
- EW development will be pursued further, with the aim of creating 'death zones' for enemy drones without harming own drones. As the number of frequencies is limited, this will turn into a complex task.
- AI development, which is still taking baby steps, will be promoted further aiming at the goal of thwarting the enemy's EW efforts without the need for a communication link to a pilot. It would be unreasonable to expect that AI could fulfil other roles such as guiding drone swarms in patrolling missions with a 'license to kill', as this would require a massive increase of battery lifetime. Still, AI development will be aimed at achieving the goal of being able to send AI-guided drones in the direction of a known enemy po-

sition (for example during an enemy attack, or in order to support an attack of friendly forces).

Naval drones will remain an interdiction tool for Ukraine, as Ukraine will not be able to build a navy strong enough to conduct drones-supported landing operations. Therefore, naval drones will only fulfil a secondary role to ensure a relative reduction of the danger from the Black Sea fleet, while the main battle will be fought on land. For other countries with similar geographic conditions (confined waters, an enemy with a fleet of conventional vessels), naval drones can be useful for significantly improving the level of their coastal defence.

Overall, drones will be used even more actively than today as a cheap and reliable tool to notably increase the firepower of any unit up to, and including, battalion level. In terms of significance, this development can be only compared to the invention of machine guns or rear-loaded artillery. Countries that continue to ignore this development and rely on traditional ways of using expensive wing drones as observation tools in combination with artillery and air strikes in support of their infantry will suffer significant losses in the event of a land war against an adversary experienced in drone warfare.

List of References

Akimova, Yuliya (2024): 'Bober', 'Lyuty' ta 'Valkiriya': Yak ukrainski drony znyshchuyut voroga na gronti ta v tylu ('Bober',' Lyuty' and 'Valkyriya': How Ukrainian drones destroy the enemy on the frontline and behind it), in: RBK-Ukraina from 13-05-2024, https:/ /www.rbc.ua/rus/news/boberlyutiy-ta-valkiriya-k-ukrayinskidroni-1715609106.html, last accessed on: 18-07-2024.

- Andrusyak, Anastasiya (2024): Dlya udariv po NPZ I aerodromakh RF: yak I de v Ukraini vyroblyayut dalekobiini BPLA (foto) (For strikes against Russia's oil refineries and airfields: how and where in Ukraine longrange UAVs are being produced (photo)), in: Focus from 30-04-2024, https://focus.ua/uk/digital/643498-dlya-udariv-po-npzi-aerodromah-rf-yak-i-de-vukrajini-viroblyayut-dalekobiynibpla-foto, last accessed on: 18-07-2024.
- BBC News Russian Service (2024): Bespilotniki atakovali predpriyatiya v Tatarstane. Chto izvestno I pri chem tut iranskie drony (UAVs have attackes businesses in Tatarstan. What is known and how Iranian drones are related to this), 02-04-2024, https://www.bbc. com/russian/articles/c3gll1njr4yo, last accessed on: 18-07-2024.
- Censor (2023): Ministre Reznikov, kazhete vesilni drony? Tse vesillya tsinoyu zhyttia nachykh khloptsiv', - Zinovyeva ('Minister Reznikov, do you say they are wedding drones? Our boys pay with their lives for this wedding', - Zinovyeva), 08-04-2023, https://censor.net/ua/ n e w s / 3 4 1 0 8 9 7 / m i n i s t r e_ reznikov_kajete_vesilni_drony_tse_vesillya_tsinoyu_jyttya_



nashyh_hloptsiv_zinovyeva, last accessed on: 18-07-2024.

- Chiappa, Claudia (2023): Elon Musk sabotaged Ukrainian attack on Russian fleet in Crimea by turning off Starlink, new book says, in: Politico from 08-09-2023, https://www. politico.eu/article/elon-muskukraine-starlink-russia-crimeawar-drone-submarine-attacksabotage/, last accessed on: 18-07-2024.
- Defense Express (2024): Ukrainian Ada Class Corvette Hetman Ivan Mazepa's Equipment in All Details, 08-07-2024, https://en.defence-ua.com/analysis/ukrainian_ada_class_corvette_hetman_ ivan_mazepas_equipment_in_all_details-11098.html, last accessed on: 17-07-2024.
- Dovgan, Konstantyn (2023): Ubiitsy mosov i korabley: kak ukrainskie nadvodnyye drony "malyshi" derzhat v strakhe flotiliyu Rossii (Killers of Bridges and Vessels: How Ukrainian Naval Drones "Sea Baby" Spread Fear Among Russian Fleet), in: 24 Channel from 18-08-2023, https://24tv.ua/ru/ sea-baby-dron-harakteristikichto-izvestno-o-nadvodnyhdronah-sbu-24-kanal_n2374928, last accessed on: 17-07-2024.
- Expres (2024): Nova zbroya vypaliue posadki z okupantamy: Ukraina vyprobuvala dron 'Drakon' (New Weapon Burns Plants with Occupiers: Ukraine has tested its 'Dragon' drone), in: 04-09-2024, https://expres.online/podrobitsi/ nova-zbroya-vipalyue-posadkiz-okupantami-ukraina-viprobuvala-dron-drakon, last accessed on: 07-09-2024.
- Flesh, Serhii (2024): Pro ukraiinsku versiyu proshyvky '1001' dlya droniv DJI

(On '1001' version of software for DJI drones), in: Militarnyi from 13-01-2024, https://mil.in.ua/uk/ blogs/pro-ukrayinsku-versiyuproshyvky-1001-dlya-dronivdji/, last accessed on: 18-07-2024.

- Freeze, Colin (2009): Ships of fleeing Tamils stir fear of hidden Tigers, in: The Globe and Mail from 23-10-2009, https://www.theglobeandmail.com/news/national/ ships-of-fleeing-tamils-stir-fearof - hidden-tigers/article4289929/, last accessed on: 17-07-2024.
- Gosselin-Malo, Elisabeth (2023): Are the once-vaunted Bayraktar drones losing their shine in Ukraine?, in: DefenseNews from 31-10-2023, https://www.defensenews.com/ global/europe/2023/10/31/arethe-once-vaunted-bayraktardrones-losing-their-shine-inukraine/, last accessed on: 18-07-2024.
- Grotnik, Tomasz (2023): Ukraine's Final Gyurza-M-Class Gunboat Starts Factory Trials Near Kyiv, in: Naval-News.Com from 27-02-2023, https://www.navalnews.com/ naval-news/2023/02/ukrainesfinal-gyurza-m-class-gunboatstarts-factory-trials-near-kiev/, last accessed on: 17-07-2024.
- Grunt (2024): 'Za dronamy maibutne': volonter Serhii Sternenko pro kolonku Zaluzhnogo, FPV ta snaryadnyi golod ('The future is controlled by drones': volunteer Serhii Sternenko about Zaluzhny's column, FPV, and ammunition hunger), unspecified date in February 2024, https://grnt.media/opinion/sergij-sternenko-prokolonku-zaluzhnogo-fpv-ta-

snaryadnyj-golod/, last accessed on: 18-07-2024.

- Guardian News (2022): Footage appearing to show damaged Russian warship Mosvka emerges, in: YouTube from 19-04-2022, https:/ /www.youtube.com/watch? v=CW6D3F9aBpg, last accessed on: 17-07-2024.
- Lagrone, Sam (2017): Navy: Saudi Frigate Attacked by Unmanned Bomb Boat, Likely Iranian, in: USNI News from 20-02-2017, https:// news.usni.org/2017/02/20/ navy-saudi-frigate-attacked-unmanned-bomb-boat-likely-iranian, last accessed on: 17-07-2024.
- Militarnyi (2024a): U Kurskoi oblasti FPVdron urazivrosiiskii Mi-28 (An FPV drone has hit a Russian Mi-28 in Kursk region), 07-08-2024, https:/ /mil.in.ua/uk/news/u-kurskijoblasti-fpv-dron-urazyv-rosijskyj-my-28/, last accessed on: 07-09-2024.
- Militarnyi (2024b): V ZSU presentuvaly novyi rid viisk – Syly bezpilotnykh system (The Ukrainian Armed Forces have presented a new Corps: Unmanned Systems Corps), 11-06-024, https://mil.in .ua/uk/news/v-zsu-prezentuvaly-novyj-rid-vijsk-syly-bezpilotnyh-system/, last accessed on: 18-07-2024.
- Mizokami, Kyle (2020): The Surprising History of Unmanned Navy Systems, in: U.S. Naval Institute, Vol. 146/6/1,408, https://www.usni. org/magazines/proceedings/ 2020/june/surprising-historyunmanned-navy-systems, last accessed on: 17-07-2024.
- New Voice (2023): Udar po Engelsu. Viiskovy ekspert rozpoviv, shcho mogla zastosuvaty Ukraina (A

strike on Engels. A military expert explained what Ukraine could have used), 31-01-2023, https:// nv.ua/ukr/ukraine/events/yakukrajina-mogla-atakuvati-engels-viyskoviy-ekspert-noviniukrajini-50301133.html, last accessed on: 18-07-2024.

- New Voice (2024): Drones will not bring 'decisive advantage' to either Ukraine or Russia, says HUR chef, 16-02-2024, https://english.nv.ua/nation/drones-have-beenin-full-use-by-both-sides-for-ayear-now-50393447.html, last accessed on: 02-09-2024.
- Nikolov, Boyko (2024): Russia moved Karakurt-class warship to Caspian via inland waterways, in: BulgarianMilitary.Com from 04-05-2024, https://bulgarianmilitary.com/2024/05/04/russiamoved-karakurt-class-warshipto-caspian-via-inland-waterways/, last accessed on: 17-07-2024.
- Novyny.LIVE (2023): Ataka morskoho drona (Attack of a Naval Drone), in: YouTube from 10-08-2023, https://www.youtube.com/ watch?v=EbT9dOkci1M, last accessed on: 17-07-2024.
- Offshore-Energy (2011): Corvette Vladimir Veliky to Join Ukrainian Navy by 2016?, 24-08-2011, https://www.offshore-energy.biz/ corvette-vladimir-veliky-to-joinukrainian-navy-by-2016/, last accessed on: 17-07-2024.
- Radio Svoboda (2024): Rassldovateli podtverdili potopleniye raketnogo korablya 'Ziklon' v Sevastopole (Investigators Confirmed Sinking of Missiles Vessel 'Ziklon' in Sevastopol), 23-05-2024, https://www.svoboda.org/ a/rassledovateli-podtverdili-po-

toplenie-raketnogo-korablyat s i k l o n - v - s e v a s t o p o l e / 32960360.html, last accessed on: 17-07-2024.

- Romanenko, Valentyna (2023): Zelenskyy: We'll produce 1 million drones next year, in: Ukrainska Pravda from 19-12-2023 https:// www.pravda.com.ua/eng/news/ 2023/12/19/7433765/, last accessed on: 18-07-2024.
- Shwarts, Kateryna (2024): Rossiyane v panike: na ukrainskikh morskikh dronach zametili rakety (foto, video) (The Russians are panicking: one noticed missiles installed on Ukrainian naval drones (photo, video)), in: UNIAN from 06-05-2024, https://www.unian.net/ war/r-73-na-ukrainskiemorskie-drony-ustanovilirakety-rossiyane-v-panike-fotovideo-12627864.html, last accessed on: 18-07-2024.
- Stavskaya, Yana (2023): Podbit korabl Chenomorskogo flota 'Ivan Khurs': poyavilov video (Black Sea Fleet Vessel 'Ivan Khurs' has Been Hit: A Video Appeared), in: UNIAN from 25-05-2023, https://www. unian.net/war/podbit-korablchernomorskogo-flota-ivanhurs-poyavilos-video-12270045. html, last accessed on 17-07-2024.
- Sternenko, Serhii (2024): Masshtabny nebisnyi rusoriz (Massive Sky Russian Massacre), in: Serhii Sternenko's X account from 06-09-2024: https://x.com/sternenko/ status/1831973525445591101/ video/1, last accessed on 07-09-2024.
- Suchomimus (2024): Ukrainian FPV Drones Intercept ZALA 421 and Orlan-10 Drones, in: YouTube from 01-06-2024, https://www.

y o u t u b e . c o m / w a t c h ? v=9LeJH8iZ6ZM, last accessed on: 18-07-2024.

- Talmazan, Yuliya (2023): Ukraine is furious with Elon Musk for thwarting an attack on Russia's navy, in: NBC News from 08-09-2023, https:// www.nbcnews.com/news/ world/musk-stopped-ukraineattack-russian-fleet-starlinkrcna104019, last accessed on: 18-07-2024.
- The Insider (2024): 'Druzhestvennym ornem' sbit vertolet Ka-29, 'golye oklady' dlya rosiiskikh voyennykh v prigranichye Kharkovskoi oblasti. Chto proiskhodit na fronte (A Ka-29 helicopter shot down by 'friendly fire', 'basic salaries' for Russian military in areas close to border of Kharkiv oblast. What is going on on the frontline), 21-06-2024, https:// theins.ru/news/272580, last accessed on: 18-07-2024.
- TSN TV (2024): Vidnovlennyu ne pidlyahaye! HUR pokasaly yak drony vidpratsyuvaly po rosiyskomu korablyu RF 'Sergey Kotov' (No Repair Possible! HUR Demonstrated How Drones Worked Against Rusian 'Sergey Kotov' Vessel), in: YouTube from 05-03-2024, https:/ /www.youtube.com/watch? v=yG-gHUtcvj8, last accessed on: 17-07-2024.
- Ukrayinska Pravda (2018): Viina u Kerchenskiy prototsi: taran, shturmovyky ta zakhoplennya ukrayinskykh korabliv (War in the Kerch Strait: Ramming, Storm Assalt and Hijacking of Ukrainian Vessels), 25-11-2018, https:// www.pravda.com.ua/articles/

2018/11/25/7199243/, last accessed on: 17-07-2024.

- Yann (2023): Udarni morski drony u viini proty Rosii (Assault Naval Drones in the War Against Russia), in: Militarnyi from 20-06-2023, https:// mil.in.ua/uk/articles/udarnimorski-drony/, last accessed on: 17-07-2024.
- Zaluzhny, Valery (2024): Ukraine's army chief: The design of war has changed, in: CNN from 08-02-2024, https://edition.cnn.com/ 2024/02/01/opinions/ukrainearmy-chief-war-strategy-russia-

valerii-zaluzhnyi/index.html, last accessed on: 02-09-2024.

Zhirokhov, Mikhail (2021): Finish dlya 'Leleki-100'. Pochemu bespilotnik v voiskakh s 2015 g., a prinyat na vooruzheniye tolko seichas (A finish line for 'Leleka-100'. Why this UAV is being used by the army since 2015, but officially accepted into service only now), in: Dsnews. ua from 18-05-2021, https:// www.dsnews.ua/politics/finishdlya-leleki-100-pochemu-bespilotnik-v-voyskah-s-2015-g-aprinyat-na-vooruzhenie-tolkoseychas-18052021-425272, last accessed on: 18-07-2024.


Tactical Fruit Flies and a Strategic Petri Dish: The Black Sea as Testing Ground for the Future of Maritime Conflict

While likely familiar to readers, Ukraine's undisputable military success at sea despite not having a navy to speak of bears reemphasis. Two dozen hulls in Russia's Black Sea Fleet are out of commission, including two successive flag ships, a Kilo-class submarine, a top-of-the-line Karakurt-class corvette, and numerous amphibious landing vessels.¹ Russia's key Crimean maintenance and logistical base of Sevastopol has for now been rendered essentially unusable. The threat of Russian amphibious assault has been eliminated, and merchant shipping out of Ukrainian ports continues to grow.²

Many of these achievements can be attributed to Ukraine's novel and aggressive use of uncrewed air and surface vessels. Their spectacular successes have led the UK's First Sea Lord to refer to the rise of naval drones as a "dreadnought moment" that is "rewriting the rules of naval warfare."³ A former NATO commander observes that "we are at a pivot point in maritime combat."⁴ What should the world's leading naval power learn from this?

When it comes to drones, the answer is...not much, at least at this point.⁵ From the U.S. Navy's perspec-

4 Stavridis quoted in Boot 2024.

tive, the Black Sea is simply not central to either its preparation for or learning about naval warfare. China remains the official pacing threat and countering a Chinese invasion of Taiwan the pacing scenario for the U.S. military. The United States' ongoing combat operations against the Houthi threat in the Red Sea differ considerably from those in the Black Sea. The U.S. Navy remains committed to supporting NATO operations, particularly in the Baltic, but this environment again bears little resemblance to the waters east of the Bosporus.

Finally, Ukraine's success is based on a set of uniquely favorable circumstances for drones. Black Sea drones are the equivalent of fruit flies in biological research: large in number, short in lifespan, and little more than an annoyance outside of their laboratory environment. One can still learn from fruit flies, but it takes both many generations' worth of research and circumspection in applying lessons to larger, more complicated fauna.

While the uncrewed maritime war in the Black Sea is of limited direct relevance for the United States at a tactical or operational level, there remain many lessons to be learned from any naval clash given their rarity.⁶ The Black Sea's constrained environment allows for analysis, on a small scale and

¹ Kollakowski 2025: 6-10.

² Miller/Diakun 2024.

³ Key 2023.

⁵ Tallis 2024.

⁶ Hoffman/Garrett 2024.

in a controlled environment, of the strategic role played (and not played) by naval assets in modern warfare. To add a second scientific metaphor, if maritime drones are tactical fruit flies, the Black Sea is a strategic petri dish.

1 Fruit Flies

Generations of drones resemble fruit flies, dying almost as soon as they are born.⁷ The Turkish TB-2, which once dominated the Ukrainian skies, is now hardly relevant. Approximately 75% of all drones are lost to electronic warfare in Ukraine, leading the French Chief of Staff to predict that the "life of impunity of small, very simple drones over the battlefield is a snapshot in time."⁸ But a short lifespan also means fast evolution. The development of the Magura V5 surface drone was announced in November 2022; and it sunk its first ship just a year later.9 While the tactical and operational lessons learned now are of limited value for the United States, we should not dismiss the potential implications of future drone generations. But the engineering and operational challenges that must still be overcome are massive.

What the Ukrainians have accomplished is not easy. Coordinating strikes between multiple platforms in the air and on the water not only requires significant hardware, but extensive software, intelligence, and communications capabilities. But then Kiev's efforts are simplified by environmental and structural factors. Compared to the North Atlantic and portions of the Pacific Ocean, the Black Sea boasts a relatively benign sea state, especially in the summer. The Black Sea is also a confined water space, allowing Kiev's USV operations to benefit from both proximity to Ukrainian controlled shoreline and limits to Russian reinforcement due to Turkey's application of the Montreux Convention. In addition, USV operations are conducted in a relatively benign information and electronic environment, thanks to intelligence provided from multiple friendly sources, the continued robustness of Starlink at sea, and the collapse of Russian maritime domain awareness thanks to successful Ukrainian attacks on command ships and airborne surveillance platforms early in the war. These conditions have few analogues outside the theater.

The economics of generating effects at scale and at distance against a determined and sophisticated adversary are likely to be another matter entirely. Consider the two most prominent kinetic sea drones operated by Ukraine, both of which cost roughly the same per unit, a far from trivial 220,000 to 280,000 USD.¹⁰ The Magura V5 sacrifices explosive power and flexibility for speed, while the Sea Baby makes the opposite tradeoff. A drone able to do both would cost much more than double the cost; prices do not increase linearly.¹¹ Once translated to a theater outside the Black Sea, drones will have to become more sophisticated (and therefore expensive) to per-

- 7 Pettyjohn et al 2024.
- 8 Ruitenberg 2024
- 9 Troshkin 2024.

- **10** Hatton 2024; Lagrone 2022.
- **11** Everly et al 2015. On inflation in defense more generally, see Hove and Lillekvelland 2017.



form in more challenging environments.¹²

For the Ukrainians to pursue the Black Sea Fleet past the Kerch Strait, where it controls no coastline, their drones and concepts of operations will need to develop further. Russia controls the entire coast of the Sea of Azov. USVs will have to pass under the heavily defended Kerch Bridge or be covertly portaged over land, and will then have to operate inside a formidable integrated air and electronic warfare defense bubble. Reaching the Kerch area will extend one-way transit distances by 150 miles.¹³

Drones generally cannot be the only component of a successful maritime campaign. Despite drones receiving the lion's share of attention in the Black Sea conflict, Ukraine's success has fundamentally rested on the threat of its shore-based anti-ship missile systems. These weapons gave Ukraine its first victory in the naval war by sinking the cruiser Moskva, made a Russian amphibious assault of Odessa impossible, and turned the western Black Sea into a denial zone from which drones impunity.¹⁴ could operate with Ukraine has prioritized its preciously few Storm Shadow and SCALP cruise missiles for the Black Sea fleet and its ports.¹⁵ The relative value of missiles over drones will likely increase with range, which is why Ukraine is investing in a long-range version of its in-

15 Watling et al 2023.

digenous Neptune missile and increasing production rates "tenfold."¹⁶

U.S. systems, which must operate over greater distances and in harsher conditions than their Ukrainian cousins, face a more complex set of challenges. Increasing the power and range of uncrewed systems requires considerable growth because the sophisticated system that enables them also must be extended. These weapons' success depends on the ever-changing balance between communications and sensing systems and their ugly stepchild of electronic warfare. Mechanical casualties, which are more likely in vessels that must operate in more challenging conditions for longer times, cannot be easily monitored or fixed without a human on board. An unrepaired vessel will fail earlier. Even if remote repair is possible, the process creates exploitable electronic vulnerabilities that raise the risk of mission failure.¹⁷ The fundamentals of war in the Black Sea do not force Ukraine to deal with these questions.

Finally, the success of Ukrainian naval drones is predicated on one other less appreciated aspect of the naval battle: Russia does not appear to be replicating Ukrainian platforms and tactics with any sense of urgency, and has only slowly developed tactics and technologies that allow it to defeat USVs.¹⁸ While it has mitigated attacks on its naval facilities with simple physical barriers, its ships at sea remain vulnerable.

Several factors might explain Russia's lack of attention to maritime drones. First, and most obviously, the

- **17** Panter/Falcone 2022.
- **18** Kretsul/Ramm 2023.

¹² Tallis 2024.

¹³ Altman 2024.

¹⁴ Tallis 2024.

¹⁶ Harman et al 2024.

Ukrainians no longer have a navy to attack. Second, Russia is no doubt focusing its limited resources on the far more dynamic, violent, and consequential land war. Third, and perhaps most importantly, Russia still possesses plenty of long-range ground- and sealaunched missiles that can threaten Ukrainian ports as well as vessels. According to a Ukrainian spokesperson, Russia retains the ability to project power into the larger Black Sea with *Kilo*-class submarines, three of which are armed with Kalibr cruise missiles.¹⁹

Thus, while Ukrainian tactics have played a key role, perhaps the major reason Russia is no longer contesting the Black Sea with surface ships is because it can still accomplish its primary maritime missions – long-range land attack and protection of critical infrastructure like the Kerch Bridge – without having to take risks at sea.²⁰ To date, while Russian tactical behavior has changed, its strategic behavior has not.²¹

We do not argue that the fruit flies are not evolving; it appears that for a given level of uncrewed capability, the cost curve is being driven down.²² Initial phases of technological advancement often show exponential price inwith performance creases gains, whereas mature technologies tend to exhibit power law relationships due to cost reductions and economies of scale. And even current capabilities suggest the potential for defense dominance in similarly small and constrained bodies of water; the "hellscape" posited by the American Indo-Pacific commander

- **19** Grotnik 2024.
- 20 Peterson 2023.
- **21** Kornev 2024.
- 22 Hollenbeck et al 2025.

within the Taiwan Strait almost certainly is taking cues from the Black Sea.²³

But these capabilities' use in many other places by (or more likely against) the U.S. Navy remains implausible.²⁴ At longer ranges, against better defenses, and in a contested electronic environment where the United States Navy plans to operate, the current potential is modest. Given simple physics, as higher-order species of USV evolve, they will either have to more closely resemble ships or missiles. In its recent, admittedly telegraphed, retaliatory attack on Israel, Iran launched 170 drones, 30 cruise missiles, and 120 ballistic missiles.²⁵ While an unspecified number of missiles made it through the considerable defenses, none of the drones did.

2 Petri Dish

But while the tactics of the Ukrainian-Russian maritime drone war little resemble those appropriate to higher priority theaters for its Navy, the United States and other maritime powers still have much to learn from this conflict in terms of strategy. The Black Sea starkly features two venerable maritime struggles. The first is the ongoing and uncertain contestation over the size and shape of zones of sea denial and sea control, a strategic competition that differs greatly from its terrestrial analogy.²⁶ The second, related strategic struggle epitomized in the Black Sea stems from the Nelsonian adage that a

- 24 Spender 2024.
- 25 Federman/Gambrell 2024.
- 26 Caverley/Dombrowski 2020.



²³ Rogin 2024.

"ship is a fool to fight a fort."

While current Black Sea drone tactics do not necessarily scale up to larger, more challenging theaters it is more plausible to see how these struggles are quite readily portable to a potential Baltic or Western Pacific conflict between major powers. And yet there is very little analysis of the Black Sea from this perspective.

2.1 Economic Warfare in a Mutual Denial Environment

The ability to control one's littoral is a fundamental component of a country's sovereignty. For example, the traditional international legal standard of two nautical miles for territorial waters was determined by contemporary cannon ranges. In a tightly constrained body of water, observers can see the strategic impact of advances in coastal defense. While the technologies have changed somewhat, coastal defense continues to rest on elements U.S. Naval Academy professor Armstrong associates with Mahan: "shore-based gunnery, the use of mines, and small attack craft."27 Modernized versions of all three have allowed to extend denial if not control to what is left of Ukraine's littoral.²⁸

While control of land is relatively easy to ascertain, the control and denial balance at sea entails vastly more uncertainty. Until recently the United States Navy has not needed to worry about this, at least since the Cold War's end. But Mahan and other naval theorists have always admonished that sea

control is generally limited in space and episodic in time. Operating in such an environment is therefore an exercise in competitive risk-taking to send signals and apply coercive effects. Navigating this eternal struggle is the current primary interest of the United States, as it seeks to maintain its own sea control - what Posen famously called "command of the commons" while extending denial essentially up to the Chinese mainland, particularly the Taiwan Strait.²⁹ And of course China is seeking to do the opposite. Naval strategists should look to the Black Sea to address the question: What happens when a body of water becomes "no man's sea," at least part of the time?³⁰

The growing flow of merchant traffic to Ukraine, as well as the continued shipping of Russian oil through the Black Sea despite the existential nature of this war, bears consideration. Although a Ukrainian officer described the opening of a transit corridor as "unilateral" after the reconquest of Snake Island, this is simply not the case.³¹ Rolling back initial Russian sea control early in the war does not mean that Ukraine has established sea control even in its littoral. While pushing the Russian surface navy, which had previously been used to disrupt Ukrainian trade, out of the Black Sea surely plays some role, Ukraine's funding of insurance for merchant ships is another, costly, prerequisite for merchants to begin transiting to and from Odessa.³²

- **31** Kormych/Averochkina 2023.
- 32 Cohn/Saul 2023.

