Maritime airborne intelligence, surveillance and reconnaissance in the High North –

The role of anti-submarine warfare – 1945 to the present

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Abstract

There is mounting consensus among NATO allies that the resurgent Russian naval and submarine activity in the High North needs to be closely monitored and kept in check. And in spite of the rise of satellite technology and unmanned aircraft, the *key* instrument in that effort, at least for now, remains the Maritime Patrol Aircraft (MPA) with its Anti-Submarine Warfare (ASW) capabilities. However, after three decades of focus on expeditionary and counterinsurgency (COIN) warfare, there has taken place an atrophy within the MPA community of knowledge, resources, experience and practice when it comes to the ASW aspects of maritime surveillance. This atrophy occurred just as the concept of intelligence, surveillance and reconnaissance (ISR) came to play an increasingly important role in operational planning. The concept of ISR, however, is linked to expeditionary and COIN warfare, and it pays insufficient attention to the challenges of *maritime* airborne surveillance and the specific challenges of ASW. This thesis seeks to address this gap. It does so by analysing the past in order to find solutions for the future.

The thesis examines the entwined evolution of airborne maritime surveillance by MPA and ASW in the High North, both during and after the Cold War, and focuses on the key NATO allies of Norway, the US, and the UK. The thesis further seeks to identify the fundamental 'building blocks' and tenets of these historical surveillance operations that are then used to craft a novel theoretical framework for understanding the nature and function of maritime airborne ISR and its relationship to ASW. That framework is then applied to make recommendations for the future for maritime surveillance in the High North.

The thesis's key findings of this thesis are that:

- Russian submarines as the capital ships of the Russia Navy. They have morphed from noisy, predictable vessels operating in known patrol areas, to superbly silent vessels operating in unpredictable patterns, carrying world-leading cruise missiles technology that constitute a renewed threat to both European and American targets;
- the traditional airborne tool to meet the submarine threat, the MPA, is crucial but not adequate in a modern context. A multi-layered, international approach is required, which will benefit from utilizing artificial intelligence for complex acoustic sensor processing.

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Author's Declaration

I declare that, except where explicit reference is made to the contribution of others, this dissertation is the result of my own work and has not been submitted for any other degree at the University of Glasgow or any other institution.

Abbreviations

A2/AD	Anti-access/area denial
AAM	Air-to-air missiles
AAR	Air-to-air refuelling
AAW	Anti-Air Warfare
ACINT	Acoustic intelligence
AGS	Alliance Ground Surveillance
AIMS	Advanced Imaging Multi-Spectral Sensor
AIP	Anti-Surface Warfare Improvement Program
AIP	Air Independent Propulsion
AIS	Automatic Identification System
AOR	Area of responsibility
ASuW	Anti-Surface Warfare
ASW	Anti-Submarine Warfare
ATO	Air Tasking Order
BAMS	Broad Area Maritime Surveillance
BAMS-D	BAMS-Demonstrator
BDA	Battle Damage Assessment
BLOS	Beyond-line-of-sight
C2	Command and control
C4 for ASW	Command, Control, Computers and Communications for ASW
CAS	Close Air Support
CHOD	Chief of Defence
CHR	Command History Report
CINCEASTLANT	Commander-in-Chief Eastern Atlantic Area
CMAN	Commander Maritime Air Naples
CNA	Centre for Naval Analyses
CNO	Chief of Naval Operations
COIN	Counter-Insurgency
COMAFNORTH	Commander Allied Forces North

COMINT	Communications intelligence
COMMARAIRNATO	Commander Maritime Air NATO
CONMAROPS	Concept of Maritime Operations
COTS	Commercial-off-the-shelf
CSIS	Centre for Strategic and International Studies
CTF	Commander Task Force
CTG	Commander Task Group
CV	General type pf aircraft carrier
CVA	Attack aircraft carriers
CVS	ASW designated aircraft carriers
DCI	Director of Central Intelligence
DELTIC	Delayed Time Compression
DOTMLPFI	Doctrine, Organization, Training, Materiel, Leadership & Education, Personnel, Facilities, Information/Interoperability
DSP	Defence Support Program
ELINT	Electronic intelligence
EO	Electro-optical
EO/IR	Electro-optic/infrared
ESM	Electronic *Support* Measures
FDS	Fixed Distributed System
FISINT	Foreign instrumentation and signals intelligence
FMR	Fagmilitært Råd (Norwegian Chief of Defense White Paper)
FOIA	Freedom of Information Act
GIN	Greenland-Iceland-Norway
GIUK	Greenland-Iceland-UK
GPS	Global Positioning System
GRAB	Galactic Radiation and Background
HALE	High Altitude/Long Endurance
HF	High Frequency
HUMINT	Human intelligence
ICBM	Intercontinental Ballistic Missile