²⁷ Armstrong 2022.

²⁸ Lancaster 2022.

²⁹ Posen 2003, Caverley forthcoming.

³⁰ Gholz et al 2019.

But Russian restraint remains necessary. Despite limited attacks on merchant shipping early in the war and an ongoing, if inconsistent, campaign against grain infrastructure, Russia has largely avoided attacking merchant ships at sea. But Russia still officially regards commercial traffic to Ukrainian ports as potential carriers of military cargo. Even if its ability to board and search ships has been hindered, the Russian Navy retains the capability to threaten ships from standoff ranges in the Black Sea. In late 2023 and early 2024, Ukraine also demonstrated its willingness to target Russian merchant vessels but has since backed off these attacks.³³ Despite the two nations failing to formally agree to avoid such strikes, both sides have nonetheless mainly refrained from attacking each other's merchant shipping.³⁴

Whether the relatively smooth resumption of commerce through a zone of mutual denial is a function of capability or will is an urgent research question for the United States and its allies. As in the Cold War nuclear balance, the mutual ability to hurt the other no doubt hangs over both sides' strategic deliberations, and can be manipulated for political gain through brinksmanship. But for now, it must be acknowledged: Sea control is unnecessary in the Black Sea for the flow of trade. Mutual denial appears to be enough.

2.2 When the Land Matters for the Sea

The struggle for the Black Sea is one over ports even more than ships. Even

33 Lister 2023.

34 Faulconbridge/Gumrukcu 2024.

if drones still struggle to reach some key coastal hubs, both sides have the ability to strike any of them via surfaceto-surface missiles, launched from ships and from land. The possession and location of ports and their continued viability under this threat drives both the naval capability and significant amounts of the economy on both sides. We have for example already observed the geographical limitations on Ukrainian drone effectiveness given its dearth of sea bases in the Sea of Azov.

For Russia, the most consequential maritime loss was not any ship but the strategic elimination of Sevastopol naval base, which has been fought over for centuries as the key to the northern Black Sea.³⁵ Not only has Russia repositioned what remains of its Black Fleet, according to a Ukrainian military spokesperson, Ukraine has "rendered unusable" the port's capacity to deliver, reload, and service Kalibr missiles. It is not clear that Russia currently has the infrastructure to load these missiles elsewhere in the theater.³⁶

Russia's ability to reconstitute its land-based support capability for its maritime forces in the theater remains uncertain. As noted earlier, it may not be a high priority for scarce resources. Russia is clearly taking steps to defend naval its remaining assets in Novorossiysk.³⁷ While Ukraine has targeted the oil infrastructure of that port with aerial and surface drones in limited numbers (with few results), it has not employed surface-to-surface missiles.³⁸ Developments in the breakaway

- 35 Lambert 2020.
- 36 Cook 2024.
- 37 Ministry of Defence 2024.
- **38** Brennan 2025.



territory of Abkhazia also bear watching.³⁹

On the other hand, Russia has devoted significant portions of its strike capacity to target Odessa, primarily a commercial rather than naval port, with apparently limited success. It remains to be seen if either belligerent is able and willing to cause severe damage to trade without threatening merchant ships at sea.

For all the attention to maritime drones, around the world, the primary threat under which the United States must operate is posed by missiles.⁴⁰ Every major (and indeed minor) naval base and economic hub in theaters will be vulnerable to a portfolio of longrange missiles. How Ukraine and Russia will operate in this environment will provide significant clues for potential operations in war under these circumstances, and the relative value of missile defense, hardening, and repair.

3 Conclusion

Observers of the security assistance effort have criticized the U.S. military for failing to learn from Ukrainian experience in battle. The United States military leadership tends to focus on tactical rather than strategic problems. This brief analysis suggests the urgent need to overcome these biases in order for the United States to learn the potential lessons from the Black Sea laboratory. But this analysis also identifies a necessary third, perhaps even harder, change in mindset.

Ironically, even as it continues to support Ukrainian defense, when it

40 Caverley forthcoming.

comes to the Black Sea the most relevant lessons for the United States are likely to come from the aggressor's reaction. It is Russia that has struggled to maintain sea control against a landbased anti-access/area denial threat. It is Russia's forward bases that have been made militarily irrelevant. Russia has for now given up on maritime blockade as a potential form of coercion. Russia has struggled with logistics and reconstitution due to the limitation of its internal waters and Turkey's management of the Bosporus and Dardanelles (and the United States' logistics problems in the Indo-Pacific are vastly more challenging). If it is going to learn much from the Black Sea laboratory, the U.S. Navy needs to recognize that it likely has more in common with the beleaguered Black Sea Fleet, rather than its scrappy maritime antagonist.

List of References

- Altman, Howard (2024): Ukraine Situation Report: Russia Now Launching Kalibr Cruise Missiles From The Sea Of Azov, in: TMZ from 22-06-2024, https://www.twz.com/ news-features/ukraine-situation-report-russia-now-launching-kalibr-cruise-missiles-fromthe-sea-of-azov, last accessed on: 18-05-2025.
- Armstrong, B. J. (2022): The Russo-Ukrainian War at Sea: Retrospect and Prospect, in: War on the Rocks from 22-04-2022, https:// warontherocks.com/2022/04/ the-russo-ukrainian-war-at-searetrospect-and-prospect/, last accessed on: 18-05-2025.
- Boot, Max (2024): Ukraine's Naval Drones Are Working. The Pentagon Should Pay Attention, in: Wash-

³⁹ Demytrie et al 2023.

ington Post from 17-06-2024, https://www.washingtonpost. com/opinions/2024/06/17/ ukraine-naval-drone-successpentagon/, last accessed on: 18-05-2025.

- Brennan, David (2024): Russia Reports Massive Ukraine Drone Attack on Strategic Port, in: ABC News, https://abcnews.go.com/International/russia-reports-massiveukraine-drone-attack-strategicport/story?id=119198093, last accessed on: 18-05-2025.
- Caverley, Jonathan D. (forthcoming): So What? Re-Assessing the Military Implications of Chinese Control of Taiwan, in: Texas National Security Review.
- Caverley, Jonathan/Dombrowski, Peter (2020): Cruising for a Bruising: Maritime Competition in the Anti-Access Age, in: Security Studies, 29(4), pp. 671–700.
- Cook, Ellie (2024): Russia Using Kalibr Cruise Missiles to Target Ukraine, in: Newsweek, https://www. newsweek.com/russia-kalibrcruise-missiles-ukraine-blacksea-fleet-crimea-1885891, last accessed on: 18-05-2025.
- Cohn, Carolyn/Saul, Jonathan (2023): Marsh, Lloyd's Launch Ukraine War Risk Ship Insurance to Cut Grain Costs, in: Reuters from 15-11-2023, https://www.reuters. com/business/marsh-lloydslaunch-ukraine-war-risk-shipinsurance-cut-grain-costs-2023-11-15/, last accessed on: 18-05-2025.
- Demytrie, Rayhan/Brown, Paul/ Cheetham, Joshua (2024): Ukraine's Naval Campaign Puts Pressure on Russia, in: BBC News, https://www.bbc.com/news/

world-europe-67625450, last accessed on: 18-05-2025.

- Everly, Randall E./Limmer, David C./ MacKenzie, Cameron A. (2015): Cost-Effectiveness Analysis of Autonomous Aerial Platforms and Communication Payloads, in Melese, F./Richter A./Solomon, B. (eds.), Military Cost-Benefit Analysis: Theory and Practice, New York, Routledge, pp. 401-423.
- Faulconbridge, Guy/Gumrukcu, Tuvan (2024): Russia, Ukraine Black Sea Shipping Deal Was Almost Reached Last Month, in: Reuters from 15-04-2024, https://www. reuters.com/world/europe/russia-ukraine-black-sea-shippingdeal-was-almost-reached-lastmonth-sources-say-2024-04-15/, last accessed on: 18-05-2025.
- Federman, Joe/Gambrell, Jon (2024): Vessel Incident in the Strait of Hormuz Highlights Naval Risks, in: AP News, https://apnews.com/article/strait-of-hormuz-vessel-33fcffde2d867380e98c89403776 a8ac, last accessed on: 18-05-2025.
- Gholz, Eugene/Friedman, Benjamin/ Gjoza, Enea (2019): Defensive Defense: A Better Way to Protect U.S. Allies in Asia, in: Washington Quarterly 42(4), pp. 171–189.
- Grotnik, Tomasz (2024): Russia Deploys Three Submarines Armed with Cruise Missiles to Sea for the First Time, in: Naval News, https:// www.navalnews.com/navalnews/2024/07/russia-deploysthree-submarines-armed-withcruise-missiles-to-sea-for-thefirst-time/, last accessed on: 18-05-2025.
- Harman, Jane/Rudman, Mara/Zakheim, Roger (2024): Ukraine's Freedom

GIDS

Forge, in: RealClearPolitics from 12-04-2024, https://www.realclearpolitics.com/articles/ 2024/04/12/ukraines_freedom_ forge_150791.html#, last accessed on: 18-05-2025.

- Hatton, Barry (2024): The sea drone that's lifting Ukraine morale as it hunts Russian ships, in: C4ISRNET from 06-03-2024, https://www.c4isrn e t . c o m / u n m a n n e d / 2024/03/06/the-sea-dronethats-lifting-ukraine-morale-asit-hunts-russian-ships/, last accessed on: 18-05-2025.
- Hoffman, Frank G./Garrett, George P. (2024): A Break in the Clouds: Learning Lessons From the Sea, in: Texas National Security Review, 7(3).
- Hollenbeck, Neil/Altaf, Muhammed Hamza/Avila, Faith/Ramirez, Javier/Sharma, Anurag Jensen, Benjamin (2025): Calculating the Cost-Effectiveness of Russia's Drone Strikes, in: Center for Strategic & International Studies from 19-02-2025, https://www. csis.org/analysis/calculatingcost-effectiveness-russiasdrone-strikes, last accessed on: 18-05-2025.
- Hove, K. H./Lillekvelland, T. (2017): On Growing Operating Costs in the Armed Forces, in: Defence and Peace Economics, 30(4), pp. 438– 453.
- Key, Ben (2023): First Sea Lord's Sea Power Conference Keynote Speech, in: UK Ministry of Defence from 17-05-2023, https:// www.gov.uk/government/ speeches/seapower-conferencekeynote-speech, last accessed on: 18-05-2025.
- Kollakowski, Tobias (2025): War in the Black Sea: The Revival of the Je-

une École?, in: Journal of Strategic Studies, pp. 1–33, https://doi.org/ 10.1080/01402390.2025.247106 7, last accessed on: 18-05-2025.

- Kormych, Boris/ Averochkina, Tetiana (2023): Black Sea Grain Initiative is Dead, Long Live the New Trade Corridor, in: Lex Portus, 9(4), pp. 7-15. https://lexportus.net.ua/vipusk-4-2023/kormych_941.pdf, last accessed on: 18-05-2025.
- Kornev, Dmitry (2024): Dron protiv drona: kak razvivayutsya bespilotnyye perekhvatchiki, in: Izvestia from 17-06-2024, https://iz.ru/ 1712619/dmitrii-kornev/dronprotiv-drona-kak-razvivaiutsiabespilotnye-perekhvatchiki, last accessed on: 18-05-2025.
- Kretsul, Roman/Ramm, Alexey (2023): Morskoy roy: kak rossiyskiye voyennyye korabli budut zashchishchat'sya ot dronov, in: Izvestia from 13-07-2023, https:/ /iz.ru/1543336/roman-kretculaleksei-ramm/morskoi-roi-kakrossiiskie-voennye-korablibudut-zashchishchatsia-otdronov, last accessed on: 18-05-2025.
- LaGrone, Sam (2022): Ukraine Launches Crowd-Funding Drive for 250K Naval Drones, in: USNI News from 11-11-2022, https://news. usni.org/2022/11/11/ukrainelaunches-crowd-funding-drivefor-250k-naval-drones, last accessed on: 18-05-2025.
- Lambert, Andrew (2021): The Crimean War, Routledge: London/New York.
- Lancaster, Jason (2024): An Anti-Access Denial Strategy for Ukraine, in: CIMSEC, https://cimsec.org/ananti-access-denial-strategy-for-

ukraine/, last accessed on: 18-05-2025.

- Lister, Tim/Butenko, Victoria/Nechyporenko, Kostan (2023): Ukraine Hits Russian Oil Tanker with Sea Drone, in: CNN from 05-08-2023, h t t p s : // w w w . c n n . c o m / 2023/08/05/europe/ukrainesea-drone-attacks-intl/index. html, last accessed on: 18-05-2025.
- Miller, Gref/Diakun, Bridget (2024): Ukrainian Grain Exports Rebound as Ship Arrivals Near Pre-War Levels, in: Lloyd's List from 26-04-2024, https://www.lloydslist. com/LL1148978/Ukrainiangrain-exports-rebound-as-shiparrivals-near-pre-war-levels, last accessed on: 18-05-2025.
- Panter, Jess/Falcone, Alice (2022): Feedback Loops and Fundamental Flaws in Autonomous Warships, in: War on the Rocks from 24-06-2022, https://warontherocks. com/2022/06/feedback-loopsand-fundamental-flaws-in-autonomous-warships/, last accessed on: 18-05-2025.
- Petersen, Michael B. (2023): Toward an Understanding of Maritime Conflict with Russia, in: Andrew Monaghan (ed.), The Sea in Russian Strategy, Manchester University Press: Manchester, pp. 205-241.
- Pettyjohn, Stacie/Dennis, Hannah Dennis/Campbell, Molly (2024): Swarms Over the Strait, in: CNAS Reports, https://www.cnas.org/ publications/reports/swarmsover-the-strait, last accessed on: 18-05-2025.
- Posen, Barry (2003): Command of the Commons: The Military Foundation of U.S. Hegemony, in: Inter-

national Security 28, no. 1, pp. 5– 46.

- Rogin, Josh (2024): The Taiwan Hellscape Plan, in: Washington Post from 10-06-2024, https://www.washingtonpost.com/opinions/ 2024/06/10/taiwan-chinahellscape-military-plan/, last accessed on: 18-05-2025.
- Romaniuk, Roman (2024): Target and eliminate: How Ukraine's Magura drones devastate Russian ships, in: Ukrainska Pravda from 04-03-2024, https://www.pravda.com. u a / e n g / a r t i c l e s / 2024/03/4/7444793/, last accessed on: 18-05-2025.
- Ruitenberg, Rudy (2024): Small Drones Will Soon Lose Combat Advantage, in: Defense News from 19-06-2024, https://www.defensenews.com/global/europe/ 2024/06/19/small-drones-willsoon-lose-combat-advantagefrench-army-chief-says/, last accessed on: 18-05-2025.
- Spender, Tom (2024): Israeli Navy Intercepts Hostile Drone in Red Sea, in: BBC News, https://www.bbc. com/news/world-middle-east-68811273, last accessed on: 18-05-2025.
- Tallis, Joshua (2024): The Calm Before the Swarm: Drone Warfare at Sea in the Age of the Missile, in: War on the Rocks from 07-07-2024, https://warontherocks.com/ 2024/07/the-calm-before-theswarm-drone-warfare-at-seain-the-age-of-the-missile/, last accessed on: 18-05-2025.
- Troshkin, Yehor (2024): The Role of Naval Strike Drones in the Russia-Ukraine War, in: Political Science and Security Studies Journal, 5(2), pp. 44–45, https://doi.org/



10.5281/zenodo.12701509, last accessed on: 18-05-2025.

United Kingdom Ministry of Defence (2024): [Social Media Briefing], in: Twitter from 17-04-2024, https:// twitter.com/DefenceHQ/status/ 1780878487068242335, last accessed on: 18-05-2025.

Watling, Jack/Danylyuk, Oleksandr V./ Reynolds, Nick (2024): Preliminary Lessons from Ukraine's Offensive Operations, 2022–23, in: RUSI Special Report from June 2024, https://static.rusi.org/ lessons-learned-ukraine-offensive-2022-23.pdf, last accessed on: 18-05-2025.

GIDS

Part II: The Baltic Sea



Maritime Critical Infrastructure and Lessons from the Black Sea: Hybrid Threats from Russia to NATO's Littoral States on the Baltic Sea

Observations from Poland, a frontline state

Poland is already exposed to hybrid attacks from Russia and actors supported by Russia.¹ These attacks take various forms: Apart from the ongoing crisis on our border with Belarus, there have been several attempts to conduct acts of sabotage against critical infrastructure and a number of other incidents that are still not fully explained. We also know of intelligence activities and disinformation campaigns. Against this backdrop, the following questions arise: What are possible scenarios of hybrid warfare in the Baltic Sea and what key lessons can we learn from the Ukraine War? What measures can be taken to increase maritime security in the Baltic Sea region?

This paper seeks to answer these questions and provide recommendations for action. To this end, examples of hybrid threats and several scenarios – or warnings – will be described.

1 General Lessons and Russian Potential

Pre-2022 data regarding the naval potential of Russia and Ukraine would show that, even when counting only Russia's Black Sea Fleet, the aggressor had a clear advantage over the defender – especially if one looked at the plain numbers of vessels, aircraft, and shore-based forces. The outcome of the naval battle seemed to be decided even before the first shots were fired.

However, to this day Russia has already lost at least nineteen ships of various classes, including the Moskva cruiser and two modern missile corvettes. Russian forces have been proven weaker than anticipated. The Ukrainian efforts – drone and missile strikes – have to some degree levelled the playing field, limiting Russian operational freedom on the Black Sea and causing damage to ships and shore facilities.

On the other hand, Russian actions have inflicted considerable damage on Ukraine. For example, ships and submarines have been used to launch cruise missiles, targeting Ukrainian

¹ For example, in 2024 nine people who had planned an arson attack on a chemical plant in Wroclaw were arrested and charged with espionage and sabotage (Ptak 2024). In 2023, a group of people who had gathered intelligence on railway lines and were preparing to derail trains were arrested (Associated Press 2023). In addition, the border crisis with Belarus continues.

cities and critical infrastructure. The Russian naval blockade caused significant economic problems to Ukraine leading to wider consequences.²

Therefore, one lesson to be drawn is: even if a war is land-centric and airfocused, the maritime domain still matters.

Successful Ukrainian attacks, including drone and missile strikes, have shown that Russian forces have exploitable vulnerabilities. Their anti-access/area denial (A2/AD) zones created by missile systems – sometimes colloquially described as 'bubbles'³ – can be burst, and drone attacks were apparently a surprise for Russian forces, revealing inadequate force protection against such attacks.

Yet despite the losses in the Black Sea, Russia still possesses notable naval resources. For example, most of its Baltic Fleet remains intact.

According to 'The Military Balance', in 2023 the Baltic Fleet possessed one submarine, one guided missile destroyer, seven frigates and thirty-five smaller surface combatants and patrol vessels as well as twelve mine warfare ships and thirteen amphibious vessels.⁴

However, this data does not consider other elements of the Russian forces. Apart from its aviation component and shore-based forces, including naval infantry, special operations forces, and coastal missile batteries, Russia has other tools at its disposal. One is the paramilitary component like the border guard, subordinate to the Federal Security Service (FSB). Another set of tools are formally civilian ones. One is the state agency named Main Directorate of Deep-Sea Research, which operates a fleet of surface and submarine research vessels that may be used to gather intelligence or conduct sabotage.⁵ Another refers to commercial vessels including the socalled 'shadow fleet' - owned by shell companies, often without direct links to Russia.⁶ Apart from operating alone or in conjunction with military special operations forces, they could also be utilised in hybrid warfare activities for instance, if Russia wishes to keep a conflict below the threshold of open, conventional war.

Overall, it is clear that the Russian forces have strengths and weaknesses and that Ukraine has been able to exploit some of these weaknesses by conducting successful missile and drone strikes. On the other hand, Russia is still able to launch missiles using various platforms, including maritime ones. Therefore, when assessing the general Russian potential and looking at Black Sea naval engagements as a source of 'lessons learned', one aspect is particularly important with regard to the Baltic Sea. In this theatre, both NATO and Russia have advantages and disadvantages, for instance due to geographic conditions. For example, in case of open war, the Russian bases in Kaliningrad could be targeted by the Polish Coastal Missile Unit, which is armed with NSM cruise missiles; and port facilities as well as moored ships could be attacked by the Polish Land



² For example, grain that could not be exported via the Black Sea route was either sold in Poland or rerouted to Polish ports. The influx of grain resulted in protests of Polish farmers and there is suspicion that at least one act of sabotage targeting a grain-carrying train was committed involving Russian-supported persons.

³ Dalsjö et al. 2019.

⁴ IISS, The Military Balance 2024.

⁵ Kaushal 2023.

⁶ Braw 2024.

Forces and their HIMARS launchers. Therefore, a repetition of the successful attacks on ships in the Black Sea would be possible in the Baltic setting. In the Russo-Ukrainian war, Russian air defence systems have been unable to provide sufficient protection against drones, cruise missiles and tactical ballistic missiles that represent a fraction of NATO capabilities – and it is safe to assume that a greater number of assets could be successfully deployed in Baltic area.

However, another important question arises with a view to Russia's possible and probable course of action.

Since the Russian fleet already has a number of ships armed with cruise missiles, and has missiles at its disposal that can also be fired from land and air platforms, Russia could carry out a preemptive or retaliatory strike against Polish ports and other infrastructure, both military and civilian. Furthermore, hybrid warfare scenarios provide even more dilemmas and questions. In comparison to conventional warfare, which would lead to the invocation of Article V of the North Atlantic Treaty and the deployment of at least part of available NATO forces, hybrid warfare may allow Russia to keep the crisis below the Article V threshold and try to achieve its political goals while limiting the risk of a conventional confrontation with NATO.

2 Potential Role of Russian Naval Forces in a Hybrid Conflict

Russian naval forces could be utilised in several ways during a potential conflict. As described above, hybrid warfare, defined as actions occurring close to the threshold of open warfare, is one potential way of operation. In the maritime domain, the spectrum of possible hybrid actions stretches from intelligence gathering, show of force, and testing the other side's defence mechanisms to sabotage. Certainly, intelligence gathering is constantly conducted. It involves not only traditional activities using naval vessels or aircraft, but also civilian ships. They may be used to gather information on shipping, ports, and critical infrastructure (like pipelines). For example, in 2023 two freighters were noticed loitering close to Polish territorial waters without a clear purpose.⁷ The purpose may well have been to gather intelligence or to test the response and reaction time of Polish authorities.

Another form of aggressive action is the well-known harassing ('buzzing') of ships by Russian ships and aircraft. While such behaviour is not a direct attack, it involves a high risk of accidents and may be used in information warfare. For example, one buzzing incident was used to spin a narrative about Russia's purported ability to deactivate a ship's electronics systems.⁸ That narrative represents a typical case of spreading disinformation. Other recent cases of navigation systems jamming represent a different form of harassing where an actually existing capability is employed to threaten the general safety of shipping and aviation.⁹

Another imaginable scenario is the attempt to weaponise certain cases or issues. In May 2024, a draft document was posted online by the Russian government. According to this document, Russian maritime borders in the Baltic

⁷ Marszałkowski 2023.

⁸ Meurmishvili 2017.

⁹ Eggert 2024.

Sea region may be revised or even changed, under the pretext that the territorial waters off Russia's mainland coast were measured in 1985 on the basis of 'small scale nautical navigation maps'.¹⁰ While this incident is enigmatic, it is possible that it was designed to test the response of the Baltic neighbours. If Russia proceeded with this course of action and tried to unilaterally change maritime borders, it could use its border guard force for the first steps - as in May 2024, when the Russian border guard removed buoys marking the border with Estonia on the Narva River.¹¹

There are even more possibilities for Russia acting on the basis of unilateral interpretations of legal rules and claiming that certain measures are necessary for reasons of shipping safety. For example, part of the Polish EEZ overlaps with Russia's declared search and rescue region. This could potentially be weaponised by Russia creating a crisis followed by unilateral action under the cover of a 'rescue mission' or 'antiterrorist operation.' Such a pretext would be paper thin but could be a justification for the deployment of forces.

Beyond that, another possible set of action has to be highlighted. It refers back to events such as the damage to the Nord Stream and Baltic Connector pipelines as well as GPS jamming cases. These represent attacks on maritime critical infrastructure, which consist of several elements:

 Transportation systems: ports, ships, and aids to navigation. The Polish ports in Gdańsk, Gdynia and Szczecin-Świnoujście are critical to the economy and ensure strong trade relations. According to official data, in 2023 annual cargo tonnage in Polish seaports reached 135.9 million tonnes (for comparison: in 2022 it was 119 million tonnes).¹² In 2024, the amount of cargo traffic was slightly lower -135 million tonnes.¹³ The most important types of cargo are liquid fuels, bulk cargo, and containers. The port of Gdańsk is particularly important for this last type of cargo, having constantly exceeded the number of 2 million TEUs since 2021.¹⁴ A further increase in cargo handling is also expected in Szczecin-Świnoujście and Gdynia due to the planned expansion of these ports, including the construction of new container terminals. Therefore, limiting or stopping cargo traffic always creates the risk of causing significant economic disruptions and breaking supply chains. Poland also has naval and law enforcement (Border Guard) bases, providing capabilities to receive allied military support in the event of a crisis. In this respect, the consequences of disruption may be severe, particularly if a port is forced to limit or suspend operations. Compensating for this loss of capacity would be challenging for other ports.