IFF	Identification Friend or Foe
IMINT	Imagery intelligence
INF	Intermediate Nuclear Forces
ISAR	Inverse Synthetic Aperture Radar
ISR	Intelligence, surveillance and reconnaissance
ISTAR	Intelligence, Surveillance, Target Acquisition, Reconnaissance
IUSS	Integrated Undersea Surveillance System
JAPCC	Joint Air Power Competence Centre
JFC	Joint Force Command
JP	Joint Publication
KEFTACEX	Keflavik Tactical Exercise
km	Kilometre
LACM	Land-attack cruise missiles
LAWS	Lethal Autonomous Weapons Systems
lbs	Pounds (weight)
LTP	Long-Term Plan
MACA	Maritime Air Control Authority
MALE	Medium altitude/long endurance
MARCOM	Allied Maritime Command
MC	Military Committee
MHQ	Maritime Headquarters
MIRV	Multiple, independently targeted re-entry vehicles
MAC	Multi-static Active Coherent
MAD	Magnetic Anomaly Detection
MAOC	Maritime Air Operations Centre
MDAP	Mutual Defence Assistance Program
MoD	Ministry of Defence
MoU	Memorandum of Understanding
MPA	Maritime Patrol Aircraft
NAC	North Atlantic Council

NIS	Norwegian Intelligence Service
nm	Nautical miles
NSR	North-Eastern Sea Route
NATO	North Atlantic Treaty Organization
NIE	National Intelligence Estimate
NOSS	Naval Ocean Surveillance System
OAE	Operation Active Endeavour
ONI	Office of Naval Intelligence
ONR	Office of Naval Research
OPINTEL	Operational intelligence
PED	Processing, exploitation and dissemination
PfP	Partnership for Peace
PNI	Presidential Nuclear Initiatives
RAF	Royal Air Force
R&D	Research and development
RF	Radio frequency (RF)
RPG	Rocket propelled grenades
SACEUR	Supreme Allied Commander Europe
SACLANT	Supreme Allied Commander Atlantic
SAM	Surface-to-air missiles
SALT	Strategic Arms Limitation Treaty
SAR	Synthetic Aperture Radar
SAR	Search-And-Rescue
SBIRS	Space-Based IR System
SDSR	Strategic Defence and Security Review
SATCOM	Satellite communication
SIGINT	Signals intelligence
SLAM	Stand-off Land Attack Missile
SLBM	Submarine launched ballistic missile
SLCM	Submarine launched cruise missile

SLOC	Sea-lines of communication
SoI	Statement of intent
SOSUS	Sound Surveillance System
SSBN	Strategic submarines carrying nuclear ballistic missiles
SSGN	Multi-role cruise missile submarine
SSK	Conventional attack submarine
SSN	Nuclear attack submarine
STANAVFORLANT	Standing Naval Force Atlantic
SURTASS	Surface towed array sonar systems
TACCO	Tactical Coordinator
TCDL	Tactical Common Data Link
T-LAM	Tomahawk Land Attack Missile
UHF	Ultra High Frequency
UIP	Upgrade Improvement Program
VHF	Very High Frequency

1. Introduction

1.1 Background for the project

The requirement for military surveillance in the High North has become somewhat of a dogma for Norwegian authorities – it is regularly taken as self-evident and self-explanatory. The main reasons emphasized are unexploited natural resources, fishery surveillance, increased maritime traffic along the coast, and perhaps most importantly: Russian military activities in the High North stemming from the bases on the Kola peninsula. The surveillance missions have been the responsibility of the Norwegian Armed Forces. The Kola peninsula is the home of the Russian Northern Fleet, the most powerful fleet in the Russian Navy, and with year-round ice-free passage to the Atlantic. Among the Russian naval capabilities, submarines played a key role in naval strategy throughout the Cold War and increasingly do so again today, both for assuring a nuclear second-strike capability, but also in posing a threat towards Western surface forces and carrier battle groups in the Atlantic. Moreover, the Russian Navy has historically been, and still is, carrying out sub-surface, surface and air testing and development of weapons systems and platforms just outside the Russian coastline in the North.