Additionally, these ports play a crucial role in energy se-

- **10** Associated Press 2024.
- **11** Hartog 2024.

- 12 GUS 2024.
- **13** Trade.gov.pl 2024.
- 14 Port Gdańsk 2024.



curity. Poland's only LNG terminal is located in Świnoujście harbour, and the port of Gdańsk, which is already equipped with a large oil terminal, is going to be expanded to include a Floating Storage Regasification Unit (FSRU).

Energy-related infrastructure: pipelines, energy cables, and offshore platforms. Until recently, the latter were just oil platforms - but due to the developments in offshore wind generation, the importance of these installations is expected to increase rapidly. According to current Polish government policy documents¹⁵, Poland is reforming its energy policy. Traditional energy sources like coal or Russian-supplied gas and oil are being replaced by other sources. Therefore, any disruption may bring serious consequences for society and the economy alike. For example, as far as gas is concerned, the main import routes are maritime ones: by the Baltic Pipe and LNG terminals. Any attack on those facilities would very likely result in limiting the supply of natural gas, which is critical for industry and households. That would require taking alternative steps: rationing energy use, employment of emergency gas reserves and searching for alternative routes

of supply. Even in case of a short disruption, it is expected that Russian information operations would portray this as a much more serious incident – and try to create panic and fear among the population. Therefore, ensuring the security of those energy import routes is critical.

Communication infrastructure: undersea data cables. These may be targeted in order to intercept data or disrupt online services and data transfer. While the interception of data is a typical activity in the signals intelligence field and does not cause publicly visible immediate harm, the disruption of the flow of data may be useful for Russia since it affects the availability of online services and information, and this, in turn, may create a perenvironment missible for (dis)information campaigns. Certainly, such an operation would be most effective if other communication infrastructure (land and satellite connections) were targeted.¹⁶

All the assets mentioned above can be targeted in various ways; scenarios can be classified by probability. The most unlikely scenario is an early overt Russian action – this would constitute an armed attack and could trigger Article V of the NATO treaty, which may not be desirable to the aggressor. It is much more likely that an attack would be carried out in a way that allows it to be kept below an escalation threshold. Such an attack could be a highly ambiguous action, staged to

¹⁵ The most relevant are: Strategia Bezpieczeństwa Narodowego Rzeczypospolitej Polskiej (*National Security Strategy of the Republic of Poland*) (2020) and Polityka energetyczna Polski do 2040 r (*Energy Policy of Poland until* 2040) (2021).

¹⁶ Murphy et al. 2016; Lange et al. 2019.

look like an accident. The 'anchor dragging' that damaged the Baltic Connector is one notable example, as are the later cases of the vessels Eagle S and Yi Peng 3, which are suspected of damaging several data cables in the Baltic Sea.¹⁷

Another possibility would be the blockade of a major port, for instance by civilian vessels. For example, a freighter might enter the port for a legitimate reason and later cause a collision with another ship or port infrastructure, or sink for some other pretend reason. This would block entry to and exit from the harbour, disrupt port operations and require a long and costly effort to salvage the vessel. At the same time, the consequences would be noticeable. Such an attack, if conducted during a major crisis, could effectively limit the amount of military equipment that could reach Poland in time.

An attack masqueraded as a 'protest action', such as a port blockade by yachts and other small civilian boats, would also be a possibility. That form of protest could target ships transporting military equipment or oil and gas tankers. Other potential targets could be LNG terminals, such as the FSRU that is planned to be constructed near Gdańsk. The action could be disguised as an 'anti-war' or 'ecological' protest and, if the blockade is lifted by force, a narrative could be spun around a violent regime that disregards the citizens' right to protest.

More advanced and more kinetic methods may include the covert mining of shipping lines, ports and anchorages or acts of underwater sabotage. Also, the use of other means is conceivable. For example, unmanned surface

17 Wiese Bockmann 2024.

or aerial vehicles could be used to attack critical infrastructure. In these scenarios, the actions of a state actor (Russia) would be disguised as activities of non-state actors – such as terrorists or protesters. Hypothetically speaking, acts of sabotage at an LNG terminal could be disguised as actions by violent environmental activists.

Finally, it is sensible to consider the possibility of an overt military operation, as the final element in a string of hybrid actions. Following an at least partial disruption of critical infrastructure, increasing polarisation of society, and actions that would undermine Allied unity, a short-term, limited use of force could be employed to pressure Poland into complying with Russia's will. An example would be a single cruise missile attack on oil refineries or power plants. This would be an 'escalate to de-escalate' scenario.¹⁸

All these scenarios show that an important element of hybrid warfare is the combined use of different elements. All actions would be interlinked, different tactics and tools would be mixed to destabilise Poland's society and economy, create polarisation and shape the security environment according to Russia's wishes. The last element could be the open use of force, as illustrated by the last scenario.

3 Recommendations for Security Policy in the Baltic Sea Region

This part of the paper focuses on possible measures to prevent or respond to

¹⁸ A more detailed discussion of similar scenarios can be found in: Frederick et al. 2022.

hybrid activities. These recommendations and conclusions are written from a Polish perspective, but may also be applicable to other countries of the region. The conclusions range from general ones, related to wider policy and strategy issues, to more specific ones associated with technical capabilities and the procurement of certain platforms.

3.1 Tackling sea blindness

One of the fundamental recommendations is to limit 'sea blindness' – the lack of awareness related to maritime (security) issues. This is particularly important in the context of critical infrastructure protection, as problems different from those encountered in the land domain mean that techniques, tactics, procedures and equipment typically used on land may not be applicable to protect offshore wind farms or pipelines, particularly outside a country's territorial waters. This understanding is fundamental for the further recommendations described below, especially for the formulation of a strategy to prevent and respond to Russian activities. Therefore, continuous informational and educational efforts aimed at both the general public and decision makers are recommended.

This is imperative, given the fact that the Baltic Sea was not a scene of decisive naval engagements in the 20th century and that there is thus a tendency to consider this area as insignificant. This, in turn, leads to the setting of different priorities in security policy, with a special focus on the land domain. Notably, the role of the Baltic being important not only for security and defence, but also for commercial shipping and energy generation and transfer should be constantly explained to the public and decision makers alike.

3.2 Formulation of a strategy and implementation at the operational level

Key areas of maritime security and related recommendations need to be translated into a national-level strategy. Ideally, such a maritime security strategy should describe the key national interests in the Baltic Sea area. The strategy should also define an area of responsibility – either only the Southern Baltic Sea (territorial waters and EEZ) or additional areas as well (the rest of the Baltic, the Danish Straits, the North Sea or others), based on which areas are considered important and where Polish forces should be deployed.

However, a more specific document should directly describe the strategic interests and objectives as well as the measures taken to prevent and respond to crisis situations and threats in the Baltic Sea region. In the Polish hierarchy of strategic documents, this would ideally be a document published by the Ministry of Defence, i.e. one level below the National Security Strategy.

There should be a clear plan of action, particularly for crisis situations that might, at least initially, lie below the threshold of an armed conflict. Specifically, the strategy should describe the desired approach to deterrence. A defensive approach – implemented by building hardened, resilient infrastructure – would be a form of deterrence by denial. Another way could be deterrence through punishment, implemented by imposing sanctions and/or tariffs on Russia in the event of malicious actions in the Baltic Sea area, and by exerting additional political, economic, and military pressure. This path could be more complicated, since it requires ways to apply pressure acceptable under international law, to develop resources that allow credible punishment and, last but not least, to find vulnerabilities that could be exploited.

In any case, the strategy would have to be consistent with strategic decisions made at the NATO level, especially in the context of the recent Washington Summit Declaration.¹⁹

In addition, such a document should also provide a clear division of roles and responsibilities between various services and organisations. In the case of Poland, it should in particular determine the role of the Navy and the maritime branch of the Border Guard. Currently, the Polish Border Guard is tasked exclusively with law enforcement missions - in the past, it has focused on fishery protection and on countering various forms of smuggling. As a result, it has surface surveillance capabilities (coastal radars, patrol boats, aircraft), but no subsurface surveillance capabilities. It also has a limited capability to engage surface targets, but neither the capability nor the legal basis to engage subsurface targets.

The Polish military, however, is by nature oriented towards countering military threats. Deployment to support the Border Guard is permitted only if civilian resources are deemed inadequate. While this division may be effective in peacetime when attacks on shipping or critical infrastructure are rare, it is less efficient nowadays when, for example, it may become necessary to conduct regular patrolling of pipelines in order to detect sabotage attempts. Under current legal rules²⁰, however, unless a Navy vessel is deployed as an asset supporting the Border Guard, it is not allowed to perform any law enforcement tasks (such as the boarding and inspection of a suspicious vessel).

above-mentioned Due to the threats, it may be necessary to widen the Border Guard's set of capabilities including a change of legal rules and investments in more capable equipment - or, alternatively, the consideration of a more active deployment of naval forces. The latter would also require changes to the law and the building or acquisition of more ships to match the requirements. In each case, necessary changes in the legal framework as well as in the organisation, equipment and training of forces should be defined and implemented at the operational level. That is particularly important for shipbuilding and other force generation efforts.

Following the first path to strengthen the Border Guard itself would require changing the rules of engagement, especially in engaging submarine targets and unmanned surface vessels, and the acquisition of new equipment (vessels and aircraft) as well as major changes in training, which would essentially turn the Border Guard into a second Navy.

If we were to choose the second option, naval forces would already have most capabilities at their disposal. From a legal perspective, a standing

19 NATO 2024b.

²⁰ Act of Parliament of the Republic of Poland on State Border Protection (1991) and Act of Parliament of the Republic of Poland on the Border Guard (1990) (with amendments).

rule (possibly written into an act of parliament) allowing military personnel to stop, board and inspect vessels both in Polish territorial waters and in its exclusive economic zone as well as new rules of engagement would have to be introduced. Also, military forces would need more vessels and more aircraft, to fulfil their new, widened mission of protecting critical infrastructure.

In the short term, an expansion of the Navy's mission to include the protection of critical infrastructure, which would result in an increase in the size of naval forces, is more promising. The Navy already has the capabilities that the Border Guard lacks – it is easier to enlarge existing forces than to build those capabilities from scratch in a different service.

3.3 Situational awareness

Dealing with hybrid threats means dealing with uncertain situations. Therefore, the ability to achieve and maintain situational awareness is fundamental. This allows not only to detect potential direct threats but also to gather wider intelligence on adversary actions. In the context of hybrid threats, it would be crucial to obtain evidence of potential Russian responsibility and later use this evidence for further (e.g. legal) actions.

In order to maintain situational awareness in the maritime domain, various sensors and resources can be used. From a Polish perspective, all sorts of systems – from land-based radars to sensors mounted directly on or in close proximity to infrastructure to patrol vessels and aircraft – could be employed. What might prove problematic in this respect is that a variety of stakeholders would be involved, from infrastructure owners and operators, maritime administration and law enforcement forces to the military. All of these actors and entities are subject to different legal regulations, and the above-mentioned platforms have different capabilities. Another factor is the cost of acquisition and maintenance of surveillance systems, depending on their intended purpose. For example, the most important systems for the owner of an offshore wind farm are those that help to ensure the protection of their property. On the other hand, law enforcement services such as the Border Guard are interested in having systems that fit their law enforcement mission (which currently excludes subsurface surveillance). Finally, the military is interested in having capabilities of detection with regard to a wide range of military threats (including submarines).

Therefore, I recommend to implement integrated surveillance systems – both on the national and international level, if possible. Such systems should receive data provided by the stakeholders mentioned above and could help to establish a common situation picture. An integrated approach should also be the basis for any future developments in this field, also considering shared costs and results. For example, offshore wind facilities could be used as platforms for surveillance systems (radars, cameras or drones).

Finally, critical elements of situational awareness are maritime and airborne intelligence-gathering platforms. The current state of the Polish naval forces and maritime aviation requires the acquisition of new ships and airborne platforms (helicopters and maritime patrol aircraft). The ship-related issues are discussed in more detail below. As for the air domain, it should be noted that a replacement for light patrol aircraft and the procurement of additional helicopters is required. Two Saab 340 Airborne Early Warning planes were acquired in 2023, but they will be required to provide radar coverage also in other areas – notably, on the eastern border with Belarus and Ukraine. A partial solution would be the employment of TB2 and MQ-9B drones in a maritime patrol role; the former have been purchased already, and the latter were ordered recently.

3.4 Ships and shipbuilding

Maintaining situational awareness requires a constant presence, and this presence requires resources - in the maritime domain, these resources are mostly ships. The geography of the Baltic Sea region is one determinant of these requirements. Even if Polish maritime strategy makers decided to limit the area of responsibility to the southern Baltic Sea, vessels would have to be able to remain in the designated areas for a certain period of time while simultaneously detecting and pursuing multiple categories of targets, whether above the surface, on the surface, underwater and on the seabed.

Ships have an additional advantage: the ability to respond to a detected threat, using armament or other capabilities (i.e. a boarding team or special operations soldiers, if they are on board).

For example, in the above-mentioned scenario of a covert mine approach to a port, special mine-countermeasure vessels are the primary tool for detecting and defusing mines. This also illustrates the dual capability that armed forces offer outside of the spectrum of conventional conflict.

In a similar manner, a designated anti-aircraft frigate could be employed to provide protection against airborne threats (such as cruise missiles or drones). The Polish Navy already has or will have Kormoran II-class minehunters²¹ and Wicher-class frigates²² providing these capabilities. It is important to emphasize that the proiected Polish surface fleet shall be composed of three frigates, six minehunters, and one patrol corvette, with the addition of auxiliary vessels and older ships approaching the decommissioning date. Even in peacetime, the tasks of such a small-sized fleet will already be many: training, participation in national and international exercises, deployment to NATO's standing maritime groups and finally planned and unplanned maintenance periods may leave little room for supporting civilian authorities.²³ Therefore, the number of ships may have to be increased, either by upgrading older vessels in order to keep them in service or by purchasing new ships, resulting in higher costs.

The first option is potentially the less costly, but also the more risky ap-

23 During the Cold War, when the Polish Navy had many more vessels than nowadays, there were ships deployed on presence / surveillance patrols as well as designated alert vessels, which could be quickly deployed in case of crisis.

²¹ Six vessels have been contracted. So far, three vessels have been delivered and commissioned into service and a fourth was launched in 2024. Cf. 8th FOW 2024; Wojsko Polskie 2024.

²² Build under the codename 'Miecznik' (Swordfish). Three ships shall be delivered by 2031. See: PGZSW 2024; Wilewski 2023.

proach, since the capabilities of upgraded ships would be limited by their original design. Another unknown factor is how long such ships would be able to remain in service. The second option would be more costly and take more time, since requirements for new vessels would have to be formulated, and the entire acquisition process is complicated. On the other hand, this would provide the Navy with new ships to fulfil its contemporary and future requirements.

Since Poland has not published any official documents regarding naval strategy and shipbuilding plans in a wider perspective besides its Strategic Concept for Maritime Security from 2017, it is difficult to predict how likely the acquisition of new vessels actually is or whether the government might prefer to invest in the retention and upgrading of older ones. However, a telling announcement was made in 2024 regarding the redirection of the 'Murena' (Moray) programme, which was originally aimed at delivering new fast attack craft, towards the acquisition of four multi-role corvettes.²⁴

Due to the nature of hybrid threats, it is necessary to consider further procurement projects, including vessels capable of seabed surveillance and underwater activities support (similar in concept to the UK MROSS programme²⁵). Given the size of Polish maritime areas and the critical role of seabed infrastructure, notably pipelines and future offshore wind installations requiring underwater power lines, the development of such a capability is crucial. A first step in this direction is the already existing 'Ratownik' programme (for the construction of a submarine rescue and diving support vessel)²⁶ as well as the planned acquisition of a survey vessel.²⁷

Another possibility to increase the number of available ships is building dedicated offshore patrol vessels (or patrol corvettes), equipped to detect and counter threats to critical infrastructure and shipping. These vessels should have anti-surface, anti-submarine and anti-aircraft capabilities less advanced than frigates, but most importantly allowing them to detect and respond to enemy unmanned vessels (drones). Their task would be to ensure a presence in the Baltic Sea. This would result in a mixed fleet: a small number of high-end ships for the most demanding missions and a larger number of low-end vessels for simpler tasks. It is possible that the above-mentioned Murena programme may result in the delivery of such capabilities, supplehigh-end guided-missile menting frigates.

Another fundamental issue that should be the subject of a strategic decision is the maintenance of submarine forces. Currently, the Polish Navy operates one Kilo-class submarine. Regarding the acquisition of new boats ('Orka' programme), it has been announced that submarines shall be purchased and a respective contract shall be signed in 2025.²⁸ This decision needs to be based on a careful assessment of the Russian threat and capabilities on the one hand, and costs and benefits related to intelligence gathering or special forces support missions on the other. From the Polish perspective, the

26 Kamiński 2024b.

28 Ciślak 2024b.

²⁴ Kamiński 2024a.

²⁵ Navy Lookout 2023.

²⁷ Ciślak 2024a.

most important issue is the cost of building and maintaining a fleet, since defence spending is already high due to other projects such as the acquisition of tanks, missile systems for land forces, attack helicopters and air force programmes.

One possible solution would certainly be to increase overall defence spending in order to build more ships, or to redirect funding from air or land programmes to naval ones. From a more realistic point of view, it may be fair to assume that future ship acquisition programmes will be limited, for example to the 'Orca' and 'Ratownik' programmes, which would leave a capability gap. This gap can be covered partially by other systems, especially unmanned ones (drones).

3.5 Drones and counter-drone measures

Due to technical progress and the growing proliferation of unmanned surface and underwater vehicles, it is likely that they may be used as a tool in attacks on shipping or critical infrastructure. However, despite the fact that Russia has employed unmanned surface vessels as a direct response to Ukrainian attacks involving uncrewed vessels²⁹, a direct replication of activities known from the Black Sea in the Baltic is unlikely, due to the different operational and geographical environment.

Ukrainian surface vessels are usually employed in overt attacks against ships – notably in harbour areas. It is possible that in a hybrid warfare scenario in the Baltic Sea, unmanned underwater vessels would be preferred for several reasons. First, a large number of potential targets are underwater (i.e. pipelines or cables). Secondly, an underwater vehicle is much more difficult to detect. Finally, they are less vulnerable to weather conditions than surface ones. It is known that Russia has developed an autonomous underwater vehicle equipped with a manipulator arm.³⁰ This Russian construction works just as well on various other vessels. For example, the Russian company Rubin advertises several unmanned systems, named 'Yunona', 'Amulet' and 'Amulet-2' that are easy to transport and deploy without the need to use cranes.³¹

In wartime these unmanned vessels may be employed as part of a system composed of warships, submarines, conventional weapons (missiles) and aircraft. In a hybrid warfare scenario, it is possible that drones in particular could be used in order to enable plausible deniability – in this case Russia could use commercially available equipment (entire drones or just their components) and spin the narrative that the attack was carried out by nonstate actors.³²

Therefore, a part of the already mentioned strategy and its operationalisation should be devoted to the establishment of a system aimed at the prevention of and response to malicious drone use. The fundamental issue is to create a legal framework that regulates the use of drones in maritime areas, to establish rules of engagement in the event of a detection of enemy drones, and finally to allocate rules and resources for military, law enforcement

29 Sutton 2024.

³⁰ Sutton 2022.

³¹ Rubin 2024.

³² For further information, see Łuka-siewicz et al. 2021.

and commercial actors. It is simply a matter of choice: if an unidentified drone is detected near a port or pipeline, who should be responsible for the interception or destruction of this device? Resolving this issue is fundamental for the acquisition of technical equipment such as anti-drone systems.

Furthermore, unmanned platforms can support the protection of shipping and infrastructure, especially in a surveillance function. In this respect, another matter that should be regulated is whether, for example, underwater pipeline or cables should be monitored by drones operated by the Navy, the Border Guard or the infrastructure owner. Poland recently decided to upgrade Hugin underwater drones for pipeline surveillance.³³ However, as they are part of the mine countermeasure force and also have other tasks, this may only be an interim solution and greater efforts may be required.

3.6 International cooperation

Given the current geopolitical situation and the fact that most of the states bordering the Baltic Sea are now members of NATO and the EU, intensifying international cooperation is a logical conclusion.

Most prominently, the recent implementation of NATO's multi-domain vigilance activity Baltic Sentry aims at enhancing allied maritime situational awareness. In addition, the development of Task Force X aims to add a sufficient uncrewed component to allied enhanced vigilance activities. The Baltic states are already involved in multiple programmes, for example cross-Baltic pipelines (Baltic Pipe, Baltic Connector). Also, since not only these states are threatened by Russia's hostile actions, the implementation of an agreement such as the North Sea security agreement signed by Belgium, Denmark, Germany, the Netherlands, Norway and the United Kingdom in 2024³⁴, which facilitates a better exchange of information and a coordinated response to identified threats, is vital. In addition, international cooperation could allow for sharing the costs of building and maintaining sensor networks, thus enabling a better monitoring of Russian maritime activities. It could also enable the joint acquisition of maritime surveillance platforms such as maritime patrol aircraft (MPA) and ships. As regards patrol aircraft, it should be noted that while Germany has purchased eight P-8 Poseidon aircraft and five such planes were delivered to Norway, most of the Baltic Sea countries have only limited or no surveillance capabilities. Denmark operates four Cl-604 jets that can be used in a maritime patrol role apart from their transport mission; similarly, Finland has three Learjet 35 planes that can be used as MPAs. Poland does have a designated patrol squadron equipped with M-28 Bryza light patrol planes.

Apart from the P-8s, however, all those platforms lack anti-submarine warfare capabilities. They are supplemented by border guard planes and helicopters, but law enforcement airplanes also do not have ASW equipment.

As regards helicopters, only Germany, Denmark, Sweden, Norway and Poland have ASW-capable machines, and in most of those states, they are

33 Zalesiński 2023.

³⁴ Chiappa 2024.

also tasked with missions outside the Baltic Sea (especially deployments on board of warships). In the case of Poland, older helicopter types (Mi-14PŁ and SH-2G Seasprite) will soon be decommissioned, and so far, only four AW101 helicopters have been contracted – a number that is much smaller than necessary to cover all requirements.³⁵

Also, maritime patrol aircraft are costly – joint procurement could allow for multiple countries to benefit from their capabilities, in a manner similar to existing programmes such as NATO's multinational AWACS force³⁶ or its tanker/transport fleet (MRTT-C).³⁷

When it comes to ships, there are generally no multinational fleets. However, it is possible to have several ships of the same class built together, especially if several countries have similar requirements - as in the case of the type 212CD submarines (a joint German-Norwegian purchase) or the older Tripartite-class mine warfare ships. There are obstacles, certainly: different requirements, different budgets and political factors shaping procurement decisions. However, several possible options can be pointed out. For example, the Swedish parliamentary defence commission suggested building four more corvettes, supplementing the already procured Luleå-class vessels.³⁸ If Sweden decided to purchase additional corvettes, that would pave the way for a possible cooperation with Poland to also acquire four corvettes, provided

35 IISS, The Military Balance 2024.

³⁸ Häggblom 2024.



the Moray programme is implemented as announced.

Another field of cooperation in the Baltic region could be mine-countermeasures forces. Several countries have ships built more than twenty-five years ago, including Germany (*Frankenthal*class) and Sweden (*Koster*-class), and sooner or later those vessels will need replacement. The smaller Baltic states, Lithuania, Latvia and Estonia, all operate older mine warfare ships that they received from Western Europe. The replacement of those vessels might also be part of a joint programme.

Also, submarine programmes are another potential area of cooperation, especially in the case of Poland.

4 Summary

The Russo-Ukraine war casts a shadow on the perception of contemporary threats, and the maritime domain is no exception. From a Polish perspective, the main lesson is that there are no direct lessons. There are different environmental, political and military conditions to consider.

On the one hand, the Russian armed forces have performed differently than expected in many areas. On the other hand, hybrid attacks, especially those targeting maritime critical infrastructure, represent major risks compared to open, conventional attacks as seen in the invasion of Ukraine. Hybrid attacks may bring significant damage to the affected country's national economy and social stability, and a failure on our part to protect this infrastructure and the services provided by it may allow for more successful Russian hybrid operations in the future. This risk is enhanced by the growing importance of the Baltic Sea to

³⁶ NATO 2024a.

³⁷ NATO 2022.

Poland despite the existing sea blindness.

Therefore, among the listed recommendations, tackling sea blindness must be considered fundamental, followed by the formulation of a national maritime strategy. Without those steps, any further ones cannot be planned predictably. A planned development approach, however, is particularly important for shipbuilding.

From a Polish perspective, due to the long-standing neglect of its naval forces, the continuation of already started programmes and the planned, systematic development of its future fleet are of crucial importance in order to be able to assume a significant role in Baltic Sea security.

List of References

- 8th FOW (2024): Niszczyciele min typu Kormoran II (proj. 258), https:// www.wojsko-polskie.pl/8fow/ kormoranii/, last accessed on: 28-09-2024.
- Act of Parliament of the Republic of Poland on State Border Protection, 1991 (with amendments).
- Act of Parliament of the Republic of Poland on the Border Guard, 1990 (with amendments).
- Associated Press (2023): Poland Detains 9 People Suspected of Spying for Russia, in: Associated Press dated 16-03-2023, https://apnews. com/article/espionage-polandukraine-russia-belarus-sabotage-foiled-a105984d15ddc200369d8b13ca37f4b6, last accessed on: 14-09-2024.
- Associated Press (2024): Baltic Sea Nations React Warily to a Reported Russian Proposal to Revise Its Maritime Border, in: Associated

Press dated 23-05-2024, https:// apnews.com/article/baltic-searussia-security-border-fb9849dd556fa166f1135172c6935c9d, last accessed on: 14-09-2024.

- Braw, Elizabeth (2024): Russia's Growing Dark Fleet: Risks for the Global Maritime Order, in: Atlantic Council dated 11-01-2024, https:// www.atlanticcouncil.org/indepth-research-reports/issuebrief/russias-growing-darkfleet-risks-for-the-global-maritime-order/, last accessed on: 21-12-2024.
- Chiappa, Claudia (2024): 6 Countries Move to Protect the North Sea from Russians, in: Politico dated 09-04-2024, https://www.politico.eu/article/6-european-countries-sign-pact-protect-criticalenergy-infrastructure-northsea-from-russia/, last accessed on: 21-12-2024.
- Ciślak, Jarosław (2024a): Czy powstanie nowy Hydrograf? [ANALIZA], in: Defence24 dated 17-09-2024, https://defence24.pl/sily-zbrojne/czy-powstanie-nowy-hydrograf-analiza, last accessed on: 22-12-2024.
- MON Ciślak, Jarosław (2024b): realizację zadeklarował programów Ratownik, Orka i dozbrojenie Ślązaka, in: Defence24 dated 28-11-2024, https://defence24. pl/sily-zbrojne/monzadeklarowal-realizacje-programow-ratownik-orka-idozbrojenie-slazaka, last accessed on: 22-12-2024.
- Dalsjö, Robert/Berglund, Christofer/Jonsson, Michael (2019): Bursting the Bubble? Russian A2/AD in the Baltic Sea Region: Capabilities, Countermeasures, and Implications, in: FOI dated March 2019,

https://www.foi.se/rapportsammanfattning?reportNo=FOI-R--4651--SE, last accessed on: 23-09-2024.

- Eggert, Konstantin (2024): GPS Jamming in the Baltic Region: Is Russia Responsible?, in: Deutsche Welle dated 05-05-2024, https://www. dw.com/en/gps-jamming-inthe-baltic-region-is-russia-responsible/a-68993942, last accessed on: 14-09-2024.
- Polityka energetyczna Polski do 2040 r (Energy Policy of Poland until 2040), https://www.gov.pl/web/ klimat/polityka-energetycznapolski, last accessed on: 24-09-2024.
- Frederick Bryan/Charap Samuel/Mueller Karl P (2022): Responding to a Limited Russian Attack on NATO During the Ukraine War, in: RAND dated 20-12-2022, https://www. rand.org/pubs/perspectives/ PEA2081-1.html, last accessed on: 29-09-2024.
- GUS (2024): Gospodarka morska w Polsce w 2023 roku, in: Główny Urząd Statystyczny dated 29-04-2024, https://stat.gov.pl/obszary-tematyczne/transport-i-lacznosc/ transport/gospodarka-morskaw - p o l s c e - w - 2 0 2 3 roku,7,21.html, last accessed on: 27-09-2024.
- Häggblom, Robin (2024): Sweden Looking at More Surface Combatants and Submarines, in: Naval News dated 29-04-2024, https://www. navalnews.com/naval-news/ 2024/04/sweden-looking-atmore-surface-combatants-andsubmarines/, last accessed on: 29-09-2024.
- Hartog, Eva (2024): Russia Mysteriously Deletes Threat to Redraw Baltic Sea Border, in: Politico dated 22-

05-2024, https://www.politico.eu /article/russia-defense-ministrychange-baltic-sea-border-finland-latvia/, last accessed on: 14-09-2024.

- IISS (2024): The Military Balance 2024, Routledge: Abingdon-on-Thames, UK.
- Kamiński, Rafał (2024a): Marynarka Wojenna chętna także na korwety? Wielki powrót programu "Murena", in: Gospodarka Morska dated 09-05-2024, https://www. gospodarkamorska.pl/marynarka-wojenna-chetna-takzena-korwety-wielki-powrot-programu-murena-77936, last accessed on: 27-09-2024.
- Kamiński, Rafał (2024b): Do trzech razy sztuka? Agencja Uzbrojenia zamówi okręt ratowniczy programu "Ratownik", in: Gospodarka Morska dated 15-11-2024, https:/ /www.gospodarkamorska.pl/dotrzech-razy-sztuka-agencjauzbrojenia-zamowi-okret-ratowniczy-programu-ratownik-81685, last accessed on: 22-12-2024.
- Kaushal, Sidharth (2023): Stalking the Seabed: How Russia Targets Critical Undersea Infrastructure, in: RUSI Commentary dated 25-05-2023, https://rusi.org/exploreour-research/publications/commentary/stalking-seabed-howrussia-targets-critical-underseainfrastructure, last accessed on: 28-09-2024.
- Lange Heinrich/Combes, Bill/Jermalavičius, Tomas/ Lawrence, Tony (2019): To the Seas Again. Maritime Defence and Deterrence in the Baltic Region, in: International Centre for Defence and Security dated 16-04-2019, https:// icds.ee/wp-content/uploads/

2019/04/ICDS_Report_To_the_ Seas_Again_Lange_Combes_Jermalavicius_Lawrence_April_ 2019.pdf, last accessed on: 24-09-2024.

- Łukasiewicz Jędrzej/Piekarski Michał/Kluczyński Maciej (2021): Security of Infrastructure Critical to Threats from Unmanned Platforms, The Raport PTBN, Volume II, https://drive.google.com/file/ d/1hCHNae2847TwpHQjE-KcBwAI4SreDt4Y/view, last accessed on: 29-09-2024.
- Marszałkowski, Mariusz (2023): Rosjanie szpiegują na Bałtyku? Podejrzana aktywność u morskich granic Polski, in: Biznes Alert dated 23-01-2023, https://biznesalert.pl/polska-baltyk-statki-wywiad-rosjabzpieczenstwo-gdansk-naftoport/, last accessed on: 27-09-2024.
- Meurmishvili, Ia (2017): Russian Mystery Weapon Claim Seen as Sign of Military Weakness, in: Voice of America dated 02-05-2017, https://www.voanews.com/a/russian-mystry-weapon-claimseen-as-sign-of-military-weakness/3834792.html, last accessed on: 26-09-2024.
- Murphy Martin/Hoffman Frank G./ Schaub jr Gary (2016): Hybrid Maritime Warfare and the Baltic Sea Region, in: Centre for Military Studies, University of Copenhagen dated November 2016, https://cms.polsci.ku.dk/publikationer/Hybrid_Maritime_ Warfare_and_the_Baltic_Sea_Region.pdf, last accessed on: 29-09-2024.
- Strategia Bezpieczeństwa Narodowego Rzeczypospolitej Polskiej (National Security Strategy of Republic Of Poland) (2020): https://

www.bbn.gov.pl/ftp/dokumenty/Strategia_Bezpieczenstwa_ Narodowego_RP_2020.pdf, last accessed on: 24-01-2025.

- NATO (2022): Multi Role Tanker Transport Capability (MRTT-C), https:// www.nato.int/nato_static_ fl2014/assets/pdf/2022/9/pdf/ 2209-factsheet-mrtt.pdf, last accessed on: 30-09-2024.
- NATO (2024a): E-3A Component 2024, https://awacs.nato.int/ page5835237, last accessed on: 24-01-2025.
- NATO (2024b): Washington Summit Declaration, dated 10-06-2024, last updated 15-06-2024, https:// www.nato.int/cps/en/natohq/ official_texts_227678.htm, last accessed on: 30-09-2024.
- Navy Lookout (2023): A Guide to RFA Proteus – the UK's New Seabed Warfare Vessel, in: Navy Lookout dated 10-10-2023, https://www. navylookout.com/a-guide-torfa-proteus-the-uks-newseabed-warfare-vessel/, last accessed on: 22-12-2024.
- PGZSW (2024): Miecznik wielozadaniowe fregaty dla MW RP, https:// pgzsw.com.pl/oferta/program_ miecznik/, last accessed on: 26-09-2024.
- Port Gdańsk (2024): Facts and Figures, https://www.portgdansk.pl/en/ business/general-information/ facts-and-figures/, last accessed on: 26-09-2024.
- Ptak, Alicja (2024): Poland Charges Nine People Suspected of Sabotage on Behalf of Russia, in: Notes from Poland dated 21-05-2024, https:/ / n otesfrompoland.com/ 2024/05/21/poland-chargesnine-people-suspected-of-sabo-

tage-on-behalf-of-russia/, last accessed on: 14-09-2024.

- Rubin (2024): Rubin Robotics, https:// ckb-rubin.ru/en/projects/ robototekhnika/, last accessed on: 27-09-2024.
- Sutton, H I (2022): Russian Underwater Drone with Manipulator Arm for Seabed Operations, in: Covert Shores dated 29-09-2022, http:// www.hisutton.com/Russian-Intervention-Underwater-Drone. html, last accessed on: 27-09-2024.
- Sutton, H I (2024): Overview of Maritime Drones (USVs) of the Russo-Ukrainian War, 2022-24, in: Covert Shores dated 21-09-2024, http://www.hisutton.com/Russia-Ukraine-USVs-2024.html, last accessed on: 27-09-2024.
- Trade.gov.pl (2024): Polskie porty morskie w 2024 roku, in: Trade.gov.pl dated 16-01-2025, https://www. trade.gov.pl/aktualnosci/polskie-porty-morskie-w-2024roku/, last accessed on: 23-01-2025.
- Wiese Bockmann, Michelle (2024): Finland police seize Russian-linked

dark fleet tanker Eagle S in cablecutting investigation dated 26-12-2024, https://www.lloydslist. com/LL1151950/Finland-policeseize-Russian-linked-dark-fleettanker-Eagle-S-in-cable-cutting-investigation, last accessed on: 15-03-2025.

- Wilewski, Krzysztof (2023): Poznaliśmy uzbrojenie Mieczników, in: Polska Zbrojna dated 15-12-2023, https://polska-zbrojna.pl/home/articleshow/40881?t=Poznalismyuzbrojenie-Miecznikow, last accessed on: 26-09-2024.
- Wojsko Polskie (2024): Wodowanie i chrzest przyszłego ORP Jaskółka, https://www.wojsko-polskie.pl/ articles/tym-zyjemy-v/2024-06-27v-wodowanie-i-chrzestprzyszego-orp-jaskoka/, last accessed on: 27-09-2024.
- Zalesiński, Łukasz (2023): Dron sprawdzi rurociągi, in: Polska Zbrojna dated 10-11-2023, https://www.polska-zbrojna.pl/home/articleshow/40660?t=Dronsprawdzi-rurociagi, last accessed on: 30-09-2024.



Re-Thinking War in the Baltic Sea

1 Preface

More than 1,000 days after the beginning of Russia's full-scale invasion of Ukraine, and over a decade since the initiation of Russia's war of aggression back in 2014, it is the Baltic Sea region apart from, of course, the Black Sea and Ukraine itself - that has emerged as a pivotal area where the war's consequences are most keenly felt by NATO and the West, and where a new approach to dealing with the Russian Federation may manifest itself. This paper elucidates potential lessons and implications for the Baltic Sea in terms of the threat environment, strategic goals and challenges, and the practical defence of NATO allies. In this context, certain trends and developments are identified for the Baltic maritime area of operations, both as implications and inspirations from the Ukrainian war of defence. Although events in the Black Sea cannot simply be used as a blueprint for the Baltic, there are a number of areas that require further investigation and discussion, as highlighted by the subsequent set of topics. Thus, as a second pillar, this paper provides additional food for thought, a series of careful considerations for further examination by practitioners, strategic thinkers, academics, and analysts alike.

2 Tectonic shifts

In light of the tectonic shifts described below, a cautious analysis is essential to guide future strategic considerations. The three principal shifts framing this analysis are as follows:

First and foremost, acknowledging the necessity of updating and adapting defence plans for the region is crucial. In fact, this important step was taken at NATO's Vilnius Summit in 2023 in response to the full-scale invasion of Ukraine. Following a first decision to upscale NATO's Force Model taken in 2022, the member states then agreed on a fundamental upgrade and adaptation of their Baltic defence plans when they met in Vilnius: the forward presence approach consisting of multinational battlegroups, established as a low-threshold reaction to the Russian aggression beginning in 2014 and often referred to as 'tripwire force', was transformed into the plan of establishing a substantial forward defence posture.¹ This was further reinforced at NATO's 75th anniversary summit in Washington.² Aiming at improving the broad spectrum from capabilities to command and control, the overall strategic posture is being moved 'from deterrence by punishment to deterrence by denial.'3

Based on that development, the second trend encompasses recognising the dramatic needs resulting from large-scale, high-end, and thus highly attritional conventional warfare. As such, the military level is inextricably linked with its societal and economic

¹ NATO 2022; NATO 2023.

² NATO 2024b.

³ Kepe 2024.

counterparts.⁴ Current and future scenarios need to adapt to today's strategic and operational challenges whilst being aware of each conflict's specific context, be it historical or contemporary.⁵ This notwithstanding, one of the key prerequisites to avoid pitfalls is to prevent following the infamous mantra of fighting the last war.⁶ In this case, it is imperative to carefully differentiate between the Russian invasion of Ukraine and the circumstances of a potential Article 5 scenario for NATO following a Russian aggression against a member of the alliance.

Thirdly, the fundamental change of mindset that has taken place in both Sweden and Finland, culminating in their decision to join the NATO alliance is a symbol for the revolution of Baltic Sea security dynamics.⁷ Although close military cooperation has been developed over the years, not only between the two countries themselves, but also within the Nordic Defence Cooperation (NORDEFCO) structure and with NATO, both countries have, until recently, followed the idea of being aligned, but not formally allied.⁸ The changes that have taken place in this regard underscore the countries' adjusted threat perception of Russia, instigated by its full-scale invasion of Ukraine, as well as the continuous relevance of defensive, military alliances such as NATO, and the concept of collective defence enshrined in the alliance's Article 5, including the overall significance of (nuclear) deterrence. As a result, an even more coherent allied approach for NATO's Northern Flank

- 5 Hoffmann/Garrett 2024.
- 6 See for instance Freedman 2017: 62–64.
- 7 Lundqvist 2022.
- 8 Lunde Saxi 2022.

to enhance collective defence becomes possible.⁹

3 Theatre Dynamics and Threat Environment

The Baltic Sea theatre matches the definition of a confined, narrow sea:¹⁰ it features an overall close proximity to coasts, multiple strategically relevant islands, large and small, like Swedish Gotland, Danish Bornholm, or Estonian Hiiumaa, as well as crucial shallows and choke points like the Danish Straits. In addition, approximately 2,500 vessels are crossing the Baltic Sea on a daily basis. Even in the absence of major conflict, these factors turn the Baltic Sea into a highly congested and challenging area of operations. Compared to blue-water environments, manoeuvrability is reduced and options for naval operations are limited.¹¹ The vulnerability of naval vessels increases, particularly in the face of detection and attack from air, land, and sea in both symmetric and asymmetric ways.

Considering the strategic significance of islands in littoral warfare, the case of Snake Island (*Zmiinyi*) in the Black Sea is a vivid, practical example. This seemingly minor outpost holds considerable value, offering critical advantages in surveillance and naval operations. However, its defence is fraught with challenges due to its inherent isolation and vulnerability to air and missile attacks. The task of recapturing an island, once occupied, is further complicated by the complexity of

- **10** Vego 2003.
- 11 Vego 2015.



⁴ Vershinin 2024.

⁹ Pawlak 2021.

amphibious operations. It requires extensive coordination, robust air and naval support, and precise execution to mitigate the vulnerabilities and operational difficulties inherent in such endeavours. The case of Snake Island exemplifies the pivotal role islands can play in regional security dynamics, as well as the formidable challenges involved in their defence and reclamation. On the other hand, forces, if properly used, can utilize the strategic position of islands to influence sea lines of communication (SLOCs) and choke points, or establish air defence and electronic warfare systems, all the while considering the fact that islands are by no means invulnerable.

One of the key characteristics of the Baltic Sea theatre is freedom of navigation for all vessels in its waters, including choke points and SLOCs.¹² However, the fact that the majority of countries bordering the Baltic Sea are NATO members does not necessarily amount to NATO exercising unlimited sea control. On the contrary, ongoing Russian activities in the so-called grey zone, from sabotage and influence operations to espionage and disinformation campaigns, create a constant threat from below the threshold of war. Such actions aim at destabilising not only individual societies, but the coherence of alliances as a whole. They have escalatory potential and could eventually level the field for potential conflicts in the aggressor's favour. These dynamics necessitate constant readiness and alertness, particularly regarding potential hybrid actions threatening societies, commercial shipping, and maritime and other critical infrastructure. The Nord Stream sabotage has served as a wakeup call in this respect. The infamous Russian shadow fleet is another aspect to watch out for. Not only armed forces, but law enforcement agencies, the private sector, and civil societies as a whole, are called upon to stay vigilant and build resilience against hybrid threats.

Overall, for both NATO and the Russian Federation, sea control in the Baltic Sea is no end in itself, but has implications that support broader objectives related to the strategic situation in the region. For Russia, first and foremost, the protection of Baltic SLOCs to and from the Russian mainland and its Kaliningrad Oblast is vital for economic and military purposes. The Baltic Sea is the only way to adequately complement the narrow land connection to this Russian outpost via Lithuania. In addition, currently 1/3 of Russian seaborne crude oil exports are leaving Russian Baltic ports.¹³ On the other hand, the maritime domain is a way to support land-based forces and their task to defend the Russian mainland and territories such as Kaliningrad Oblast and the Northwestern Federal District, including St. Petersburg and the Kola Peninsula. Even though the Baltic Sea is not the first priority in Russian maritime doctrine, Russia has adapted to the new NATO members in Scandinavia by adjusting its organisation of military districts and the planned re-establishment of forces along its Western border.¹⁴

¹² Siig/Kilpatrick 2023.

¹⁴ Edvardsen 2024.

4 Outlook for NATO Defence in the Baltic Sea and Issues Requiring Further Attention

Re-Thinking War in the Baltic Sea does not only necessitate the implementation of comprehensive and adaptive defence strategies. Basically, several issues from cooperation to enemy capabilities are to be considered carefully. Ukrainian experiences, Russian adaptations and vice versa can inform and help to shape the strategic approach to ensuring security and defence in the Baltic region. Yet, current observations and certain lessons need further investigation to re-think fighting and winning wars, in the Baltic region and beyond. This chapter provides a selection of issues to ponder.

SLOCs and Baltic Peculiarities: Similarly to the Russian Federation, NATO nations pursue the objective of defending the vital Baltic SLOCs and freedom of navigation. They are crucial for the security, defence, and economic prosperity of the Baltic littorals. The example of Finland's imports and exports, 95% of which are shipped via the Baltic Sea, speaks for itself.¹⁵ The congested nature of a confined and shallow sea like the Baltic, however, provides opportunities for hostile forces to employ hybrid measures including both classic naval tactics as well as asymmetric actions from the shores and archipelagos to the sea. In contrast, in order to be able to prevail in a potential high-intensity conflict, NATO has to prepare for large parts of the naval warfare spectrum, including mining and mine

countermeasures, anti-surface, anti-air, and anti-submarine warfare, as well as the possibility of limited amphibious operations. The complex environment of the Baltic, consisting of fragmented coastlines and numerous islands, offers both strategic advantages and challenges. It underscores the importance of both offensive and defensive naval operations as part of a whole range of naval tactical actions.¹⁶ NATO forces should leverage this environment to distribute their growing denial capabilities, increasing both surprise and deception, while minimizing the potential impact of long-range enemy strikes.17

Flexibility, Awareness and Communication: Implementing joint force principles and a unified command and control (C2) system by overcoming still existing national barriers is essential to effectively address issues ranging from grey-zone conflicts to high-intensity warfare. This requires advanced maritime situational awareness and preparation for scenarios where intelligence, surveillance, and reconnaissance (ISR) capabilities may be compromised, and satellites and surveillance aircraft will be targeted. Supplementing the defence of the Baltic shores and ensuring mobility and flexible basing by rotating vessels are essential ways to avoid detection and destruction. This applies to air assets as well, with islands offering strategic and operational opportunities, but limited numbers of basing options - which can become valuable targets in terms of Russian long-range strike capabilities. The Baltic littoral states themselves should continue

GDS

17 Kaushal/Balletta 2024.

¹⁵ Yle 2023.

¹⁶ Vego 2020.
procuring and deploying mobile denial systems, such as shore-based anti-ship missiles, to enhance flexible area denial and strike capabilities.

Interoperability: Apart from the aforementioned, interoperability with national law enforcement agencies, such as coast guards and police forces, is crucial for the defence and security of the Baltic shore areas. This cooperation is particularly valuable with regard to protecting critical infrastructure and controlling territorial seas, thus ensuring a comprehensive approach to regional security. The impact of destroyed bridges, ports, or blocked choke points can prove much more disastrous than single vessel incidents, as Ukrainian drone strikes against Russian energy infrastructure in the Baltic have shown.¹⁸

Mutual Denial: Looking at the higher end of a potential escalation ladder, the issue of sending high value assets into the Baltic and areas within the potential range of denial capabilities remains a point of discussion. In this context, it is reasonable to anticipate that both NATO and Russian forces would attempt to deny the other side access to certain areas of the Baltic Sea, basically achieving mutual denial in a joint environment.¹⁹ On a smaller scale, this mutual denial shows similarities to Krepinevich's 'maritime no man's land' in the context of a maritime precision strike regime.²⁰ Although denial capabilities do have a certain effect, in the current state of affairs actors might not be able to utilize the maritime theatre to their own advantage without first achieving a sufficient disruption of the other's capabilities – eventually resulting in a highly contested, and thus perilous, area of operations.

Naval Mining: Mine Warfare is considered a central topic in the Baltic Sea, particularly due to certain geographical conditions such as in the Gulf of Finland and the Danish Straits.²¹ Through blockades or the disruption of SLOCs, it can be used to effectively shape the respective naval area of operations. History provides insights into how this was operationalized in the past, but warnings can be heard that 'much of NATO's institutional knowledge' has been lost.²² Apart from such knowledge, the number of capable units is limited, and their survivability during a high-intensity conflict is by no means guaranteed. From another perspective, in this day and age, the Baltic SLOCs are of even greater economic and military significance than in the past. In the Black Sea, the risk of collateral damage from mines persisted in its western and north-western parts, even as a result of a relatively limited mining campaign.²³ In any potential endeavour in the Baltic, allies would have to carefully consider SLOCs and existing own maritime dependencies in light of the extensive need for mine countermeasures following own mining campaigns, but even more so following the opponent's respective actions, which could take place during an armed conflict or even prior to that.

18 Black 2024; Osborn/Rodionov 2024.

19 Warnar 2023.

20 Krepinevich 2014.

- 21 Reuters 2024.
- **22** Laanements 2024.
- 23 NATO 2024a.

72 — Julian Pawlak

Uncrewed Systems: Along with the general, unprecedented use of uncrewed systems in the war in Ukraine, its naval aspect is mostly known for Ukraine's successful use of naval drones.²⁴ Their potential role for naval strategy and operations in the Baltic requires careful consideration, from the perspective of an attacker as well as from that of a defender. Both NATO and Russia are expected to adapt to these developments, enhancing their own uncrewed capabilities for defensive and offensive purposes alike. The bandwidth of these systems offers opportunities to increase maritime situational awareness (MSA) and expand ISR capabilities, to further develop uncrewed minelaying, or to monitor and defend critical infrastructure. In addition, even with their limitations, the systems could serve both as means of denial against Russian vessels and as alternatives to operating in restricted, high-risk denial environments. The Baltic littoral states, however, must be prepared to counter UxS threats on, above, and below the water surface against vessels, but particularly against port installations and other critical infrastructure, and closely consider Russian perspectives and developments in this regard. Notably, the characteristics of the Black Sea theatre of operations are quite specific and cannot simply be applied to the Baltic. Differences and limitations, such as durability or the effects of weather conditions, and the 'technological game of cat and mouse' call for a precise, forward-thinking development of uncrewed systems.²⁵ Eventually, the disproportional amount of attention bestowed on these

systems should not distract from their effective, combined use under the continuous missile threat at sea.²⁶

Russian Adaptation and Capabilities: The recent Russian naval performance should not lead to the erroneous belief that the Russian armed forces and the country's defence industry would not aim at adapting to the experiences and developments in the Black Sea. Even today, i.e., adaptations in port defence installations and own drone developments are taking place.²⁷ Foreseeably, adaptations of Russian offensive and denial capabilities in areas like the Baltic as part of its active defence²⁸ should not be excluded prematurely. In addition, its deep-sea and seabed warfare capabilities offer further opportunities not only for subsea, but also for asymmetric, grey-zone approaches within the Baltic and along NATO's Northern Flank.²⁹ In addition to the ongoing adaptation in terms of uncrewed systems and related operations, naval construction rates and weapon procurement in Russia are increasing, new vessels are being put into service. As stated by the Chief of the German Navy, Vice Admiral Kaack, it would be a fallacy to expect Russian naval forces along Europe's Northern shores to be weakened due to events in the Black Sea.³⁰ Rather, its 'global power projection capabilities are undiminished.³¹ Whilst blue water capabilities enabling the conduct of naval battles should not be expected in the Baltic, the 'Russian naval threat' consists of more than its

26 Tallis 2024.

- **28** Kofman et al. 2021: 10–17.
- **29** Axe 2024; Galeotti 2023.
- **30** ntv 2024.
- **31** Petersen 2024.

²⁴ Zafra et al. 2024; Sutton 2024.

²⁵ Zafra et al. 2024; see also Redford 2024 as another paper of the series at hand.

²⁷ Sutton 2023.

truly capable SSBNs.³² Although confronted with a shorter coastline and limited naval means, in this scenario Russian Forces could utilize a lowthreshold, asymmetric approach against the larger NATO force in the Baltic. As pointed out by Mike Petersen, '[t]he Russian military [...] actively seeks asymmetries in its favour, either via technology development or innovative concepts of operations or both.³³ Being aware of the existing asymmetry in the naval domain, Russia could be able to circumvent their limited anti-ship maritime strike capability by leveraging missile strikes, coastal defence systems, and tactical aviation with air defence capabilities in a region like the Baltic.³⁴ The result of potentially successful strikes on Western high value targets, from ports to headquarters, military installations and capitals, in immediate Russian range creates strategic and political issues to worry about.35

5 Conclusion

Rethinking contemporary warfare in the Baltic Sea necessitates a nuanced understanding of naval dynamics, particularly in light of insights drawn from the ongoing war in Ukraine and the Black Sea. While this war offers valuable lessons, it cannot serve as a onesize-fits-all model for other seas like the Baltic. The rise of uncrewed vessels, for example, while garnering significant attention, must be contextualized within their actual operational impact, which may not align with public perception.