NATO's strategy towards the Soviet Union was from the beginning one of containment of Soviet expansion. This led to a forward maritime posture in the 1950s in the North Atlantic, and information and early warning on an attack by the Soviet Union against Norway and the Norwegian coast was viewed as crucial. The main NATO deterrent was the strategy of *Massive Retaliation* and a threat of nuclear annihilation should the Soviet Union attack a NATO member. However, in the 1960s the Soviets themselves achieved a credible capability to strike the United States with nuclear weapons, making the NATO deterrent less credible when a retaliatory nuclear attack by the Russians was likely. In the mid-1960s, the new strategy of *Flexible Response* came into being, which would affect the defence of the flanks in particular. In the case of the northernmost parts of Norway, i.e. the county of Finnmark, these areas were considered to be of higher military value to the Soviet Union than to NATO because they provided staging areas for aircraft into the North Atlantic, whilst NATO aircraft carriers could launch their attacks into the Soviet Union from positions further south, in addition to from Norwegian bases further south. This led to a rising concern that the Soviet Union would be able to claim certain parts of Northern Norway without reaching the threshold for a retaliatory nuclear response from the United States. This further rocked the notion of a credible security guarantee for the Alliance members. Thus, a loss of Finnmark turned into a political problem, if not a significant military one.[1] This risk had to be reduced through a strengthened defence of Northern Norway. In addition, the build-up on the Kola peninsula included a growing number of attack submarines that posed a threat against the *Sea Lines of Communication* (SLOC), the logistical lines between the United States and continental Europa during times of war. These were considered to be of high strategic importance, particularly now that NATO were through the strategy of *Flexible Response* planning on a protracted conventional war in Europe. To maintain control of the Norwegian coast therefore increased in importance. In addition to a build-up of presence of Norwegian armed forces in North Norway during the 1960s and 70s, the most important contribution to the United States as a bilateral partner and to the NATO alliance as a whole, would become intelligence on Soviet Union capabilities and early warning of an attack in the North.[2] The intelligence was of strategic nature, and the information gathered became the core of the close bilateral military strategic relationship between the United States and Norway. Several collection tools were utilized, from stationary electronic intelligence stations in Northern Norway to intelligence ships sailing on a daily basis just off the Kola coastline. A crucial element of the intelligence contribution to the United States and NATO was the fleet of maritime patrol aircraft (MPA), which contributed initially with basic surface surveillance and early warning. With the introduction of more capable aircraft first in the early 1960s and then again to an even more capable aircraft in 1969, Norwegian MPAs conducted increasingly advanced intelligence operations against the Soviet Northern Fleet, in particular against the growing submarine menace. The submarines in themselves did not pose a direct threat to Norway *per se*. There were no threat assessments that projected Soviet strategic nuclear submarines attacking Norwegian cities or harbours, or Soviet attack submarines posing a direct threat to Norwegian bases or infrastructure. The threat from the Soviet Navy was in essence directed towards American cities (strategic nuclear submarines) and NATO forces and SLOCs (attack and multi-role submarines). This means that the intelligence gathering in the High North was *inherently* a contribution to alliance partners and the collective defence of NATO. In addition, the Americans thought the contributon of such a crucial nature that they contributed with MPA under the weapons support program at no cost in 1961, then later by contributing significantly to the Norwegian procurement of an updated

[1] Jacob Børresen, Gullow Gjeseth, and Rolf Tamnes, *History of the Norwegian Armed Forces 1970-2000 (“Norsk Forsvarshistorie, 1970-2000”)* (Bergen: Eide Forlag, 2004), 86–87.
[2] Børresen, Gjeseth, and Tamnes, 89.