Strategically, the ability to harness the potential of the maritime domain will remain crucial for the defence of the Baltic Sea region. To achieve, exploit, or deny sea control in a theatre like the Baltic demands close, joint and combined cooperation. Likewise, allies need to prepare for confrontations with Russian capabilities in the region which will not necessarily always be symmetric.

For NATO, eventually, deterrence not just in the Baltic region encompasses strategic preparations for adversarial action across the entire spectrum from the ongoing strategic competition towards high-intensity conflict. The necessary preparations must be matched by strong political resolve. The alliance needs to be prepared for the possibility of both conventional escalation and nuclear coercion. In a kinetic conflict in a collective defence scenario, decision-makers will face tough choices, such as neutralizing significant portions of the conventional threat in the Baltic Sea region.³⁶ A strong, credible posture of deterrence must go hand in hand with pivotal decisiveness towards handling escalatory efforts, from grey zone activities to a high-intensity conflict scenario and potential nuclear blackmailing.³⁷

List of References

Axe, David (2024): In the Silent War Down in the Black Abyss, Russia Is now Stronger than the US Navy, in: The Telegraph from 10-05-2024, https://www.telegraph.co.uk/

³² Kaushal 2024.

³³ Petersen 2023: 220.

³⁴ Kofman 2023: 117; Kaushal 2024.

³⁵ Petersen 2023: 225.

³⁶ Pawlak 2024.

³⁷ Stubbs 2017.

n e w s / 2024 / 05 / 10 / d e e p s e a b e d - w a r f a r e - g u g i - s u b marines-us-navy-russia/, last accessed on: 25-09-2024.

- Black, James (2024): No More Sanctuary: NATO Must Prepare for War at Home, in: RAND Commentary from 24-06- 2024, https://www. rand.org/pubs/commentary/ 2024/06/no-more-sanctuarynato-must-prepare-for-war-athome.html, last accessed on: 18-07-2024.
- Edvardsen, Astri (2024): Russia's Forces in the High North: Weakened by the War, Yet Still A Multidomain Threat, in: High North News from 12-01-2024, https://www.highnorthnews.com/en/russiasforces-high-north-weakenedwar-yet-still-multidomainthreat, last accessed on: 18-07-2024.
- Freedman, Lawrence (2017): The Future of War. A History, PublicAffairs: New York.
- Galeotti, Mark (2023): Bear Underwater: Russia's Undersea Capabilities, in: Britain's World from 26-06-2023, https://www.geostrategy.org.uk/ britains-world/bear-underwater-russias-undersea-capabilities/, last accessed on: 25-09-2024.
- Hoffmann, Frank G./Garrett, George P. (2024): A Break in the Clouds: Learning Lessons from the Sea, in: Texas National Security Review Vol. 7 (3), Summer 2024, https:// tnsr.org/2024/06/a-break-inthe-clouds-learning-lessonsfrom-the-sea/, last accessed on: 25-09-2024.
- Kaushal, Sidharth/Balletta, René (2024): An Asymmetric Approach to the Use of NATO's Maritime Forces in Competing with Russia (RUSI Oc-

casional Paper, February 2024), https://static.rusi.org/maritimeforces-of-nato-competing-withrussia-occasional-paper-february-2024.pdf, last accessed on: 18-07-2024.

- Kaushal, Sidharth (2024): Lessons for the Royal Navy's Future Operations from the Black and Red Sea, in: RUSI from 26-07-2024, https:// www.rusi.org/explore-our-research/publications/commentary/lessons-royal-navys-futureoperations-black-and-red-sea, last accessed on: 25-09-2024.
- Kepe, Marta (2024): From Forward Presence to Forward Defense: NATO's Defense of the Baltics, in: RAND from 14-02-2024, https://www. rand.org/pubs/commentary/ 2024/02/from-forward-presence-to-forward-defense-natosdefense.html, last accessed on: 18-07-2024.
- Krepinevich, Andrew F. (2014): Maritime Warfare in a Mature Precision-Strike Regime, Center for Strategic and Budgetary Assessment: Washington, DC.
- Kofman, Michael (2023): Evolution of Russian Naval Strategy, in: Andrew Monaghan, Andrew and Richard Connolly (eds.): The Sea in Russian Strategy, Manchester University Press: Manchester, pp. 94–123.
- Kofman, Michael/Fink, Anya/Gorenburg, Dmitry/Chesnut, Mary/Edmonds, Jeffrey/Waller, Julian (2021): Russian Military Strategy: Core Tenets and Operational Concepts, Center for Naval Analyses: Arlington, VA.
- Laanements, Ott (2024): Reinventing Mine Warfare in the Baltic Sea, in: U.S. Naval Institute Proceedings, Vol. 150 (5), https://www.usni.



org/magazines/proceedings/ 2024/may/reinventing-minewarfare-baltic-sea, last accessed on: 18-07-2024.

- Lunde Saxi, Håkan (2022): Alignment but not Alliance: Nordic Operational Military Cooperation, in: Arctic Review on Law and Politics, Vol. 13, pp. 53–71.
- Lundqvist, Stefan (2022): A Convincing Finnish Move: Implications for State Identity of Persuading Sweden to Jointly Bid for NATO Membership, in: Studies in European Affairs, Vol. 26 (4), pp. 73–110.
- NATO (2024a): Risk of Collateral Damage in the North Western, Western, and Southwest Black Sea, 13-03-2024, https://shipping.nato.int/ nsc/operations/news/-2022/ risk-of-collateral-damage-inthe-north-western-black-sea-2, last accessed on: 18-07-2024.
- NATO (2024b): Washington Summit Declaration, 10-07-2024, https:// www.nato.int/cps/en/natohq/ official_texts_227678.htm, last accessed on: 18-07-2024.
- NATO (2023): Vilnius Summit Declaration, 11-07-2023, https://www. nato.int/cps/en/natohq/official_ texts_217320.htm, last accessed on: 18-07-2024.
- NATO (2022): Madrid Summit Declaration, 29-06-2022, https://www. nato.int/cps/en/natohq/official_ texts_196951.htm, last accessed on: 18-07-2024.
- ntv (2024): Marinechef: Moskaus Flotte ist uns in vielen Bereichen überlegen. Berlin will Seeminen für Ostsee, 09-07-2024, https://www.n-tv. de/politik/Vizeadmiral-Kaackwarnt-vor-Russlands-Flotte-inder-Ostsee-Deutschland-will-S e e m i n e n - k a u f e n - a r t i cle25075532.html, last accessed

on: 18-07-2024.

- Osborn, Andrew/Rodionov, Maxim (2024): Russia Suspends Operations at Fuel Export Terminal After Suspected Ukrainian Drone Attack, in: Reuters from 21-01-2024, https://www.reuters.com/ world/fire-erupts-russias-novatek-baltic-sea-terminal-afterexplosions-heard-2024-01-21/, last accessed on: 18-07-2024.
- Pawlak, Julian (2024): Charting the Challenges in the Baltic Sea, in: War on the Rocks from 21-05-2024, https://warontherocks.com/ 2024/05/charting-the-challenges-in-the-baltic-sea/, last accessed on: 25-09-2024.
- Pawlak, Julian (2021): Bridge the Gaps— An Allied Naval Approach for Northern Europe, in: Julian Pawlak and Johannes Peters (eds.): From the North Atlantic to the South China Sea. Allied Maritime Strategy in the 21st Century, Nomos: Baden-Baden, pp. 163– 180.
- Petersen, Michael B. (2024): Russia's Navy and Naval Platforms, in: Mathieu Boulègue, Justin Bronk, Karolina Hird, Jaclyn Kerr, Rob Lee, Michael B. Petersen (eds.): Assessing Russian Plans for Military Regeneration. Modernization and Reconstitution Challenges for Moscow's War Machine, Research Paper, July 2024, Chatham House: London, pp. 29–35.
- Petersen, Michael B. (2023): Toward an Understanding of Maritime Conflict with Russia, in: Andrew Monaghan, Andrew and Richard Connolly (eds.): The Sea in Russian Strategy, Manchester University Press: Manchester, pp. 205–241.
- Redford, Duncan (2024): Maritime Lessons from the Ukraine-Russia Conflict: USVs and the Applicabil-

ity to the Baltic and High North, #GIDSstatement 11/2024.

- Reuters (2024): Germany, Eight Other Baltic Sea Nations Seek to Jointly Buy Naval Mines, 09-07-2024, https://www.reuters.com/ world/europe/germany-eightother-baltic-sea-nations-seekjointly-buy-naval-mines-2024-07-09/, last accessed on: 18-07-2024.
- Reuters (2023): The Danish Straits: Gateway for a Third of Russia's Seaborne Crude Exports, 15-11-2023, https://www.reuters.com/ business/energy/danish-straitsgateway-third-russias-seaborne-crude-exports-2023-11-15/, last accessed on: 18-07-2024.
- Siig, Kristina/Kilpatrick, Jr, Richard L. (2023): Why Denmark Can't "Block" Dark Tankers, in: EJIL: Talk! from 14-12-2023, https:// www.ejiltalk.org/why-denmarkcant-block-dark-tankers/, last accessed on: 18-07-2024.
- Stubbs, Bruce B. (2017): U.S. Sea Power Has a Role in the Baltic, U.S. Naval Institute Proceedings, Vol. 143 (9), pp. 46–51.
- Sutton, H I (2024): Overview of Maritime Drones (USVs) of The Russo-Ukrainian War, 2022-24, in: Covert Shores from 17-06-2024, http://www.hisutton.com/Russia-Ukraine-USVs-2024.html, last accessed on: 18-07-2024.
- Sutton, H I (2023): New Russian USV to Counter Ukraine's, in: Cover Shores from 14-12-2023, http:// www.hisutton.com/Russia-KMZ-BBKN-Dandelion-USV. html, last accessed on: 25-09-2024.
- Tallis, Joshua (2024): The Calm Before the Swarm: Drone Warfare at Sea in

the Missile Age, in: War on the Rocks from 31-07-2024, https:// warontherocks.com/2024/07/ the-calm-before-the-swarmdrone-warfare-at-sea-in-theage-of-the-missile/, last accessed on: 25-09-2024.

- Vego, Milan (2020): General Naval Tactics. Theory and Practice, Naval Institute Press: Annapolis, MD.
- Vego, Milan (2015): On Littoral Warfare, in: Naval War College Review, Vol. 68 (2), pp. 30–68.
- Vego, Milan (2003): Naval Strategy and Operations in Narrow Seas, 2nd Edition, Frank Cass: London.
- Vershinin, Alex (2024): The Attritional Art of War: Lessons from Russian War on Ukraine, in: RUSI from 18-03-2024, https://www.rusi.org/explore-our-research/publications/commentary/attritional-artwar-lessons-russian-warukraine, last accessed on: 18-07-2024.
- Warnar, Henk (2023): Ukraine and Russia in the Black Sea: a Naval War of Mutual Denial, in: Atlantisch perspectief, 04-2023, pp. 12–17.
- Yle (2023): Industrial Lobby Presses for Secure Alternative Shipping Routes, in: YLE News from 20-04-2023, https://yle.fi/a/74-20028034, last accessed on: 25-09-2024.
- Zafra, Mariano/Hunder, Max/Rao, Anurag/Kiyada, Sudev (2024): How Drone Combat in Ukraine Is Changing Warfare, in: Reuters from 26-03-2024, https://www. r e u t e r s . c o m / g r a p h i c s / UKRAINE-CRISIS/DRONES/dwpkeyjwkpm/, last accessed on: 18-07-2024.



The Wider Baltic Sea Region: Strategic Challenges and Opportunities in the Maritime Domain

Sweden joined NATO on 7 March 2024, assuming the responsibilities and rights that alliance membership entails. An acceleration of defence and security affairs and not least increased defence spending has followed. A rethinking and reorientation of Swedish naval and maritime strategy had begun a few years earlier and is now well underway, and will be further developed in the defence bill to be decided upon by Parliament in the late autumn of 2024.

The backdrop is the worsening security situation in Europe, arguably the most difficult since the end of the Second World War. The Nordic-Baltic region consists of a number of frontline nations, now members of NATO. The strategic situation in the Nordic-Baltic, North Sea, North Atlantic, and Arctic regions has shifted. While they are all central to security in the wider Nordic-Baltic-Arctic region, this article focuses particularly on the wider Baltic Sea region from the perspective of Sweden, covering the following aspects:

- The Baltic Sea, the North Sea and the High North as maritime operational areas – a maritime outlook;
- implications of hybrid and high-end conflict scenarios;
- how to manage the maritime domain of the Baltic Sea region
 the 'NATO lake debate';
- changes in Sweden's maritime posture and upcoming naval developments; and
- the country's long-term strategy.
- The Baltic Sea, the North Sea and the High North as maritime operational areas – a maritime outlook

Three areas in the Nordic-Baltic and Euro-Atlantic Arctic regions, indicated in figure 1, are of special naval and military interest. While these areas demand different mixtures of naval and military resources, the maritime domain plays a central role in all of them:

In the High North, long-term Russian strategic interests relate to the nuclear submarine capability based on the Kola Peninsula, plus the opening of the North Sea Route due to the rapid icemelt. This generates a Russian cylinder of interest centred on the Kola Peninsula that encompasses Finnish and Swedish Lapland and extends to Northern Norway, the Norwegian and Barents seas and west to Greenland. All

^{*} The Swedish Defence Research Agency, FOI, is a Swedish civilian government agency subordinated to the Ministry of Defence. The views presented in this article do not necessarily reflect the policies of the Government of the Kingdom of Sweden.



Fig. 1: The Baltic Sea, the North Sea and the High North as maritime operational areas – a maritime outlook.

naval and military activities within the cylinder that could possibly threaten what Russia sees as an existential capability generate tension. Simultaneously, protection in peacetime and defence in wartime of the territories and sovereign interests of Norway, Finland, Sweden and Denmark/Greenland generate a clear security dilemma in the High North. In the Arctic, new transoceanic Sea Lines of Communication (SLoCs) are gradually opening up as a result of the accelerating ice-melt.

The coastal states around the Baltic Sea proper constitute a vibrant region with strong economic life, linked by an equally strong dependence on seaborne trade with the rest of the world. All nations are heavily dependent on the sea for safe and secure SLoCs. All coastal nations of the region depend on an extensive network of infrastructure criss-crossing the Baltic sea-bed. Pipelines for natural gas, electric cables for importing and exporting electricity and sea-based wind power and, not least, telecommunication cables tie the region together, contributing further to regional complexity and sensitivity. Seaborne trade across the Baltic Sea has increased substantially in the last few decades. Around 4,000 ships pass through the Baltic Sea on a daily basis. The geography dictates much of the operating environment in the Baltic Sea. Complicated and shifting hydrography, the shallowness of the sea, nautically complex archipelagos and seasonal ice-cover present mariners venturing into the Baltic Sea with ample challenges. The narrowness of the sea also means that operations in the maritime domain overlap with the air domain in particular as well as with the land domain. In short, the Baltic Sea is complex, confined, congested and contested.

The Danish and Swedish Sounds connect the Baltic Sea to the Kattegat, Skagerrak, the North Sea and the North Atlantic. Several major ports act as hubs for much of the regional trade in the Nordic-Baltic region. The port of Gothenburg on the Swedish west coast, the largest port in Scandinavia and Norway's biggest port, stands out in this respect.

As far as potential lessons from the Black Sea are concerned, a few points deserve mention: Since Russia's fullscale attack in February 2022, the maritime forces of Ukraine have successfully pushed the Russian Black Sea Fleet out of the north-western and western Black Sea. The main naval base at Sevastopol on the Crimean peninsula has been practically rendered unusable, and Ukraine's seaborne export routes have reopened. Russian naval losses are extensive. The ongoing open conflict involves rapidly maturing new technologies as well as creative tactical and operational concepts and will likely affect the conditions for future naval combat, perhaps decisively. Openly accessible data on the war at sea is difficult to acquire - as with all conflicts, operational security and deception play a major role in this war, too.

How the blend of old and new will be incorporated into naval warfare and its precise impact on the future structure and tactics of navies and other maritime forces is still an open question.

1 Hybrid and high-end conflict scenarios

One way of analysing the wider Baltic Sea region is by using scenarios. Two types of these stand out, focusing on hybrid and high-end conflicts.

1.1 A hybrid scenario for the wider Baltic Sea region

The strong dependence on seaborne trade of all the Baltic Sea nations, including Russia, frames much of the circumstances for safety and security at sea in the wider Baltic Sea region. All nations in the region depend heavily on both imports of food and intermediate goods and exports of manufactured goods. In many ways, the region resembles an island. Much of the local production depends on a just-in-time system for import and export. Stockpiles of intermediate goods are very limited. As impressive as the system is, it is also vulnerable to physical as well as non-physical interference, influence and sabotage.

Hybrid threats have been discussed extensively in recent years, and definitions vary. For the purposes of this brief analysis, a hybrid scenario is when a state or non-state actor attempts to disturb and/or influence the flow of goods and people, preferably without resorting to physical force and without attribution in order to reach operational and strategic goals. Ideally, the attacked party does not detect such attacks or recognise them as a coordinated operation until it is too late.

In case of a hybrid attack, the need to scale up resources for surveillance and protection would rapidly increase. Interagency, inter-service and international cooperation will be central to enhance situational awareness and take timely countermeasures. A substantial part of the surveillance and protection efforts would involve maritime forces. All estimates indicate that these tasks will be both resource-demanding and time-consuming.

Such a hybrid threat scenario in the wider Baltic Sea region is no longer hy-

pothetical; it is in fact already a reality. The past few years have seen an increase in acts of sabotage, beginning with the Nord Stream 2 pipeline explosion in September 2022. More recently, there have been attempts to sabotage pipelines in the Gulf of Finland, and submarine telecommunication cables have been damaged. The picture that has emerged in recent months also includes interference with GPS navigation systems and cyberattacks, causing increased risks to air traffic as well as maritime safety. In addition, there have been Russian attempts at redrawing maritime borders in the Gulf of Finland and between Lithuania and the Kaliningrad exclave as well as endeavours to remove Estonian buoys demarcating the Russo-Estonian border in the Narva river. Refugees have been weaponised and sent towards the Norwegian, Finnish, Baltics' and Polish land borders in attempts at destabilisation. Probing incursions by Russian aircraft into Swedish and Finnish airspace are recent additions to this mix of hybrid activities. Clearly, Russia is using all available means at its disposal in a coordinated effort to destabilise the region.

The developing hybrid situation in the Baltic Sea was met by counter-operations in late 2023 by the Joint Expeditionary Force Framework (JEF), activating one of the JEF Response Options in the Baltic Sea in order to increase the risk of apprehension and strengthen deterrence. This exemplifies the role of the JEF framework and its cooperation with NATO in hybrid scenarios below the Article 5 threshold.

As a follow-on effect of Russia's war against Ukraine, a Russian shadow fleet of over 400 ships has appeared, attempting to circumvent western sanctions on Russian oil and gas exports. Uninsured, often poorly maintained and operating without pilots, these ships sail in the shallow, confined and complex waters of the Baltic Sea, its approaches and elsewhere.

Much, if not all of the different hybrid activities so far have emanated from Russia and its state and non-state proxies and accomplices. Russia now acts as a rouge state with little or no regard for maritime safety. It seems likely that more escalation will follow, not limited to the wider Baltic Sea region.

This state of affairs with an ongoing hybrid conflict is, in all probability, here to stay for the longer term. How to manage this much more difficult operational environment below the threshold of NATO's Article 5 will remain a challenge to the western world.

1.2 A High-end scenario for the wider Baltic Sea region

In a high-end scenario, an armed attack from Russia aimed at the High North and/or the wider Baltic Sea region with the ultimate goal of resurrecting and re-imposing some version of a Russian empire activates NATO's defence plans. A movement of units and assets from west to east across the North Atlantic, over the North Sea and across the Baltic Sea to reinforce, support and resupply the allied member states in the east would follow.

Geography and logistic capacity dictate that a substantial part of these assets would need to be transported by sea via safe and secure SLoCs. In northern and western Scandinavia, units would arrive in Norwegian, Swedish and Danish ports for further movement east and north. Units could also be transported directly to ports of debarkation on the eastern and northern shores of the Baltic Sea. Medical evacuation operations and the transport of refugees and damaged equipment in need of repair in the opposite direction would also require sea-based transportation, at least in part.

This scenario presents a series of serious challenges to maritime forces of the alliance. How to provide for safe and secure SLoCs in an ongoing open conflict over time in order to sustain troops on the frontline in the east?

2 The NATO lake debate

A recurring theme in the debate on maritime security for the wider Baltic Sea region is that, since all like-minded nations in the Nordic region are now members of NATO, the Baltic Sea can be considered a safe 'NATO lake'. Supporters of this view have argued that the Russian Baltic Sea Fleet is, at last, confined to the Kaliningrad exclave and Kronstadt naval base in the innermost part of the Gulf of Finland. However, the NATO lake concept is problematic for at least four reasons:

First, it could create the false impression that the problems of deterrence in the Baltic Sea region vis-á-vis Russia are now solved or at least manageable. NATO's efforts to promote stability and enhance deterrence in the Baltic Sea region could be given a lower priority in view of pressing operational needs elsewhere. The risk is that, over time, allied naval presence in the wider Baltic Sea region could dwindle in favour of other urgent priorities. Russia could interpret this as a gap in NATO's deterrence posture, which could encourage further Russian adventurism, leading to open conflict.

Second, a dwindling allied naval presence involving fewer assets from outside the region could eventually lead to a loss of expertise on conditions in the wider Baltic Sea region. Should a crisis arise and the need for additional allied naval forces in the Baltic Sea region become paramount, weakened deterrence could be the result in a hybrid scenario as well as in a high-end conflict.

Third, to uphold a NATO lake concept over time, substantial resources for seacontrol tasks would be needed continuously. It is difficult to see how this could be achieved cost-effectively, if at all. Sea power assets are a scarce resource.

Finally, designating the Baltic Sea as a NATO lake runs counter to the longstanding interests of Sweden and other Baltic Sea nations in keeping Sea lanes of communication open and safe for seaborne trade for as long as possible.

To sum up, the Baltic Sea is not a NATO lake, but control of the SLoCs in the region remains a central operational task for NATO's efforts toward collective defence in the hybrid situation we now find ourselves in as well as in a potential high-end conflict.

With this dual policy, NATO could send a signal to Russia that the Baltic Sea region is open to all, that NATO strives for safe and secure seaborne trade in peacetime, and that the alliance is prepared and capable of providing effective sea control in crisis and war.

In case of a Russian escalation, trade in the region would be restricted or even curtailed. This would complicate matters for all Baltic Sea nations, but most of all for Russia itself. Ideally, Russia should interpret NATO's posture as a 'this is the best you will get' message: As long as Russian behaviour in the region complies with agreed international rules and norms, its seaborne trade will not run the risk of interruption. In case of a Russian escalation, however, a credible plan underpinned by adequate resources for providing effective sea-control will be activated.

We should not forget Russia's own vulnerabilities: about half of Russia's seaborne trade runs through the Baltic Sea.

3 Changes in Sweden's maritime posture and upcoming naval developments

Sweden is the most recent member of the NATO alliance, and its maritime and naval policy is undergoing a number of changes. Its background, direction and future are relevant for the analysis of regional security.

Developments in recent years have led Sweden to widening its geographic focus in the maritime domain, adding areas of naval and maritime operational interest beyond the Baltic Sea. Moreover, the Royal Swedish Navy is transforming from a navy with a near exclusive sea-denial focus into one navigating a sea-control context within the alliance framework. This has clear implications for its structure, size, posture, operational stance and technology.

There is also a growing realization within policy-making circles that not only Sweden's seaborne trade is becoming increasingly vulnerable, but also that of the other Nordic and Baltic nations. As a result, the North Sea, Kattegat, Skagerrak, and the Baltic approaches have gained in importance, as have the North Atlantic and the High North. In an alliance context, this means that maritime operations off the Swedish west coast and out into the North Sea, and possibly further away, will become part of the operational pattern.

The ongoing change in naval and maritime thinking is not limited to Sweden. Naval forces in and around the Baltic Sea region are all in different stages of modernizing, upgrading and expanding their capabilities after a long post-Cold War hiatus. This trend creates bottlenecks for production and construction and leads to the question of how – and if – economies of scale can be achieved in procurement. In the past, there used to be plenty of time, and almost no funding. Today, there is more funding, but time is short.

The direction of Swedish procurement has begun to reflect both the broader geographical focus and the worsening maritime threat picture.

A new class of frigates equipped to perform air defence tasks - the Luleåclass - is being developed; it will have the range, seakeeping abilities and armaments required for tasks in maritime alliance operations in the Baltic Sea region, the North Sea and beyond. In terms of size and capabilities, this class of frigates is something that the Royal Swedish Navy has not had for over 50 years. The current corvettebased surface combatants are going through mid-life upgrades or life-extension programmes. A new class of submarines - the Blekinge-class - is under construction, and the Gotland-class submarines have received mid-life upgrades. The amphibious corps is being modernized, expanded and upgraded. The current amphibious tactical concept is designed to deny an attacker access to the Swedish archipelagos by fires from land to sea. The concept now being introduced aims to transfer the weapon systems (anti-ship missiles, surface-to-air missiles, sea-mines and mortars) onto new types of boats, in effect turning them into an archipelago fleet. A corresponding increase in naval logistic capabilities for the Royal Swedish Navy matches these developments.

Like Finland, Sweden operates an icebreaker fleet tasked with keeping the Baltic Sea lanes open year-round. The fleet, which is currently undergoing a renewal process, will thus take up the role again that it used to perform during the Cold War. In addition, a new high-end research icebreaker is under development for polar operations.

These ongoing structural upgrades and modernisations to the Royal Swedish Navy and the icebreaker fleet will mostly take effect from the late 2020s. The question should be asked what could be done in the immediate timeframe, given the rapidly deteriorating general security situation and current hybrid activities.

4 Sweden's long-term strategy

At the time of writing, Sweden has been a member of NATO for a little over four months. Its accession was the result of a profoundly changed military-strategic situation. Alliance membership has accelerated and intensified the country's reorientation in defence and security affairs.

Current Swedish defence and security policy is designed to promote and support Swedish long-term interests and can be described as a new variant of a policy Sweden has conducted since the end of the Napoleonic wars. In the face of shifting external threats, longterm security arrangements are updated and adapted to changes in strategic circumstances. Small-state realism is a term often used to describe this policy. In NATO, Sweden will act loyally and constructively, aiming to support and promote its long-term national interests in the Northern European region and beyond.

Given the deteriorating security situation, maritime forces are likely to play a key role in the defence efforts of Sweden – along with the other services – in order to address current and future threats and ensure safe and secure seaborne trade. In case of a high-end conflict, maritime forces will be central for the support, reinforcement and resupply of eastern NATO members.

In order to enhance conventional deterrence and address the ongoing hybrid threat, Sweden and several of the other Baltic NATO nations wish for a continuous allied naval presence in the wider Baltic Sea region. This will support a credible concept for highend conflict and act as a deterrent. For reasons of credibility, this will also mean that, in addition to the Baltic Sea, Swedish naval presence is likely to increase in the Skagerrak, Kattegat and the North Sea as well. The purpose is to ensure safe and secure SLoCs in the wider Baltic Sea region, enhance protection of critical seabed infrastructure and contribute to maritime safety. This will be done within an alliance context.

The ongoing reorientation of Swedish naval strategy points to the emergence of a more relevant naval structure to address threats over a broader conflict spectrum in the wider Baltic Sea region. The many capability gaps that have emerged over the past 25 years as a consequence of strategic optimism are gradually being filled.

A more capable Swedish maritime force is underway with increased operational range, modernised tactical concepts and improved armaments. Gradually, this more capable naval force will be integrated into alliance structures. This will provide the Government of Sweden with a more flexible instrument for naval power projection also further away from traditional home waters, within an alliance context as well as in other cooperative arrangements.

The advantage of having a coherent forum – NATO – to discuss, address, and provide solutions to strategic as well as operational problems, to conduct counter-hybrid operations and to prepare credible high-end operations cannot be overestimated. A positive effect on maritime security in the region will follow, ensuring free-flowing and safe seaborne trade by countering ongoing hybrid operations and deterring Russian aggression.



Part III: The Arctic



In Times of Trump 2.0: Turning Point in the Arctic

According to climate researchers, the speed of today's global warming is unprecedented compared to the natural global temperature increases that occurred in the earth's history. Global warming is progressing at an above-average rate, especially at the North and South Poles.

In the past, the Arctic was covered by thick perennial sea ice. According to the Intergovernmental Panel on Climate Change, it is very likely that the extent of the Arctic sea ice will continue to decrease all year round. In fact, the average thickness of sea ice in the Arctic has decreased from more than three metres to less than two over the past 30 years, and old ice, i.e. multi-year ice (MYI) covered by snow from past winters, is disappearing. A study published in 2024 concludes that since 2007, the Arctic has transitioned significantly from a perennial, multi-year ice regime (thus, old ice) to a seasonal first-year ice regime (in other words, young ice).¹ US climate researcher Mark Serreze. Director of the National Snow and Ice Data Center (NSIDC), has described this development as the 'Arctic death spiral'.²

As a result, it becomes more and more likely that in the future we will have an ice-free Arctic and an Arctic Ocean that is covered by less than one million square kilometres of sea ice. It seems possible that the Arctic could see its first ice-free summer day even before 2030³ – and not in the mid-2030s or at the end of the century, as projections have suggested so far.⁴ Climate change, however, not only has devastating consequences for the biosphere. In the future, it will also allow for increasing – though not necessarily easier – access to the northern polar region, Arctic sea routes and resources.⁵ This will add to the region's geopolitical significance as it links the Atlantic with the Pacific.

In May 2019, during Donald Trump's first term in office (2017-2021), Secretary of State Mike Pompeo elevated the Arctic to a geopolitically significant 'arena' in the struggle for power and influence, and announced the dawning of 'a new age of strategic engagement in the Arctic⁶ This eloquent yet premature exaltation of the Arctic was followed by strategy papers from branches of the armed forces containing many generalities, albeit few concrete measures and no priorities.⁷ In a June 2020 memorandum, President Trump called for a 'strong Arctic security presence'. This included a 'fleet of polar security icebreakers' that was to be 'fully deployable by Fiscal Year 2029'.⁸ In fact, work on the first

- **5** For further detailed information see Paul 2022: 25–30.
- 6 Pompeo 2019.
- **7** Paul 2023: 2.
- 8 Trump 2020.

¹ Cook et al. 2024: 2.

² Serreze quoted in Wadhams 2016: 84.

³ Heuzé/Jahn 2024: 1.

⁴ Paul 2022: 25–30.

Polar Security Cutter (PSC-1), USCGC Polar Sentinel, began at a Mississippi shipyard in August 2023.9 However, this first new heavy icebreaker is not expected to be handed over to the Coast Guard before 2030 as the shipyard has underestimated the time required for complex design modifications. If construction continues at its current pace, completion of the second and third PSC could take until 2040.¹⁰ With the delivery of the fleet delayed, it can be assumed that Trump will have to rely on the Icebreaker Collaboration Effort (ICE) Pact promoted by his predecessor in order to establish a minimum presence of icebreakers as soon as possible.

The ICE Pact signed on the sidelines of the NATO Summit in July 2024 is a trilateral arrangement between the United States, Canada and Finland aimed at accelerating icebreaker shipbuilding. Canada's largest shipbuilder Davie, which owns Helsinki Shipyard in Finland, intends to invest in longterm projects in the United States. A US government representative said that they expect allies to build between 70 and 90 icebreakers over the next decade.¹¹ With the support of its allies and partners, the United States seeks to ensure a continuous presence in the Arctic.¹² With a global market share of

- **10** The original design of *Polar Sentinel* was based on the German icebreaker *Polarstern*. See Congressional Research Service 2024: 6; Humpert 2024.
- 11 Ritchie 2024.

0.13 percent, the US shipbuilding industry has already been left far behind by Asia, and the lack of icebreakers is just one part of the crisis the US shipyards are in.¹³ It remains to be seen whether and to what extent ideas from the first Trump administration will be reconsidered, and whether a first icebreaker will be built in Finland, for example. This time, however, tangible measures will be required to remedy this embarrassing state of affairs.

The conclusion reached by the United States that an increased presence in the Arctic is necessary results from the fact that both the situation and the perception of threats have changed. In March 2020, General Terrence O'Shaughnessy, Commander of the North American Aerospace Defense Command (NORAD), stated in Congress: 'The Arctic is no longer a fortress wall, and our oceans are no longer protective moats'.¹⁴ According to the U.S. Air Force's Arctic Strategy, the Arctic is part of both North America (U.S. Northern Command, USNORTHCOM) and the Indo-Pacific (U.S. Indo-Pacific Command, USINDOPACOM), highly important areas.¹⁵ In fact, all branches of the American armed forces and three of the most important combatant commands - including US-NORTHCOM, USEUCOM (U.S. European Command) and USINDOPACOM - consider the Arctic, in whole or in

15 U.S. Air Force 2020.

⁹ LaGrone 2023.

^{12 &#}x27;We're committed to projecting power into the high latitudes alongside our allies and partners. And, that requires a continuous surface presence in the polar regions, both to combat Russian aggression and to limit China's ability to gain influence.' (Daleep Singh, White House

Deputy National Security Advisor for International Economics, cited in Madhani/Santana 2024).

¹³ Kennedy et al. 2024.

¹⁴ From the statement of General Terrence O'Shaughnessy (ret.) before the United States Senate Committee on Armed Services in February 2020, quoted in Monga/ Vieira 2021.

part, as a portion of their military area of responsibility. Experts from the German Marshall Fund criticise that this 'complicate[s] the implementation of an integrated strategic mission'¹⁶ as the Arctic is becoming increasingly important for all major powers bordering the Atlantic Ocean and the (Indo-)Pacific as regards their efforts to project military power.

1 China's Arctic Ambitions

Unlike Washington, Beijing has already demonstrated its high level of Arctic ambition. In July and August 2024, three icebreakers - Xuelong 2, Ji Di and Zhong Shan Da Xue Ji Di – made China's presence in the Arctic felt for the first time, while USCGC Healy, the only American icebreaker available, had to cut its Arctic mission short due to an engine room fire. The construction of another heavy icebreaker is intended to enable China 'to operate year-round in polar environments for in-depth scientific research missions and obtain the capabilities of full-area and all-time entry,' said Wu Gang, chief designer of Xuelong 2.¹⁷

Beijing sees the Arctic as a geopolitically important area that will gain significance in the long term. As in the Pacific, Beijing can test the limits of its global ambitions and see whether new norms will be accepted there. As regards the Arctic Council, China is thus considered by some as being 'overwhelmingly the most active' observer country.¹⁸ Given that the Arctic is not as regulated as the Antarctic, it provides a good testing ground. However, attempts to acquire land in Finland, seaports in Norway and Sweden, or airports in Greenland have all failed.¹⁹ And while the amount of Chinese direct investment in Russia is increasing, it remains at a low level in the non-Russian Arctic.²⁰ Also, Chinese investors close to state interests continue to try to buy land in the Arctic, most recently in June 2024 in Søre Fagerfjord, an area of 60 square kilometres (including the island of Reinholmen) south of Longyearbyen on the Svalbard archipelago.²¹ However, there is a 'lively debate²² under way in China about the benefits of such acquisitions.²³

The fragile balance between the Arctic states and the emerging superpower China is particularly evident in science diplomacy. The Arctic states, on the one hand, are trying to integrate China without conflict through research cooperation and to get the country to commit itself more to international standards. China, on the other hand, 'is striving to expand its position as an independent player without raising concerns in the Arctic states.²⁴ An example of China's commitment in the region is the research station it has been operating in Ny-Ålesund on Svalbard since 2004. Since 2018, the Icelandic Centre for Research (Rannís) and the Polar Research Institute of China (PRIC) have jointly operated the research station China-Nordic Arctic Research Center (CNARC) as well as an aurora observatory (the China-Iceland Arctic Observatory, CIAO) in Kárhóll to

21 Milne 2024.

¹⁶ Conley et al. 2023: 19.

¹⁷ Shumei/Yuandan 2024.

¹⁸ Paul 2024b.

¹⁹ Paul 2022: 131, 134 f., 138 f.; Paul 2024a: 23.

²⁰ Wolfson et al. 2022: 9.

²² Kardon 2021: 77.

²³ Ibid.: 74.

²⁴ Paul 2024b: 2.

the east of Akureyri. Yet there are limits to such cooperation: The proposal to establish a similar research station in Greenland was rejected by Denmark 'for security concerns'.²⁵ However, China's investments in scientific infrastructure, such as those in Iceland, are often welcomed as they serve to establish a presence and build trust – which are both important steps in China's strategy for gaining influence in the Arctic. But the attitude towards such activities has changed. In Iceland, China's scientific presence is increasingly criticised as it 'is not without intent.²⁶ Following its Civil-Military Fusion strategy, China could use these initiatives for military purposes and thus pursue objectives that go beyond purely civilian scientific ones.²⁷

2 Sino-Russian Cooperation

During Xi Jinping's state visit to Moscow in March 2023, it was agreed to create a joint umbrella organisation for shipping traffic on the Northern Sea Route (NSR).²⁸ This was the basis for the agreement between the China Coast Guard and Russian border guards concluded in Murmansk in April 2023 with the aim of cooperating in the NSR. The Murmansk Memorandum mentions joint efforts in the fight against terrorism, illegal migration, smuggling and illegal fishing. In this context, Moscow criticised the fact that Western Arctic states had indefinitely suspended cooperation in the Arctic Coast Guard Forum (ACGF). Consequently, China was invited to an exercise that previously would have included ACGF members such as Norway.²⁹ The first joint patrol in the NSR took place in October 2024. China's Coast Guard stated on the media platform Weibo that this first operation in the Arctic Ocean had 'effectively expanded the scope of the Coast Guard's maritime deployment, thoroughly tested the ships' ability to carry out missions in uncharted waters, and strongly supported active participation in international and regional maritime governance'.³⁰ If more and more Chinese ships are using the NSR, does this mean it is now an international waterway? Is it also open to other countries? The increased cooperation between the two countries raises many questions that are neither pleasant nor easy for Russia. Furthermore, it puts a different perspective on Russia's former nationalist claim to power over the NSR.

Therefore, particular attention is being paid to Chinese-Russian military cooperation. However, bilateral relations at the civilian and military levels are as close as they are contradictory. Since Soviet times, Russia's armed forces have been an important source for the Chinese military in terms of providing doctrinal, operational and military technology experience. They still have an edge, which they gained over decades from studying the United States. And yet, knowledge of underwater communication and navigation is not always shared voluntarily. In June 2020, Russia accused China of having lured a Russian citizen into espionage: The researcher who fell under suspicion was accused of having passed documentation on Russian hydroacoustic



²⁵ Ibid.

²⁶ Ibid.: 3.

²⁷ Ibid.

²⁸ Humpert 2023.

²⁹ Nilsen 2023.

³⁰ Edvardsen 2024; Shkolnikova 2024.

work in the Arctic on to China. Research on underwater acoustic propagation can be used to explore submarine resources, identify submarines, and build low-noise submarines.³¹

The visit of the Chinese Defence Minister Li Shangfu to Moscow in April 2023 was another indication of the increased military cooperation between China and Russia. In the future, the Chinese Navy, which operates globally and stands to gain even more access to Russian military technology, could make greater use of both the NSR and the Maritime Silk Road (MSR). China still has shortcomings, especially in the development of submarine propulsion technology, sensors and anti-submarine techniques, which could be remedied with Russian support. Also, it remains to be seen whether China and Russia will expand their alliance even beyond the cooperation of their navies. Chinese Defence Minister Li said at the meeting with both President Putin and Russian Defence Minister Shoigu that the ties between the countries 'surpass the military-political alliances of the cold war era'.³² According to Putin, the elements of the Russian-Chinese military cooperation consist of the exchange of information, military-technical cooperation and joint exercises.³³ In 2023, a US study team found that, although political and military consultation mechanisms had been developed between Russia and China over the past

- 32 Li cited in Bräuner 2023.
- 33 Reuters 2023.

20 years, military-technical cooperation and joint military activities had not been expanded. Joint projects include a conventional submarine, tactical missiles and Russian support in the development of an early warning system for missile launches. With aircraft engines being 'the one major exception', China is now able to produce nearly all of its military equipment itself.³⁴

The US Navy also expects 'increased Chinese Navy deployments on, below and above Arctic waters'.³⁵ Beijing could use submarines in the Atlantic and in the Arctic Ocean to secure its position as a global military power. China could then directly threaten the United States from the Arctic, which would not only challenge Russia's supremacy in the region, but could also provoke dangerous countermeasures from the United States against Russia. However, Chinese submarines carrying out submerged operations cannot pass the Bering Strait at great water depth as their commanders have neither the experience nor the appropriate technology to do so - though the latter could be developed with Russian support, as mentioned above.

3 Perspectives

Far from having been long-planned or long-awaited, the Sino-Russian cooperation in the Arctic is, first and foremost, a pragmatic endeavour that is in line with Beijing's plans for the region and has so far corresponded with the ideas of the Kremlin as to how to develop and use the Russian Arctic. In ad-

³¹ The fact that the former president of Russia's Arctic Academy of Sciences was arrested and charged with treason for passing on state secrets to Chinese intelligence is a sign of deep mistrust between the two countries. Cf. Simmons 2020.

³⁴ Gorenburg et al. 2023.

³⁵ U.S. Navy 2020: 8.

dition to the use of fossil energy, this partnership of convenience serves other mutual interests concerning the social and economic development in the Arctic and far eastern regions of Russia and China's northeastern provinces. Since June 2023, this also includes the Pacific Arctic given that Russia opened up the home port of its Pacific fleet, 'gatekeeper' to the NSR, in Vladivostok³⁶ to Chinese commercial – and later military - activities. This raises security questions for the United States regarding the Aleutian Islands and the North Pacific Sea Route, particularly the Bering Strait. In addition, Japan is also affected by Russia's military presence on the Kuril Islands, which has been boosted by the deployment of weapons and troops over the recent years.

The war in Ukraine has weakened Russia and made it dependent on China. Moscow has tried to compensate for personnel and logistical shortcomings by drawing on support from the pariah state North Korea. However, this also puts China in a difficult position because it adds to the trend of rapprochement between North Asian states and NATO. The Atlantic and Pacific Arctic regions are increasingly linked by various maritime conflicts and risks of escalation.³⁷ Therefore, the United States will have to push ahead with the construction of icebreakers in order to be present in the Arctic - although, given the lack of capacity, the US will also depend on the support of new NATO allies such as Finland.

Germany is not an Arctic state like Norway, and unlike the emerging superpower China, which has described itself as a 'Near Arctic State', it does not claim any relevance in the Arctic. Therefore, the question arises as to why a European middle power is interested in the Arctic in the first place. Up until the Russian war of aggression, Germany's interest was primarily focused on scientific questions such as how climate change is affecting the Arctic and what we can learn from it. In addition, Germany as an economic power is dependent on free access to sea routes and resources - also with a view to securing its supply chains. Russia's war in Ukraine has changed Germany's focus in this respect, too, and inevitably drawn its attention to the militarystrategic significance of the Arctic-North Atlantic region. What is more, there are acts of sabotage against underwater infrastructure in the European North Sea and the Baltic Sea by ships owned by Chinese companies and the Russian 'shadow fleet' as well as espionage activities by Russian research vessels to contend with. The German-Norwegian cooperation in the construction of submarines is similar to the planned US-Finnish cooperation on icebreakers: it is a specific measure to give due attention to a strategically important area.

President Trump's renewed 'offer' to buy Greenland is based on a security argument that refers to the 'securitisation' of this increasingly geopolitically important area, but is essentially out of place. Greenland is not under threat, and neither does it pose a threat. The United States, by contrast, have had all possible options to ensure military security in Greenland since 1951. The doors are also wide open for investors,

36 Robson 2023.

³⁷ Paul 2024b: 4.



which shows that Trump's rhetoric is, once again, flawed and unnecessarily aggressive. Germany and its allies must find ways to deal with this new situation and set their strategic priorities accordingly.

4 Recommendations

First and foremost, the author of this text, a veteran researcher, strongly recommends to attract more researchers studying the Arctic and its complex challenges and to create jobs for them. Even Denmark, as an Arctic state, has too little security expertise. In Germany, Arctic experts have long focused on the scientific side of things (which is certainly not intended as a criticism of the very meritorious work of the Alfred Wegener Institute). So, there is still much to be done for research institutes and universities.

In terms of foreign policy, Germany will have to strengthen and expand its cooperation with the Arctic states if it wants to be a relevant player in the Arctic-North Atlantic region and ensure its security. Germany must intensify its cooperation not only with Denmark, Finland and Sweden (in the Baltic and North Seas and beyond), but also with Iceland, Canada, Norway and the United States. Furthermore, it should promote closer relations and understanding with non-Arctic states such as France, Great Britain and Japan as well as South Korea.³⁸ In terms of security, Germany needs better and more comprehensive situation pictures. In the future, German maritime patrol aircraft will probably not only operate from

Lossiemouth in the far north of Scotland, but will also be able to use the Kangerlussuaq airfield in Greenland for surveillance flights between the Barents Sea and the GIUK gap. This is a first step, but Germany will have to invest even more in sensors and effectors suitable for the Arctic-North Atlantic region in the future.

List of References

- Bräuner, Viktoria (2023): Peking baut Militärkooperation mit Moskau aus, in: Tagesspiegel dated 18-04-2023.
- Congressional Research Service (2024): Coast Guard Polar Security Cutter (Polar Icebreaker) Program: Background and Issues for Congress, Washington, DC: Congressional Research Service (RL34391).
- Conley, Heather A./Boulègue, Mathieu/ Arts, Sophie/Berzina, Kristine Defending America's (2023): Northern Border and Its Arctic Approaches Through Cooperation With Allies and Partners, Washington, DC, in: Center for Strategic and International Studies dated 17-08-2023, https:// www.gmfus.org/sites/default/ files/2023-09/Defending%20America%E2%80 %99s%20Northern%20Border%202023%20%289-15-23%29 0.pdf, last accessed on: 18-12-2024.
- Cook, Alison J./Dawson, Jackie/Howell, Stephen E. L./Holloway, Jean E./ Brady, Mike (2024): Sea ice choke points reduce the length of the shipping season in the Northwest

³⁸ The author has previously proposed the establishment of an Arctic Security Stakeholder Roundtable.

Passage, in: Communications Earth & Environment 5 (362), p. 2.

- Edvardsen, Astri (2024): China's Coast Guard on First Patrol in the Arctic With Russia, in: High North News dated 04-10-2024, https://www. highnorthnews.com/en/chinascoast-guard-first-patrol-arcticrussia, last accessed on: 18-12-2024.
- Gorenburg, Dmitry/Wishnick, Elizabeth/ Schwartz, Paul/Waidelich, Brian (2023): How Advanced Is Russian-Chinese Military Cooperation?, in: War on the Rocks, dated 26-06-2023, https://warontherocks. com/2023/06/29000/, last accessed on: 27-02-2025.
- Heuzé, Céline/Jahn, Alexandra (2024): The first ice-free day in the Arctic Ocean could occur before 2030, in: Nature Communications 15 dated 03-12-2024, https://www. nature.com/articles/s41467-024-54508-3, last accessed on: 18-12-2024.
- Humpert, Malte (2023) "Putin and Xi Discuss Further Deepening of Arctic Partnership", in: High North News dated 24-03-2023, https://www. highnorthnews.com/en/putinand-xi-discuss-further-deepening-arctic-partnership, last accessed on: 18-12-2024.
- Humpert, Malte (2024): Icebreaker 'Aiviq' to Join U.S. Coast Guard Before End of Year to Bolster Arctic Presence, in: gCaptain dated 14-11-2024, https://gcaptain.com/icebreaker-aiviq-to-join-u-s-coastguard-before-end-of-year-tobolster-arctic-presence/, last accessed on: 18-12-2024.
- Kardon, Isaac B. (2021): China's Overseas Base, Places, and Far Seas Logistics, in: Joel Wuthnow, Arthur S. Ding, Phillip C. Saunders, Andrew

GDS

Scobell and Andrew N. D. Yang (eds.), The PLA Beyond Borders. Chinese Military Operations in Regional and Global Context, National Defense University Press: Washington, DC, pp. 73–105.

- Kennedy, Mark/Pincus, Rebecca/Moyer, Jason C./Exner-Pirot, Heather/ Larres, Klaus/Parameswaran, Prashanth (2024): 360° View of America's "ICE Pact" Polar Icebreaker Partnership with Canada and Finland, in: Wilson Center dated 16-07-2024, https://www. wilsoncenter.org/article/ 360deg-view-americas-ice-pactpolar-icebreaker-partnershipcanada-and-finland, last accessed on: 18-12-2024.
- LaGrone, Sam (2023): Bollinger Cuts First Steel on Polar Security Cutter, in: USNI News dated 09-08-2023, https://news.usni.org/ 2023/08/09/bollinger-cutsfirst-steel-on-polar-securitycutter-polar-sentinel, last accessed on: 18-12-2024.
- Madhani, Aamer/Santana, Rebecca (2024): US, Canada and Finland look to build more icebreakers to counter Russia in the Arctic, in: AP News dated 11-07-2024, https:// apnews.com/article/unitedstates-canada-finland-icebreakers-4ceb4811c0ecd4b6511 73aa276a8a83c, last accessed on: 18-12-2024.
- Milne, Richard (2024): Oslo Blocks Arctic Property Sale on National Security Grounds, in: Financial Times dated 02-07-2024.
- Monga, Vipal/Vieira, Paul (2021): U.S., Canada to Upgrade Joint Defenses, in: Wall Street Journal dated 01-03-2021.
- Nilsen, Thomas (2023): FSB signs maritime security cooperation with

China in Murmansk, in: The Barents Observer dated 25-04-2023, https://www.thebarentsobserver.com/security/fsb-signs-maritime-security-cooperationwith-china-in-murmansk/1629 66, last accessed on: 18-12-2024.

- Paul, Michael (2022): Der Kampf um den Nordpol. Die Arktis, der Klimawandel und die Rivalität der Großmächte, Verlag Herder: Freiburg/Basel/Wien.
- Paul, Michael (2023): U.S. Arctic Security Policy. North American Arctic strategies, Russian hubris and Chinese ambitions (SWP Comment 2023/C 40), Berlin: Stiftung Wissenschaft und Politik [German Institute for International and Security Affairs].
- Paul, Michael (2024a): Grönlands arktische Wege zur Unabhängigkeit. Kalaallit Nunaat, das Königreich Dänemark und die Vereinigten Staaten (SWP-Studie 2024/S 22, October 2024), Berlin: Stiftung Wissenschaft und Politik [German Institute for International and Security Affairs].
- Paul, Michael (2024b): China's Arctic Turn. Reasons, Developments, Perspectives (SWP Comment 2025/C 08, February 2025), Berlin: Stiftung Wissenschaft und Politik [German Institute for International and Security Affairs].
- Pompeo, Michael R. (2019): Looking North: Sharpening America's Arctic Focus (Speech), Rovaniemi, in: White House Archives dated 06-05-2019, https://2017-2021.state.gov/looking-north-sharpening-americas-arctic-focus/, last accessed on: 18-12-2024.
- Reuters (2023): Putin, Chinese defense minister hail military cooperation, in: Reuters dated 16-04-2023,

https://www.reuters.com/wo rld/putin-meets-chinese-defence-minister-hails-militarycooperation-2023-04-16/, last accessed on: 27-02-2025.