MPA fleet in 1969. This support was again manifested through covering more than half of the procurement costs in 1989 for new aircraft yet again. To the Norwegian government, then, the maintenance of credible intelligence services in the High North, to which the MPA fleet contributed significantly, the military investment provided high political returns.

Traditionally, Norwegian foreign and security politics have rested on a balancing act between *integration/deterrence* and *screening/reassurance*.[3] Integration/deterrence with alliance partners, both bi-laterally with the USA and multi-laterally through NATO, and screening/reassurance through the denial of a permanent presence of foreign troops and bases on Norwegian soil. Surveillance missions flown on a case-by-case basis by allied partners from Norwegian bases have been restricted to stay west of 24-degrees East, justified by the requirement to maintain low tensions with Russia. This in turn means that in essence it has been Norwegian aircraft that have monitored Russian activity on and outside the Kola peninsula. Norwegian MPA would throughout the Cold War serve as a crucially important security policy tool for the Norwegian government in the High North.

Historically, the ability to monitor the operational movements of the Soviet and Russian submarines have been given a high priority by NATO nations. As this thesis will describe, the battle between the hunting ASW forces and the hunted submarines were for several decades conducted in favour of the hunter: NATO nations were in the lead technologically, and had the geographical advantage of staging areas along the Norwegian, Scottish and the Icelandic coasts for MPAs. In the 1980s, however, the quieting measures of the Russians took hold, which made hunting for Russian submarines significantly more complex. After a decade of downturn in activity and force levels on both sides following the collapse of the Soviet Union, Russian submarines are once again patrolling the Atlantic, this time more capable than ever. The new Russian submarines and the renewed aggressive Russian posture in the Atlantic are questioning NATO's ability to hold them at risk.

The Norwegian Defence Review white paper of 2015 (*Fagmilitært Råd* (FMR) 2015) highlighted strategic intelligence as the first tier of defence for Norway. Situational awareness in the High North is additionally brought to the front by military as well as political leaders when discussing military capabilities and requirements for Norway. The FMR of 2015 proposed changes to how the Norwegian Armed Forces would approach

[3] Johan J. Holst, "Norsk Sikkerhetspolitkk i Strategisk Perspektiv," *Internasjonal Politikk* 24, no. 5 (1966): 463–90; Rolf Tamnes, "Integration and Screening - The Two Faces of Norwegian Alliance Policy," *Forsvarsstudier*, no. 6 (1987).

surveillance in the High North through phasing out the P-3 *Orion* maritime patrol aircraft (MPA), and acquiring new unmanned systems to take over much of the intelligence, surveillance and reconnaissance (ISR) portfolio of the P-3 fleet. There is, however, a crucial gap between the intelligence collection and types of warfare that a modern MPA can perform, and those that an unmanned aircraft can perform. This gap is acoustic intelligence and anti-submarine warfare (ASW). In practical terms, the FMR of 2015 proposed to phase out the Norwegian long-range, airborne ASW capability in the North.

The proposal of the Norwegian CHOD to phase out the P-3 *Orion* raised questions regarding the importance of the ability to monitor sub-surface activity in the High North. What role have the Russian submarines of the Northern Fleet played in the High North? What role has the MPA fleet played historically in monitoring Russian submarines operating in the Atlantic? What are the elements required for conducting efficient and credible maritime airborne surveillance and reconnaissance in the High North? And in continuation of this: What role does the modern, emerging Russian submarine missile threat play in the High North today? There is currently no theoretical framework within which we can discuss the requirements for maritime airborne ISR. There is a definition of ISR, there is a definition of ASW, and there are doctrines for both. But there exists no theoretical framework that explains the basic elements of airborne ISR, how these facilitate the analysis and dissemination of intelligence products, and how these eventually fit into the execution of military operations. This thesis answers the questions above by establishing a new theoretical framework for airborne ISR in general, and airborne ASW more specifically. This new framework then provides the basis for the concluding discussion of the thesis, where future requirements for airborne ISR are discussed and the role of ASW in the High North is further highlighted.