- Ritchie, Sarah (2024): Canada to work with Finland, U.S. on 'ice pact' to build icebreakers, in: CTV News dated 11-07-2024, https://www.ctv news.ca/canada/article/canadato-work-with-finland-us-onice-pact-to-build-icebreakers/, last accessed on: 18-12-2024.
- Robson, Seth (2023): Russia welcomes Chinese shipping to Far East port for first time, in: Stars and Stripes dated 17-05-2023, https://www. stripes.com/theaters/europe/ 2023-05-17/russia-china-shipping-vladivostok-pacific-10143191.html, last accessed on: 18-12-2024.
- Shkolnikova, Svetlana (2024): Russia and China conducting joint Arctic operations for first time, Coast Guard says, in: Stars and Stripes dated 14-11-2024, https://www. stripes.com/branches/coast_ guard/2024-11-14/coast-guardarctic-icebreakers-russia-china-15849293.html, last accessed on: 18-12-2024.
- Shumei, Leng/Yuandan, Guo (2024): R&D of next-gen icebreaker progresses smoothly in China, in: Global Times dated 22-08-2024, https:// www.globaltimes.cn/page/ 202408/1318507.shtml, last accessed on: 18-12-2024.
- Simmons, Ann M. (2020): Russia Charges Scientist With Passing Information to China, in: WSJ dated 16-06-2020, https://www.wsj.com/ articles/russia-charges-scientistwith-passing-information-to-

china-11592246286, last accessed on: 18-12-2024.

- Trump, Donald J. (2020): Memorandum on Safeguarding U.S. National Interests in the Arctic and Antarctic Regions, Washington, DC: White House, in: Presidential Memoranda dated 09-06-2020, https:// trumpwhitehouse.archives.gov/ presidential-actions/memorandum-safeguarding-u-s-nationalinterests-arctic-antarctic-regions/, last accessed on: 18-12-2024.
- U.S. Air Force (2020): Arctic Strategy. Ensuring a Stable Arctic through Vigilance, Power Projection, Cooperation, and Preparation, Washington, DC, in: Department of the Air Force dated 21-07-2020, https:// www.af.mil/Portals/1/documents/2020SAF/July/Arctic-Strategy.pdf, last accessed on: 18-12-2024.
- U.S. Navy (2020): a Blue Arctic. A Strategic Blueprint for the Arctic. Washing-

ton, DC, in: Department of the Navy dated January 2021, https:// media.defense.gov/2021/Jan/ 05/2002560338/-1/-1/0/ARC-TIC%20BLUEPRINT%202021-%20FINAL.PDF/ARCTIC%20B LUEPRINT%202021%20FINAL. PDF, last accessed on: 18-12-2024.

- Wadhams, Peter (2016): A Farewell to Ice: A Report from the Arctic, London: Allen Lane.
- Wolfson, Rebecca/Overfield, Cornell/ Rosen, Mark/DeThomas, Benjamin/Tallis, Joshua (2022): Arctic Prospecting: Measuring China's Arctic Economic Footprint, Arlington, in: CNA dated January 2022, https://www.cna.org/reports/2022/01/arctic-prospecting.pdf, last accessed on: 18-12-2024.



Worlds Collide: Diverging Interests, Provocations, Conflicts, and Challenges in the High North

There is little doubt now that the era of 'High North, Low Tension' has melted away, yielding instead a complex region with an emerging new security environment. The recent accession of Finland and Sweden into NATO has further altered the security dynamics along NATO's Northern Flank. NATO's center of gravity has shifted northward as the Alliance seeks to recommit to deterrence - and defense - amidst Russia's war in Ukraine. Deterring adversaries in the arduous conditions of the High North demands a thoughtful approach that must integrate carefully balanced defense policy, strategic planning, and operational capabilities suited to the unique challenges of the region. Though security has catapulted to the forefront of regional concerns, it must be examined through a comprehensive lens.

Indeed, the pan-Arctic region is at the intersection of climate, economic, human, geopolitical, and military security trends. These trends are at times in conflict, and complicate the security situation as national, geopolitical, economic, and environmental interests converge – and diverge. This paper will seek to explore the region's unique characteristics and highlight the increasing strategic competition for and militarization of a region largely insulated from past conflicts. The Arctic, however, has never been immune to conflict and we should apply lessons of the past to prepare for and prevent

conflict in the future. The region's strategic location and resources will continue to attract global interest – and we must now enact appropriate defense policies in order to ensure a future of peace and stability.

1 Arctic Interests Abound

While indigenous communities have inhabited the Arctic region for thousands of years, the extreme weather conditions and geographic remoteness generally relegated the region to the margins of global interest. Local and indigenous communities have long prioritized preservation of the environment and sustainable economic development in order to sustain their traditions and communities. While explorers had long sought a suitable maritime route as a transpolar bridge connecting the economic centers of the Atlantic and Pacific Oceans, activity in the Arctic was generally limited due to the vast distances, extreme cold, inhospitable conditions, and poor infrastructure.

Yet the discovery of vast natural resources that include rare earth elements, oil, and natural gas potentially worth more than a trillion US dollars, has sparked international interest. Corporations and national governments alike are weighing investment strategies in the region, where warming trends are beginning to serve as key en-

ablers for regional economic activity. With the Arctic warming at least at twice the rate of the global average (and possibly four times faster), climate security is converging with human security to demand investment into infrastructure challenges such as permafrost thaw and coastal erosion that permeate the region.¹ Communities in the North have long faced challenges with adequate medical care, education, nutrition, transportation, and employment. National governments now must add climate-driven issues to the already costly list of human security challenges faced by regional populations.

Strategic competition is further upending the region, as it converges with the unprecedented rate of climate change, economic development, and Russian belligerence. While long considered a strategic space during the Cold War - the shortest flight path of a strategic bomber or intercontinental missile being over the North Pole - the region largely remained the focus of early warning and missile defense systems, though there was no shortage of activity below the ice-covered waters as submarines lurked beneath. Focus on the region as the most likely vector of an airborne attack diminished following the collapse of the Soviet Union. While homeland defense remained an important mission, the intensity of focus given to the northern horizon by national governments ceded to areas considered to be of greater strategic importance.

The security environment has drastically shifted from the decades of low tension that followed Gorbachev's 'Zone of Peace' speech in Murmansk in 1987.² The venerable cooperative mechanisms which enabled peace and stability for decades are functioning at a vastly diminished capacity following Russia's 2022 invasion of Ukraine. An emerging Sino-Russian cooperation in the Russian Arctic has tremendous implications for the pan-Arctic region. Two decades after opening its Yellow River research station on Svalbard, China has invested heavily in the Arctic. Russia has looked to China to fill the Western investment and technology gap in order to continue developing its northern resources. Last August, nearly a dozen Russian and Chinese warships conducted drills near Alaska.³ The evolving Arctic security environment demands a renewed look at the regional security architecture and investments in order to defend national interests.

2 Arctic Provocations, Conflicts, and Challenges

The war in Ukraine has served as a poignant reminder that conflict remains possible despite decades of cooperation. In addition to upending cooperation in the region, the war has served as an impetus to reshape the security architecture. The accession of Sweden and Finland into NATO redefines the Alliance's Northern Flank in a way unimaginable even during the Cold War. With the 1,340 km (833 miles) Finnish-Russian border, new geographic challenges have been added to Russia's security dilemma. Indeed, Severomorsk naval base, home of Russia's formidable Northern Fleet, is barely 185 km (115 miles) from Finland.

3 Syler/Martinez 2023.



¹ Rantanen et al. 2022.

² Exner-Pirot 2016.

Other ground force bases are even closer to the border, although most have already been decimated with the loss of troops and equipment sent to fight in Ukraine.⁴ Whereas the Soviet Union enjoyed a buffer zone with neutral Sweden and Finland, today's Russian Federation must accept the new reality of NATO next door.

It is of little wonder, then, that Russia engaged in such saber-rattling to thwart the membership bids of Sweden and Finland given their perception of NATO posing a so-called existential threat. Yet those two nations are hardly the only ones that have faced Moscow's predilection towards hybrid activity and belligerent rhetoric. The past couple of years have demonstrated the Kremlin's intent on shoring up its own Arctic capabilities while honing the skillsets needed to impact Western nations.⁵ It is necessary to consider the capabilities and provocations associated with Russian activity in order to understand the Russian approach during times of heightened tensions and conflict.

Historically, the Arctic has been a strategically, culturally, and economically important area for Russia.⁶ In 2021, the Arctic accounted for approximately 10% of the country's GDP and 20% of its exports, however, those numbers are now likely shrinking, though no official data is available.⁷ Russia views the Arctic as a singular strategic space – a "theater-wide, strategic continuum with a common operating picture—from the North Atlantic and the High North, to North Pole approaches in the Central Arctic, to the North Pacific, the Bering Strait and further south towards the Sea of Okhotsk."⁸ The Northern Fleet – though downgraded from its status of a military district with the most recent military realignment – remains the premier Russian naval fleet. Russia's Arctic forces are tasked with protecting its nuclear deterrent capabilities, its Arctic Zone, and the Northern Sea Route to enable security and economic viability.

Russia has also long valued the icy waters of the north as a test bed for the newest weapons - notably the Tsirkon, Poseidon, and Skyfall. Some of the most capable weapons systems and platforms are homeported to the Northern Fleet first, given the strategic importance of the region to Russia. Stationing advanced missiles - particularly hypersonics - at northern bases decreases flight time to NATO capitals. Since assuming office more than two decades ago, President Putin has taken personal interest in the economic and military development of the region, posing for numerous photo opportunities at northern bases and newly constructed facilities such as the Sabetta port terminal on the Yamal Peninsula.

Russia has further utilized their military infrastructure of the North to engage in malign activities. Critical infrastructure remains a key vulnerability in the High North. Well documented Russian activity near maritime infrastructure such as pipelines, cables, and windfarms in the North Sea comes following suspicious cable-cutting incidents that have affected Svalbard and the Baltic Sea.⁹ While attribution is often delayed or impossible, these inci-

9 Kaushal 2023.

⁴ Goble 2023; Staalesen 2024.

⁵ Melvin 2024.

⁶ Baev 2021.

⁷ Rumer/Sokolsky/Stronski 2021.

⁸ Boulègue 2024.

dents highlight potential vulnerabilities.

- The January 2022 incident off Svalbard involved cutting one of Space Norway AS's two subsea fiber-optic cables, known as Svalbardfiberen. This resulted in the loss of reserve capacity; loss of the redundant cable would have halted data flow from the SvalSat satellite station and internet to Longyearbyen.¹⁰ Attribution has not formally been declared, though Russian trawlers were known to have navigated in the vicinity of the break just before it occurred.¹¹
- Powerful blasts in September 2022 ruptured three of four Nord Stream pipelines in Sweden and Denmark's Exclusive Economic Zones (EEZ) in the Baltic Sea, with no public attribution.¹²
- In October 2023, the Chineseowned/Moscow-linked ship New New Polar Bear damaged the Baltic Connector gas pipeline and two underwater communications cables linking Finland-Estonia and Sweden-Estonia respectively.¹³

The presence of Russian auxiliary ships and fishing vessels near critical infrastructure – combined with the proven capabilities of Russia's GRU and GUGI directorates – serves as a warning to the West to redouble efforts to protect vital infrastructure.

Indeed, the High North offers numerous opportunities for those willing

13 Reuters 2023.

to engage in grey zone or sub-threshold military activities. In addition to offshore critical infrastructure, societal seams and existing disagreements between local and indigenous communities and governments often located far to the south can be exploited by disinformation, misinformation, and malinformation campaigns. Environmental activists are often in conflict with local communities, national governments, and corporate developers as they seek to protect fragile ecosystems.

Yet full-scale conflict over territorial disputes is unlikely. With seven of the eight Arctic nations unified under the NATO Alliance, mechanisms exist for dialogue to resolve most conflicts. Indeed, there are very few territorial disputes remaining among the Arctic states - the largest still to be resolved is between the United States and Canada. While there is some concern that the resolution of the overlapping claims of extended continental shelves amongst Russia, Canada, and the Kingdom of Denmark (all claiming an extension to the Lomonosov Ridge, specifically the North Pole) may require arbitration, a prompt decision on the validity of each claim is unlikely, thus making the concern of little relevance now.

The most likely vector of conflict in the Arctic is either spillover from another region or the result of a misunderstanding or misperception. It is essential to both be prepared to deter and defend in the Arctic, while also seeking to protect critical infrastructure, reduce tensions, and mitigate the potential of inadvertent escalation.



¹⁰ Nagelhus Schia/Gjesvik/Rødningen 2023.

¹¹ Ibid.

¹² Kaushal 2023.

3 (Re)Learning Arctic Warfighting

To effectively deter, one must demonstrate credibility and commitment while clearly signaling both to the adversary. The Arctic poses unique security challenges that require rethinking deterrence in the North. In particular, the unique environment must be considered in military and strategic planning. Climate trends will increasingly affect the ability to operate in the region, with logistical challenges arising from permafrost thaw, coastal erosion, and unpredictable weather. Enduring challenges like inhospitable terrain, vast distances across remote regions, and lack of adequate domain awareness and polar communications will continue to require creative - and often expensive - solutions.

Arctic warfighting is not new, but it is time to reexamine the lessons from the Cold War and the World War II campaigns – notably the Aleutian Islands campaign, Murmansk resupply missions, and the liberation of Norway. Warfighting in the region is challenging and demands development of appropriate training, tactics, and supply systems in order to ensure both survival and success.

Defense policy responses should be formulated to account for the uniqueness of the Arctic region, but also with an understanding of how the Arctic integrates into the broader strategic picture. In the United States, each of the military services has developed an Arctic strategy that aligns with the national and Department of Defense strategies. Yet formulation of a good strategy is only the first step – it is essential to then appropriately resource the strategy and commit to exercising the capabilities in the most demanding conditions in order to develop warfighting prowess. Resourcing of Arctic strategies must be prioritized in order to generate the infrastructure and capabilities necessary to operate – and fight – successfully in the demanding conditions of the north.

Deterrence should be at the forefront of policy objectives, with an effort made to strengthen capabilities in order to demonstrate credibility and commitment to the region. In particular, the continued emphasis on developing interoperability and interchangeability of forces in the region will prove to be a powerful deterrent. Hybrid activities and those below the threshold of conflict must not be tolerated. Similarly, it is essential to reexamine command and control across the pan-Arctic region to ensure no seams exist to be exploited. With the accession of Finland and Sweden, NATO must assert deterrence and defense plans that best account for the expanded northern flank. Updating regional plans and C2 structures, as well as logistics support and regional infrastructure will be essential in presenting a coherent and formidable deterrent.

Forces must also be exercised in the Arctic region in order to fully develop warfighting capabilities in a region that makes mere survival demanding. The Arctic is not a pick-up game - forces cannot be dispatched to the region without appropriate training, systems, and tactics. Commitment must be made to enhance skillsets in the demanding - and evolving - waters of the north. Allied navies must train together to understand the nuances of the region, which include unique weather conditions, evolving sound profiles due to the influx of fresh water and warming temperatures, and the location of critical infrastructure assets. Exercises

and operations like Trident Juncture 2018, Dynamic Mongoose, and Nordic (Cold) Response should be refined and amplified to expand both their scope and complexity.

Finally, greater effort should be made to understand Russia's Arctic interests - and its complex relationship with China in the region. In order to deter, it is essential to understand what matters to Russia. Too often communications have been lacking and messages between nations are misunderstood. Reopening communication channels - to at least the level that existed during the Cold War - is a vital step in ensuring successful deterrence. Though there are considerable differences from the bi-polar world of the Cold War to today's multi-polar world, some noteworthy lessons may still be gleaned from the past.

In particular, NATO's dual-track policy of 1979 still holds insights. The decision tied potential deployments of U.S. long-range theater nuclear forces with proposals for arms control negotiations. NATO leaders viewed the policy as necessary to respond to Soviet longrange forces targeting Europe, but Moscow viewed the policy as a threatening escalation of the nuclear-arms race - which cemented their belief that they had nothing to lose by invading Afghanistan.¹⁴ The decision triggered an immediate deterioration of NATO-USSR relations as well as anti-nuclear protests throughout Europe. However, the policy should receive some credit for the ultimately successful negotiations culminating in the 1987 Intermediate Nuclear Forces (INF) Treaty.

As demonstrated by the dual-track policy, focusing on strengthened force

posture and capabilities - and a clear demonstration of commitment to the region - is simply not enough. This still holds true today, particularly in the Arctic. As an Arctic nation, the United States has enduring national interests in the region. The Arctic is critical to both U.S. homeland defense and the collective defense of NATO Allies. It is also a region of both economic opportunities and vulnerabilities to climate change and ecosystem degradation. The 'monitor and respond' approach to Arctic threats requires investment in capabilities and infrastructure in the region, while clearly communicating intentions in order to avoid the possibility of escalation or misinterpretation.¹⁵ The latest U.S. Arctic defense strategy offers a sound strategic approach. While sound strategy is important, the implantation and resourcing will ultimately determine its effectiveness.

The U.S. should certainly improve its Arctic defense policy, strategic planning, and operational capabilities, but it must also advocate for cooperation amongst willing Arctic nations on areas of critical importance such as climate change, environmental protection, economic development, and strengthening of local and indigenous communities. Multilateral fora such as the Arctic Council have proven their value in preserving peace and stability. These mechanisms should be encouraged to flourish in hopes of establishing trust and building relationships that help sustain and enhance the Arctic region. They also provide mechanisms for dialogue which are so critical in accurately understanding both the perceptions and intentions of other nations.

GDS

¹⁵ U.S. Department of Defense 2024.

List of References

- Baev, Pavel (2021): Chapter 4: Russia and the Arctic: High Ambitions, Modernized Capabilities, and Risky Setbacks, in: Graeme P. Herd (ed.), Russia's Global Reach a Security and Statecraft Assessment, George C. Marshall European Center for Security Studies: Garmisch-Partenkirchen.
- Boulègue, Mathieu (2024): The Impact of the War Against Ukraine on Russia's Arctic Posture: Hard Power on Ice, in: Wilson Center Polar Institute from June 2024, https:// www.wilsoncenter.org/sites/default/files/media/uploads/documents/RussiaArctic_Boulegue. pdf, last accessed on: 13-06-2024.
- Burr, William (2009): Thirtieth Anniversary of NATO's Dual-Track Policy: The Road to the Euromissiles Crisis and the End of the Cold War, in: The Nuclear Vault: George Washington University from 10-12-2009, https://nsarchive2.gwu.edu/nukevault/ebb301/index. htm, last accessed on: 25-08-2024.
- Rumer, Eugene/Sokolsky, Richard/Stronski, Paul (2021): Russia in the Arctic—A Critical Examination, in: Carnegie Endowment for International Peace from 29-03-2021, https://carnegieendowment.org/ research/2021/03/russia-in-thearctica-critical-examination? lang=en, last accessed on: 10-06-2024.
- Exner-Pirot, Heather (2016): How Gorbachev Shaped Future Arctic Policy 25 Years Ago, in: Anchorage Daily News from 01-06-2016, https://www.adn.com/arctic/article/how-gorbachev-shapedfuture-arctic-policy-25-years-

ago/2012/10/01/, last accessed on: 27-11-2023.

- Goble, Paul (2023): Putin's War in Ukraine Hitting Russia's Numerically Smallest Nations Hardest, in: The Jamestown Foundation 20 (27), https://jamestown.org/program/putins-war-in-ukraine-hitting-russias-numerically-smallest-nations-hardest/, last accessed on: 25-08-2024.
- Kaushal, Sidharth (2023): Stalking the Seabed: How Russia Targets Critical Undersea Infrastructure, in: The Royal United Services Institute for Defence and Security Studies from 25-05-2023, https:// www.rusi.org/explore-our-research/publications/commentary/stalking-seabed-how-russia-targets-critical-undersea-infrastructure, last accessed on: 08-06-2024.
- Melvin, Neil (2024): How tensions between Russia and the West are mounting in the Arctic, in: RUSI from 01-01-2024, https://rusi. org/news-and-comment/in-thenews/how-tensions-betweenrussia-and-west-are-mountingarctic, last accessed on: 25-08-2024.
- Nagelhus Schia, Niels/Gjesvik, Lars/Rødningen, Ida (2023): The subsea cable cut at Svalbard January 2022: What happened, what were the consequences, and how were they managed?, Policy Brief 1/2023, in: Norwegian Institute of International Affairs from 2023, https:// www.nupi.no/content/pdf_preview/26372/file/NUPI_Policy_ Brief_1_23_Schia_Gjesvik_ R%C3%B8dningen-FERDIG.pdf, last accessed on: 10-06-2024.
- Rantanen, Mika/Karpechko, Alexey Yu/ Lipponen, Antti/Nordling, Kalle/

Hyvärinen, Otto/Ruosteenoja, Kimmo/Vihma, Timo/Laaksonen, Ari (2022): The Arctic has warmed nearly four times faster than the globe since 1979, Communications Earth & Environment 3 (168), www.nature.com/articles/ s43247-022-00498-3, last accessed on: 06-09-2024.

- Reuters (2023): China cooperating in Baltic connector investigation, Finland says, in: Reuters from 31-10-2023, https://www.reuters. com/world/china-cooperatingbalticconnector-investigationfinland-says-2023-10-31/, last accessed on: 08-05-2024.
- Staalesen, Atle (2024): War Losses Mount for Small Kola Towns, in: The Barents Observer from 11-03-2024, https://thebarentsobserver.com/ en/2024/03/war-losses-mount-

small-kola-towns, last accessed on: 25-08-2024.

- Syler, Matt/Martinez, Luis (2023): Nearly a dozen Russian and Chinese ships now moving away from Alaska, officials say, in: ABC News from 07-08-2023, https://abcnews.go. com/Politics/dozen-russian-chinese-ships-now-moving-alaskaofficials/story?id=102074925, last accessed on: 25-08-2024.
- U.S. Department of Defense (2024): U.S. Department of Defense 2024 Arctic Strategy, in: U.S. Department of Defense from July 2024, https:/ /media.defense.gov/2024/Jul/ 22/2003507411/-1/-1/0/DOD-ARCTIC-STRATEGY-2024.PDF, last accessed on: 30-07-2024.



Maritime Lessons from the Ukraine-Russia Conflict: USVs and the Applicability to the Baltic and High North

1 Introduction

One state's fight for survival is another's potential learning opportunity. The Ukraine-Russia conflict which has been ebbing and flowing across Ukraine since February 2022 is no exception. The question is: are the various states watching from the side lines learning the right lessons?

Understandably, much attention has been focused on the land aspects of the Ukraine-Russia conflict. One of the areas that has been poured over by analysts and treated as some sort of video arcade game by Youtubers and other voyeurs - often as part of information warfare operations by both sides - has been drone attacks. Analysts and other observers have been astounded both by the rapidity of development of uncrewed aircraft systems (UAS) in the conflict and the degree of improvisation of commercial off-the-shelf systems that Ukraine has achieved. The lexicon of these systems - quadcopter, first person view (FPV) and more – has entered the mainstream off the back of the considerable interest in the conflict across the world.

In the maritime domain there also have been considerable, if not always as public or frequent, learning opportunities for all interested navies. The issue of coastal defence missile systems has yet again hammered home lessons from, for example, HMS Glamorgan in the 1982 Falkland Islands Conflict. The loss of the Russian cruiser Moskva has again raised the (old) lesson regarding the mindset of combatants and mentally making the transition from peace to conflict.¹ The maritime arena has also seen the use of drones before, but this time uncrewed surface vehicles (USVs) are increasingly used in FPV kamikaze type attacks against Russian naval shipping and littoral infrastructure. Yet the Ukrainians are not the first to explore this technology – the Iranians and Houthis got there first.² This paper will consider Ukrainian style one-way attack (OWA) USVs and their wider utility in maritime warfare.

2 The Use of USVs in the War

Necessity is often the mother of invention and for Ukraine, following the scuttling, capture or destruction of almost all its surface ships on the outbreak of the war, this is especially true. Uncrewed surface vehicles offered the Ukrainians a cheap and expendable way to challenge Russian naval dominance of the Black Sea. In this respect the Ukrainians have been extremely successful. While all the information

¹ One might think of the Royal Navy's failure in pre-World War I and World War II mobilisation to issue lifejackets to all seagoing personnel. See Redford 2014: 11.

² Sutton 2022b; La Grone 2017.

operations and 'wishful sinkings' reports in the media are making the picture far from straightforward, it seems that the Ukrainians had a USV capability from at least September 2022 when a Mykola USV washed up on a beach outside Sevastopol.³ By the end of October 2022 Ukraine was using USVs (and UAVs) in coordinated attacks on the Russian Naval Base at Sevastopol.⁴ The following month USVs attacked the Russian naval base at Novorossiysk.⁵

Of course, attacks on ships at sea using these FPV USVs required a different level of capability than attacks on ships in harbour and against fixed maritime infrastructure. It took until May 2023 for the Ukrainians to be able to carry out a narrowly unsuccessful attack against the Russian intelligence gathering ship Ivan Khurs.⁶ Successful attacks followed with landing ships and corvettes being severely damaged or sunk.⁷ USVs were also used to attack the Kerch Bridge on 17 July which resulted in severe damage to the roadway.⁸ To the time of writing (June 2024) it appears that there have been nearly 30 USV attacks by Ukrainian units on Russian ships, both at sea and in harbour, as well as a solitary attack on the Kerch Strait bridge. Overall, the bulk of the attacks (17 out of 27) appear to have had limited success inflicting only minor damage or to have been completely unsuccessful.⁹ but the attacks that were

- **3** Sutton 2024d; Sutton 2022c.
- 4 Sutton 2024d; Bachega/Gregory 2022; Navy Lookout 2022.
- 5 Sutton 2024d.
- 6 Sutton 2024d.
- **7** Ozberk 2024b; Ozberk 2024a; Felstead 2024.
- 8 Bubalo/Goksedef 2023.
- 9 Figures inferred from Sutton 2024d.

successful, especially those that sank the *Tarantul*-class missile corvette *Ivanovets* and the *Ropucha*-class landing ship *Caesar Kunikov* in January and February 2024 respectively, have demonstrated the threat posed by such systems as well as providing useful video footage for the information war.

More importantly, the level of attacks by Ukrainian cruise missiles, UAS and USVs on Sevastopol have effectively made that base untenable for high value units of the Russian Black Sea Fleet, or those that have not already been sunk. From October 2023 it seems that the Russian Kilo-class SSKs,¹⁰ armed with Kalibr land-attack cruise missiles, have been moved out of Sevastopol to Novorossiysk on the eastern seaboard of the Black Sea. Furthermore, there have been apparent attempts by the Russian Navy to use disruptive or deceptive painting to confuse drone operators, which seem to have been ineffective.¹¹

All this points to significant achievements, but just in the information warfare domain, where the video footage of the USV attacks has been watched many thousands of times. One clip just 70 seconds long of the attack on the corvette *Ivanovets* has been watched 45 thousand times in four months.¹² In military terms, the Ukrainian forces have achived effective sea denial. The Russians are unable to use the Black Sea for their own puposes and have been forced to withdraw vulverable ships back out of immediate

- **10** Lister et al. 2023; Dickson 2023.
- **11** Sutton 2023a; Sutton 2024a.
- **12** BFBS 2024.