1.1.1 Main research question

This thesis discusses the airborne surveillance that took place in the North Atlantic during the Cold War, and thus underlines the place of submarines in Soviet and later Russian naval strategy and naval operations. Based on this, the role of airborne ASW capability can be outlined. In the contextualization of these questions, one seems forced to evaluate other technologies that can conduct the range of tasks that have traditionally belonged to the MPA, or at least elements of that portfolio. A theoretical framework that brings these different elements together will facilitate, structure, and benefit any discussion on airborne ISR and ASW going forward.

Also, it is an ambition of this thesis to inform the public debate on these issues. Much of the discussion is either taken for granted and not properly explained, or it remains classified and hidden from public discourse. However, the principles are not classified, and should constitute the basic premises for the ongoing discussion on the future of airborne surveillance in the High North. The fundamental question to be answered by this thesis is therefore:

> ***What is the role of anti-submarine warfare capabilities in airborne intelligence, surveillance and reconnaissance in the High North?***

Through studying the developments of airborne surveillance and reconnaissance over the past century or so, elements stand out that can be considered the basis for a theoretical framework. A theoretical framework on airborne/maritime ISR should have a generic approach, in which the specificities of airborne ASW can be discussed. Underlying questions on maritime airborne ISR that come to the fore when attempting to place it in a more holistic ISR context, are how airborne ASW can be explained within a theoretical framework for airborne ISR; whether manned MPAs can be replaced by unmanned aircraft and technology; what role force integration and interaction with other units play for modern maritime airborne ISR units; and what role sensor processing and ISR product dissemination play for maritime airborne ISR units. These are all secondary questions deriving from the main research question above.

1.1.2 Limitations

The Arctic is gaining increased focus from many nations. This increased focus has led to American intelligence services increasingly utilizing personnel full time for studying the Arctic, cooperating ever more closely with the Norwegian Intelligence Service (NIS).[4] Several factors come into play. Climate change is facilitating changes to the dynamics in the Arctic. The North-Eastern Sea Route (NSR) might become a feasible sea route for commercial traffic between Europe and Asia, and the first voyage by a commercial vessel

[4] Brian Bennett and W.J. Hennigan, "U.S. Builds up Arctic Spy Network as Russia and China Increase Presence," *Los Angeles Times*, September 7, 2015, https://www.latimes.com/world/europe/la-fg-arctic-spy-20150907-story.html.

mid-winter took place in the winter of 2017/2018.[5] Climate change is also forcing fish stocks further north, due to warming waters and changes to the oxygen level in waters at lower latitudes.[6] Security politics are also changing in parallel to increased Russian activity. China, too, is eyeing infrastructure investments in the Arctic, in support of their own ambitions for the High North.[7] Factors such as climate change, new security policy actors in the North, and resource management in the Arctic are all important to the overall international dynamics of the region. It would, however, be too time consuming to include them all in this study.[8] The role of the Russian surface fleet and airborne platforms based on the Kola peninsula is also worthy of thorough discussions, but would take away too much of the focus from the original research question of this thesis. The submarines in the Atlantic have posed unique challenges with regards to surveillance technology and the organisational framework set up to monitor their movements. In an overarching context, it is impossible to detach the most important element of the Russian defensive bastion in the High North from other supporting and supported elements without losing important understanding of how the Russian military operations in the North Atlantic are organised. The focus here, however, is on the unique challenge posed by conducting ISR in the subsurface domain by airborne assets. The discussion thus focuses on the submarines of the Northern Fleet and their interaction with airborne surveillance and reconnaissance historically, today, and in the future.

1.1.3 Personal standpoint – the researcher

This thesis builds on research conducted for a Master's thesis submitted through the Scottish Centre for War Studies, University of Glasgow, in 2009. That thesis focused on one, specific element of search technology, LIDAR, in the hunt for submarines. The current thesis is significantly more encompassing, both with regards to the timeframe involved but also with regards to the broadened focus of study.

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[5] Harald Vikøyr, "Historisk Vinteråpning Av Polhavet," *VG*, March 4, 2018, https://www.vg.no/nyheter/utenriks/i/0Er3n0/historisk-vinter-aapning-av-polhavet.