GIDS
danger from USVs, UAS and cruise missile attacks.

3 USV Considerations

There are a number of issues that the Ukrainans have resolved or mitigated in order to gain the successes they have had with their USVs. The first variable to be considered is the environmental conditions. The numerous clips of footage available for the Ukraine USV attacks, whether successful or unscuccessful, all have one thing in common. Day or night, the sea conditions are very good. If we look at the average conditions for the Black Sea, it can be seen from the data in figures 1 and 2 that the conditions which appear to be needed for an attack are far more benign than the norm.



Fig. 1: Black Sea average sea state and wind speed each month (Data supplied by the UK's JOMOC. I am grateful to Lt Cdr Max Parsonson RN for his invaluable help in compiling this data. No data available for Significant Wave Height).



Fig. 2: Black Sea days per month of rain, snowfall, or visibility 5 nm or less (Data supplied by the UK's JOMOC. I am grateful to Lt Cdr Max Parsonson RN for his invaluable help in compiling this data).

Indeed, the average sea state for the Black Sea is sea state 3 all year, with the exception of February when the average sea state is sea state 4. This indicates wave heights of 0.5 m to 1.25 m, except in February when the waves are between 1.25 m and 2.5 m in height.¹³ At the same time, the average wind speed is between 8 and 11 knots. Unfortunately, there is no data available on the significant wave height for the Black Sea. Even in the benign conditions in which USV attacks were made, there was at times significant pitching of these small 5.5 m long drones, which appeared to make keeping the target vessel in sight in the targeting camera a challenge. The difficulties in maintaining an adequate target picture and a covert approach in more typical conditions for the Black Sea should not be underestimated. For example, the Ukrainian Sea Baby USV has a significant visual detection signature due to its planing hull design and the resulting bow up posture and prominent bow wave. This will be exacerbated as the sea state and wave heights increase.

The impact of reduced visibility should also be considered, whether by rainfall, snowfall, fog, or another type of impairment, as this will affect not only the ability to find and identify a target using cameras and electro-optics, but also to manoeuvre to an intercept position and then mount a successful attack. This is compounded by the low height of eye of the targeting cameras on the USVs, typically around 0.5 m.¹⁴ This gives a horizon range for the USV of 2500 m; if the height of eye is increased to 1 m then the horizon range increases to 3600 m. If the height of the target is considered then the range at which the target can be seen can increase considerably. In the case of a *Nanuchka*-class missile corvette, the top of the Band Stand search/fire control radar above the bridge super-structure (more prominent than the vessel's lattice work mast) is approximately 17 m above the waterline.¹⁵ This gives a maximum visual range of about 9-10 nautical miles as the top of the radar dome starts to appear over the horizon.¹⁶

In the case of the Black Sea, the operating environment is, on average, favourable for the use of electro-optics for target identification and subsequent attack. As figure 2 shows, the number of days per month when rain or snow can be expected is low, as is the number of days where visibility will be 5 nautical miles or less.

The relatively short range at which the electro-optics onboard the USV will be able to see a target, does, however, place a premium on wider domain awareness and the ability to guide the USVs into the area in which the target is expected. The Ukrainians have successfully exploited their own intelligence sources as well as open-source intelligence (OSINT) – the war, after all, has been watched avidly by pundits, professional and amateur, who have made rapid and effective use of a wide range of sources, including commercial satellite imagery, voicing their assessments and opinions widely on the in-

¹³ OUCU 2023.

¹⁴ Sutton 2024c.

¹⁵ Heights derived from data in Pape (ed.) 2022: 675.

¹⁶ As the key factor is the height of a prominent feature like the main radar, this can mean that much larger vessels (in displacement and length) have broadly similar ranges, because their upperworks are roughly similar in height.



Fig. 3: Baltic Sea average sea state, wave height and wind speed each month (Data supplied by the UK's JOMOC. I am grateful to Lt Cdr Max Parsonson RN for his invaluable help in compiling this data).

ternet. It is perhaps no surprise then, that a few days after OSINT analysis of the Moskva's operating patterns hit the internet on 7 April 2022¹⁷, there was a successful coastal defence missile strike against the ship on 13 April leading to it sinking the next day.¹⁸ The guidance problem from the USV's launch area to their interception area has been taken care of by use of the StarLink satellite communications system to pass data to and from the USV. However, this is not a sovereign capability; indeed, Space X, the owner of StarLink, threated to turn off Ukrainian use of the system in February 2023.¹⁹

4 Utility for NATO

Is this repeatable elsewhere? Undoubtably, yes. Is this repeatable against Russia in a conflict with NATO? That is harder to say. Certainly, the types of USVs used by Ukraine have achieved the ranges needed to operate effectively in the Baltic and around northern Norway in the Norwegian Sea and into the Barents Sea. Furthermore, these USVs are easily launched from trailers, making them relatively independent of infrastructure for launching - a concrete slipway or hard is sufficient. However, range alone is not enough to be certain. Even when the ability to provide command and control for the drones using satellites is assumed, the answer is far more complex. In fact, the answer is the favourite one of academics and is truly loathed by maritime practitioners: it depends.

If the environmental data for the Baltic Sea and Norwegian Sea are considered, there is little cause for optimism. In both areas, as can be seen from figures 3 and 4, the average sea state is higher than that encountered in the Black Sea. While there is no significant wave height data available at

¹⁷ Sutton 2022a.

¹⁸ Sutton 2024d.

¹⁹ Sutton 2024d.



Fig. 4: Norwegian Sea average sea state, wave height and wind speed each month (Data supplied by the UK's JOMOC. I am grateful to Lt Cdr Max Parsonson RN for his invaluable help in compiling this data).

present for the Black Sea to compare to the Baltic and Norwegian Seas, it is notable that while the Baltic is under 1.5 m for the whole year, this is not the case for the Norwegian Sea where the significant wave height has a maximum of 4 m and a minimum of 1.5 m.

Understandably, the Ukrainians are extremely reluctant to give away the performance of their USVs, but it is not hard to see that a 5 m vessel with a freeboard of at most 0.5 m may not be able to cope with the seas that can be expected in both the Baltic and Norwegian Seas. Even if they can float and manoeuvre, the movement of the hull may well be so great that effective control and closure to the impact point may be unachievable.

Nor are the environmental issues limited to the potential violence of the sea and how this will limit the employability of USVs. Electro-optics, depending on their capabilities, can be adversely affected by snow and rain. As figures 5 and 6 show, the Baltic and High North see relatively high numbers of days were there is rain or snow, or days when the visibility is likely to be below 5 nautical miles (data for days with visibility below 5 nautical miles was unavailable for the Baltic), in comparison to the Black Sea (figure 2). This may further limit the tactical opportunities for the use of OWA USVs.

environmental limitations The USVs may encounter in the Baltic and High North suggest that they will need considerable development to achieve their full potential and survive contact with the elements. Making USVs bigger to enable them to operate in more unforgiving sea conditions makes them easier to detect by adversary systems. Therefore, USVs will probably have to move away from the current planing hulls with a noticeable visual signature, to hulls which, for example, exploit the Lürssen effect, which will have the added benefit of more speed for a given power input and greater stability in higher sea states.

While NATO has access to its own long-range communications systems



Fig. 5: Baltic Sea days per month of rain or snowfall (Data supplied by the UK's JOMOC. I am grateful to Lt Cdr Max Parsonson RN for his invaluable help in compiling this data. There was no data available on visibility).



Fig. 6: Norwegian Sea days per month of rain, snowfall, or visibility 5 nm or less (Data supplied by the UK's JOMOC. I am grateful to Lt Cdr Max Parsonson RN for his invaluable help in compiling this data).

which could support USV operations, the ability to use them in an Article V scenario against Russia cannot be assumed. Operations in command and control denied or degraded environments are facts of life now; GPS can be 'spoofed' too. All of this may have an impact to a greater or lesser degree on the practical utility of OWA USVs for NATO either in the High North or in the Baltic.

At the same time as USVs are being rapidly developed by the Ukrainians, we are seeing the Russian Navy developing new and potentially effective countermeasures. Close-in weapons have proven effective against USVs up to a point – the greater the number of attacking USVs and the greater the number of threat axes being used, the less effective close-in weapons will be. Helicopters have also been used to try to defeat USV attacks, although the actual success of these measures is still somewhat clouded by the fog of war and propaganda in the Russo-Ukraine conflict. The latest counter-USV development is the use of FPV one-way attack uncrewed aerial drones. None of this should be a surprise to maritime observers; these are, except for OWA FPV UAS, tried and tested anti-fast attack and anti-fast inshore attack craft approaches.

We should also expect to see increased effort going into passive countermeasures. The Kerch Strait bridge is now well protected by booms - this is an obvious harbour defence measure that can be readily replicated. Older ideas, related to booms, may make a comeback such as a modification of the pre-WW1 era ship-mounted anti-torpedo net concept, only this time designed to detonate USVs not anti-ship torpedoes at a safe distance from the warship. Chemical obscurants (smoke!), made largely irrelevant in the maritime domain due to radar, but still a staple passive defence for armoured fighting electro-optically vehicles against guided weapons, may make a return to the sea as cross-domain learning takes place - if it takes place. However, it should always be considered how your actions are compelling an enemy to operate in a way of your choosing and to expend scarce and valuable resources in a manner disadvantageous to them, which may make OWA USVs extremely useful, despite their limitations.

To deal with these active and passive real and potential countermeasures to Ukrainian style USV attacks, the USVs will have to grow to accommodate self-protection measures, more effective situational awareness and targeting systems, possibly reducing their potential to successfully attack an enemy. Indeed, some of these things have already happened - Ukrainian USVs are already mounting short-range fireand-forget anti-aircraft missiles for use against Russian helicopters and aircraft.²⁰ Nor were they the first USV user to do so.²¹ The value of the additional benefit of a larger sized platform increasing its environmental survivability and thus creating more opportunities for successful engagements over a wider area should not be underestimated.

Thus, the future utility of USVs lies not in harbour attack, or as a one-way kamikaze attack drone but as a weapon carrier, able to exploit stealth and low observability to promote its survival and get into weapon range before launching a relatively short-range attack which will be hard to counter, especially if done en masse. Yet there is still a problem with this vision. The more weapons you put on the USV the bigger it gets; the more you need to invest in ensuring its survival, the less expendable it is - which is exactly the problem navies faced with their crewed warships. So, are the right questions being asked about USVs in the first place?

Perhaps the real question regarding the transformative (or not) nature of USVs for maritime combat is about the ends of sea power rather than the means. As Julian Corbett observed towards the start of his seminal discus-

²⁰ Sutton 2024b.

²¹ Ozberg 2021.

sion on Some Principles of Maritime Strategy:

Since men live upon the land and not upon the sea, great issues between nations at war have always been decided—except in the rarest cases—either by what your army can do against your enemy's territory and national life or else by the fear of what the fleet makes it possible for your army to do.²²

What does this mean? In the context of USVs as demonstrated in the Russo-Ukrainian war it means sea denial, sea control, economic warfare and power projection. Ukraine has imposed sea denial on Russia's Black Sea Fleet: Russia is, at the moment, unable or unwilling to face the risks of operating in a sea contested by USVs. This may change in the future. The Russians have started using FPV UAS drones to attack USVs.²³ This may tilt the balance back in Russia's favour, or it may be invalidated by more Ukrainian innovation. Ukraine has, to a limited degree, sea control at times and places of its own choosing in order to achieve certain missions and operations. What Ukraine has not been able to do (yet) is to turn its ability to deny Russian use of the Black Sea (and its own ability to achieve sea control where and when it desires) into something that reaches wider via economic warfare or power projection - that telling phrase of Corbett's 'the fear of what the fleet makes it possible for your army to do.

Perhaps the most important lesson of the Russia-Ukraine conflict for the High North and Baltic is to reinforce, or remind us of, an old one. That, as Julian Corbett pointed out, the natural state for the sea is to be uncommanded.²⁴ This is a highly important (old) lesson about not just USVs, but maritime warfare, which practitioners and maritime analysts should be fully aware of, but which in the age of multi-domain operations and campaigns may not be fully understood by others, especially politicians or those used to measuring success by the amount of enemy ground occupied.

5 Conclusion

The Ukrainians have achieved something that should be almost impossible - without a navy, they have not only achieved sea denial, but also limited sea control. They have done so using a combination of old techniques (coastal defence missiles, mine warfare, land attack systems) and new ones (UAS and USVs). In doing so, they, and the Russian responses (or lack thereof), have highlighted old lessons regarding the mental and physical preparation of combat and the importance of not underestimating capabilities. They have also highlighted an old fundamental lesson of naval power - it is how navies can influence events ashore that is the decisive effect; the ends not the means is the key issue.

Are all these lessons applicable in the Baltic and High North? In the case of USVs probably not. The environmental conditions in the Baltic and High North are such that they are highly likely to severely restrict the use of USVs in an OWA concept of operations. At the same time, there are an in-

²² Corbett 1911: 16.

²³ Satam 2024; The Maritime Executive 2024; Defense Mirror 2024.

²⁴ Corbett 1911: 91.

creasing range of countermeasures that may be employed against OWA USVs that will inhibit their ability to close and attack targets at sea or inshore, be they ships or fixed infrastructure. The twin pressures of surviving the violence of the sea and of the enemy will probably result in the steady evolution of the OWA USV into a reusable weapon carrier. USVs are almost certainly here to stay and will provide a useful maritime capability for today's casualty-adverse body politics, but the lessons that NATO navies need to understand are old ones, sometimes dressed up in new clothes.

List of References

- Bachega, Hugo/Gregory, James (2022): 'Massive' drone attack on Black Sea Fleet – Russia, in: BBC from 29-10-2022, https://www.bbc. co.uk/news/world-europe-63437212, last accessed on: 05-06-2024.
- British Forces Broadcasting Service (BFBS) (2024): Dramatic footage shows Ukrainian drone boats destroying Russian warship, in: youtube.com from 02-02-2024, https://www.youtube.com/ watch?v=aHFlqgCyElo, last accessed on: 11-06-2024.
- Bubalo, Mattea/Goksedef, Ece (2023): Ukraine says it launched July attack on bridge to Crimea, in: BBC from 03-08-2023, https://www. bbc.co.uk/news/world-europe-66397227, last accessed on: 06-06-2024.
- Corbett, Julian Stafford (1911): Some Principles of Maritime Strategy, Longmans: London.
- Defense Mirror (2024): Russion FPV Drone Downs Ukrainian Magura

V5 USV in Black Sea Encounter, 30-05-2024, https://www.defensemirror.com/news/36910/ Russian_FPV_Drone_Downs_ Ukrainian_Magura_V5_USV_in_ Black_Sea_Encounter, last accessed on: 17-06-2024.

- Dickson, Peter (2023): Putin's fleet retreats: Ukraine is winning the Battle of the Black Sea, in: Atlantic Council from 04-10-2023, https:/ /www.atlanticcouncil.org/blogs/ ukrainealert/putins-fleet-retreats-ukraine-is-winning-thebattle-of-the-black-sea/, last accessed on: 06-06-2024.
- Felstead, Peter (2024): Ukrainians sink another major Black Sea Fleet surface ship, in: European Security & Defence from 14-02-2024, https:/ /euro-sd.com/2024/02/majornews/36596/ukrainians-sink-another-ship/, last accessed on: 06-06-2024.
- La Grone, Sam (2017): Navy: Saudi Frigate Attacked by Unmanned Bomb Boat, Likely Iranian, in: U.S. Naval Institute from 20-02-2017, https://news.usni.org/2017/02/20/ navy-saudi-frigate-attacked-unmanned-bomb-boat-likely-iranian, last accessed on: 05-06-2024.
- Lister, Tim/Chernova, Anna/Mezzofiore, Gianluca/Kostenko, Maria/Murphy, Paul (2023): Satellite imagery indicates Russia moving navy ships to other ports after Sevastopol attacks, in: CNN from 05-11-2023, https://edition.cnn. com/2023/10/05/europe/russia-naval-assets-sevastopol-intl/ index.html, last accessed on: 06-06-2024.
- The Maritime Executive (2024): Video: Russian FPV Drone Destroys Ukrainian Boat Drone, 30-05-



2024, https://maritime-executive.com/article/video-russianfpv-drone-destroys-ukrainianboat-drone, last accessed on: 17-06-2024.

- Navy Lookout (2022): Considering the implications of the attack on the Russian fleet in Sevastopol, 07-11-2022, https://www.navylookout.com/considering-the-implications-of-the-attack-on-therussian-fleet-in-sevastopol/, last accessed on: 06-06-2024.
- OUCO (2023): Understanding Sea State: A Comprehensive Guide, 30-03-2023, https://ouco-industry. com/understanding-sea-statea-comprehensive-guide/#Sea_ State_Definitions, last accessed on: 12-06-2024.
- Ozberk, Tayfun (2021): Iran Boosts IRCG Navy's Swarm Attack Capabilities, in: Naval News from 14-12-2021, https://www.navalnews.com/ naval-news/2021/12/iranboosts-ircg-navy-swarm-attackcapabilities/,last accessed on: 17-06-2024.
- Ozberk, Tayfun (2024a): Ukraine sinks Russian Tarantul-II class corvette with Kamikaze USV swarm attack, in: Naval News from 01-02-2024, https://www.navalnews.com/ naval-news/2024/02/ukrainesinks-russian-tarantul-ii-classcorvette-with-kamikaze-usvswarm-attack/, last accessed on: 06-06-2024.
- Ozberk, Tayfun (2024b): Ukraine hits Russia's Ropucha-I class LST Caesar Kunikov with USV attack, in: Naval News from 14-02-2024, https:// www.navalnews.com/navalnews/2024/02/ukraine-hits-russias-ropucha-i-class-lst-caesar-

kunikov-with-usv-attack/, last accessed on: 06-06-2024.

- Pape, Alex (ed.) (2022): Jane's Fighting Ships 2022-2023, Jane's Information Group: London.
- Redford, Duncan (2014): A History of the Royal Navy: World War II, I. B. Tauris: London.
- Satam, Parth (2024): Russia Destroys Ukrainian Magura Unmanned Surface Vessel with FPV Drone, in: The Aviationist from 30-05-2024, https://theaviationist.com/ 2024/05/30/fpv-vs-magura/, last accessed on: 17-06-2024.
- Sutton, H I (2022a): Russia's Most Powerful Warship In The Black Sea Is Operating In A Pattern, in Naval News from 07-04-2022, https:// www.navalnews.com/navalnews/2022/04/russias-mostpowerful-warship-in-the-blacksea-is-operating-in-a-pattern/, last accessed on: 14-06-2024.
- Sutton, H I (2022c): Suspected Ukrainian Explosive Sea Drone Made From Recreational Watercraft Parts, in: U.S. Naval Institute from 11-10-2022, https://news.usni.org/ 2022/10/11/suspected-ukrainian-explosive-sea-drone-madefrom-jet-ski-parts, last accessed on: 05-06-2024.
- Sutton, H I (2022b): Ukraine's New USV Compared, in: Convert Shores from 22-09-2022, http://www. hisutton.com/Ukraines-New-Explosive-USV.html, last accessed on: 05-06-2024.
- Sutton, H I (2023a): Russian Navy Attempts To Disguise Its Most Powerful Warship In Black Sea, in: Naval News from 22-06-2023, https://www.navalnews.com/ naval-news/2023/06/russiannavy-attempts-to-disguise-itsmost-powerful-warship-in-

black-sea/, last accessed on: 06-06-2024.

- Sutton, H I (2024a): Russian Navy's Deceptive Camouflage In Black Sea Not Effective Against Infrared, in: Convert Shores from 10-03-2024, http://www.hisutton.com/Russian-Navy-Deceptive-Camouflage-IR-Spectrum.html, last accessed on: 06-06-2024.
- Sutton, H I (2024b): Ukraine Has World's First Navy Drone Armed With Anti-Aircraft Missiles, in: Naval News from 21-05-2024, https:// www.navalnews.com/navalnews/2024/05/ukraine-hasworlds-first-navy-drone-armed-

with-anti-aircraft-missiles/, last accessed on: 17-06-2024.

- Sutton, HI (2024c): Overview Of Maritime Drones (USVs) Of The Russo-Ukrainian War, 2022-24, in: Convert Shores from 17-06-2024, http://www.hisutton.com/Russia-Ukraine-USVs-2024.html, last accessed on: 11-09-2024.
- Sutton, H I (2024d): Timeline of 2022 Ukraine Invasion: War In The Black Sea, in: Convert Shores from 12-08-2024, http://www.hisutton.com/Timeline-2022-Ukraine-Invasion-At-Sea.html, last accessed on: 11-09-2024.



Appendix



Authors

Dr Sebastian Bruns is a Kiel-based seapower and naval strategy expert with a wide range of expertise in maritime security and defense policy. He works as a Senior Researcher at the Institute for Security Policy at Kiel University. Previously, he was the inaugural McCain-Fulbright Distinguished Visiting Professor at the U.S. Naval Academy in Annapolis, Maryland (USA) and a Congressional staffer in Washington, D.C., handling then-Rep. Todd Young's defense and military legislative affairs. He also was a non-resident senior associate at the Center for Strategic & International Studies (CSIS) from November 2021 to July 2024.

Jonathan D. Caverley, PhD is Professor of Strategic and Operational Research at the United States Naval War College. He is currently interim Director of the College's Press.

Commander Rachael Gosnell is a U.S. Navy foreign area officer and strategist currently serving as a military faculty member in the Strategic Security Studies Department of the George C. Marshall European Center for Security Studies.

Niklas Granholm is Deputy Director of Studies at the Swedish Defence Research Agency, Division for Defence Analysis. He is a fellow and board member of the Royal Swedish Society of Naval Sciences (KÖMS) and a fellow of the Royal Swedish Academy of War Sciences (KKRVA).

Julian Pawlak is a Researcher at the Helmut Schmidt University/Bundeswehr University Hamburg and the GIDS. He leads the University's interdisciplinary research activities on maritime security and works on questions pertaining to (maritime) strategy, defence, and security, particularly on NATO's Northern Flank and the Baltic Sea region. Previously, Julian worked as a Researcher at the Institute for Security Policy Kiel and its adjunct Center for Maritime Strategy and Security. He was a Visiting Fellow at the Swedish Defence University in 2023 and has been a non-resident Associate Fellow at the NATO Defense College since 2024.

Captain (Navy) Dr André Pecher currently serves as the Acting Head of Research at the GIDS in Hamburg. While his areas of expertise include submarine operations, military intelligence, military history and security policy, his current research focus is on maritime strategies and security. Dr Pecher has held various assignments within the remit of the Federal Ministry of Defence, the Federal Chancellery and the Federal Foreign Office. He has also served in North and South America as well as in NATO posts. **Dr Michael Paul** is a Senior Fellow in the International Security Research Division of the German Institute for International and Security Affairs (SWP) and head of its Maritime Safety Discussion Group. From 2018 to 2019, he was a member of the Expert Team on Maritime Security in the 'Seas and Oceans' thematic cycle of the German Federal Government and from 1995 to 2019 he acted as the Project Director of the Armed Forces Dialogue (in cooperation with the German Federal Ministry of Defence). Dr Paul's areas of expertise include geopolitics, Arctic climate change and security as well as maritime security. In his research, he focuses on the Arctic, the Asia-Pacific, China, Russia, disarmament, arms control, and maritime security.

Michael B. Petersen, PhD is Principal Research Scientist with the Russia Studies Program at the Center for Naval Analyses. Previously, he served as senior advisor to the Chief of Naval Operations and founding director of the Russia Maritime Studies Institute at the United States Naval War College.

Dr Michał Piekarski is Assistant Professor at the Institute of International and Security Studies at the Faculty of Social Sciences of the University of Wrocław. His research focuses on national security issues, particularly hybrid threats, maritime security, and Poland's strategic culture.

Dr Duncan Redford is a historian at the UK's Ministry of Defence. His research areas include the defence of seaborne trade and the relationship between the sea and national identity.

Sergej Sumlenny is the founder and managing director of the European Resilience Initiative Center gGmbH (ERIC) in Berlin, a non-partisan think tank focusing on defence and foreign policy analysis. Since 2023, ERIC has also raised over \leq 1 million in donations to support Ukrainian Army units with drones and other electronic equipment. In November 2024, Sergej Sumlenny co-founded United Unmanned Systems, a German-Ukrainian drone manufacturing company based in Ukraine.

GIDS

GIDS and ISPK

German Institute of Defence and Strategic Studies (GIDS)

Founded in 2018 as a cooperation between the Bundeswehr Command and Staff College and the Helmut Schmidt University/Bundeswehr University Hamburg, the German Institute for Defence and Strategic Studies (GIDS) serves as the Bundeswehr's think tank. It provides analysis and research on military and security matters and is responsible for advising decision-makers both within the Bundeswehr and the Federal Ministry of Defence. With its insights and recommendations, the GIDS is able to contribute to the German armed forces' operational readiness. Moreover, it makes an important contribution to Germany's public debate on security and strategic culture. Bringing senior officers and researchers together, the GIDS combines military expertise with scientific excellence.

Institute for Security Policy at Kiel University (ISPK)

The Institute for Security Policy at Kiel University (ISPK) is an independent, nonprofit research institute dedicated to the analysis of security policy challenges. It provides research, analysis and commentary on conflicts and strategic issues and has set itself the task of contributing to the security policy discourse in Germany and abroad with practice-oriented, interdisciplinary research. Its Center for Maritime Strategy and Security, which originally initiated the Kiel International Seapower Series, is one of several departments dealing with today's security challenges in the maritime domain and beyond.





N

S

W

E



@Führungsakademie der Bundeswehr Manteuffelstrasse 20 | D-22587 Hamburg Tel: 040 8667 6802 | FueakBwGids@bundeswehr.org