[6] Susanne Skjåstad Lysvold, "Klimaendringene Tapper Havet for Oksygen - Fisken Rømmer Nordover," *NRK*, October 10, 2018, https://www.nrk.no/nordland/klimaendringene-tapper-havet-for-oksygen---fisken-rommer-nordover-1.14240007.

[7] John Simpson, "How Greenland Could Become China's Arctic Base," *BBC News Online*, December 18, 2018, https://www.bbc.com/news/world-europe-46386867.

[8] See for example Pan Min, "Fisheries Issue in the Central Arctic Ocean and Its Future Governance," *The Polar Journal* 7, no. 2 (2017); Mariia Kobzeva, "China's Arctic Policy: Present and Future," *The Polar Journal* 9, no. 1 (2019); Arild Moe, "The Northern Sea Route> Smooth Sailing Ahead?," *Strategic Analysis* 38, no. 6 (2014); Alexander Sergunin and Valery Konyshev, "Russia in Search of Its Arctic Strategy: Between Hard and Soft Power?," *The Polar Journal* 4, no. 1 (2014).

The professional background for writing this thesis is as a Tactical Coordinator (TACCO) onboard Norwegian P-3 *Orions*. After flying aircraft in the High North, time was spent at the Norwegian National Joint Headquarters leading MPA operations, and then at the Royal Norwegian Air Force's Inspectorate for Air Operations. Further, four years at NATO's Maritime Command at Northwood in the UK have provided insight into NATO operations and the workings of the Alliance command structure. In addition to the sources gathered, experience has played a great part for the general understanding of the workings and development of MPA operations in the North Atlantic. This experience has been fundamental to the development of the theoretical framework that is presented in this study.

A factor of concern for the validity of this study is the ability to "read between the lines" of operational reports that comes with such experience. It is much easier to envision what took place, the details that are mentioned and the factors that might have been omitted from an operational report, when it has been a part of the duty to write such reports oneself. Personal experience and knowledge of MPA operations have thus also been useful in the interpretation of archival materials for the historical chapters of this thesis.

1.2 Historiography

1.2.1 Geopolitics in the High North

The literature on geopolitics in the North Atlantic as well as Norwegian security and defence policy provide an overarching baseline for analysing the requirements for situational awareness in the areas in question. A significant body of studies was published in the later years of the Cold War.

The Russia expert Marion Leighton published in 1979 *The Soviet Threat to NATO's Northern Flank*. Based on original Soviet sources, she analyses the offensive nature of Soviet security politics in the High North, and warns of the USSR's expanding naval power, the increasingly offensive-oriented airpower, and the mounting ground forces on the Kola peninsula. There seemed to be an agenda to isolate and neutralize NATO's Northern Flank.[9] In *The Military build-up in the High North*, Sverre Jervell and Kåre Nyblom edited papers that were written ahead of the seminal conference in 1985 at the Harvard Center for International Affairs. The aim of the conference was to bring attention to the military developpments in the High North,

[9] Marion K. Leighton, *The Soviet Threat to NATO's Northern Flank* (New York: National Strategy Information Centre Inc, 1979).

in a context where most strategic attention of the West was given to Central Europe.[10] Similarly, the publication of *Northern Europe: Security issues fot eh 1990s* by Paul Cole and Dougles Hart (eds.) focusses on the relative tranquility that has characterized the High North post-World War I. At the same time, they point to the fact that the North Atlantic cannot escape a general East-West confrontation, and that a clash in the north will bleed into theatres elsewhere.[11] Clive Archer and Arthur Scrivener were members of the Royal Institute of Internatioanl Affairs' Northern Waters Study Group. Their publication in 1986 of *Northern Waters. Security and Resource issues* shed light on the study group's concerns for the water space between the Canadian eastern seaboard to the Barents Sea. These range from strategic issues to questions of resource management in the North.[12] Walter Goldstein edited *Clash in the North – Polar summitry and NATO's northern flank* in 1988, where focus is given to the increasing superpower tensions in the North Atlantic and the Baltic, as well as arms control and NATO decision making in a tense geopolitical setting.[13] In *Cold Water Politics – The Maritime Strategy and Geopolitics of the Northern Front*, Ola Tunander assesses the offensive strategy of the United States in the early and mid-1980s. He claims that a decreasingly credible nuclear deterrence in the side of the Americans demanded a conventional offensive strategy that aimed to neutralize the Soviet Union strategic naval assets early in a conventiaon conflict.[14] Brassey's Atlantic Commentary *NATO's Defence of the North*, edited by Eric Grove in 1989 summarizes the complexities of security politics in Northern Europe, with three Alliance members and two non-NATO members all aiming to maintain peace and low tensions in a highly strategic area, both the Barents Sea and the Baltic.[15] In *Soviet Sea Power in Northern Waters* from 1990, John Skogan and Arne Bruntland (eds.) draw attention more specifically to the growth and motivation of Soviet sea power, and the impact that these have on some of the nations of North West Europe. In addition, a discussion on Western responses to the Soviet expansion is debated.[16]

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[10] Sverre Jervell and Kare Nyblom, *The Military Buildup in the High North. American and Nordic Perspectives* (London: UP of America, 1986).
[11] Paul Cole and Douglas Hart, eds., *Northern Europe: Security Issues for the 1990s* (London: London Westview Press, 1986).
[12] Clive Archer and David Scrivener, eds., *Northern Waters* (London: Croom Helm, 1986).
[13] Walter Goldstein, ed., *Clash in the North* (Washington, D.C.: Pergamon-Brassey's International Defense Publishers, 1988).
[14] Ola Tunander, *Cold Water Politics - The Maritime Strategy and Geopolitics of the Northern Front* (London: SAGE Publications, 1989).
[15] Eric Grove, ed., *NATO's Defence of the North* (London: Brassey's, 1989).
[16] John Skogan and Arne Brundtland, eds., *Soviet Sea Power in the Northern Waters* (New York: St.Martin's Press, 1990).

Rolf Tamnes has published an array of studies throughout his career, but his *The United States and the Cold War in the High North* is a standard work for anyone studying historical military issues in the North Atlantic.[17] Tamnes provides a holistic overview of the bilateral relationship between the US and Norway, from WWII through the 1980s, on security policy, strategy and military cooperation. He gives a comprehensive account of how the North Atlantic and the High North emerged as the focal point of the bilateral relationship. He points to how the growing concern of the military build-up on the Kola peninsula has forced policy discussions in Norway throughout the Cold War. But the emphasis and importance given to the High North in strategic terms for the US has also varied, and fluctuating strategic emphasis have caused insecurity in Noregian policy circles. On the other side, Norway has displayed somewhat of an ambivalent posture towards encouraging American presence and activities simulatenously as Norway´s strongest ally has been held at arm´s length in order to maintain low tensions towards the Soviet Union. This dichotomy is a clear constant throughout Tamnes´analysis.

The overarching framework for understanding Norwegian security politics and historical defense policies is constituted by two main volumes of work. The six volume *Norsk utenrikspolitikks historie*[18] published in 1996/1997, provides essential overview of Norwegian security policy in a larger international context. The analysis underlines the different aspects of alliance coordination and cooperation, as well as formative domestic discussions and challenges that have shaped that interaction. In this work it is emphasized that maritime strategic questions and the surveillance of the High North have played important roles in foreign relations and the transatlantic relationship. Most relevant for this study has been Jakob Sverdrup´s *Inn i storpolitikken, 1940-1949,*[19] Knut E. Eriksen and Helge Ø. Pharo´s *Kalg krig og internasjonalisering, 1945-1963,*[20] and finally Rolf Tamnes´ *Oljealder, 1965-1995*.[21]

The five volume series on *Norsk forsvarshistorie*[22] published in 2004 gives a thorough account on the development of the Norwegian defense establishment and armed forces.

[17] Rolf Tamnes, *The United States and the Cold War in the High North* (Oslo: Ad Notam, 1991).
[18] "The history of Norwegian foreign policy"
[19] Jakob Sverdrup, *Inn i Storpolitikken, 1940-1949*, vol. 4, Norsk Utenrikkspolitikks Historie (Oslo: Universitetsforlaget, 1996).
[20] Knut E. Eriksen and Helge Ø. Pharo, "Kald Krig Og Internasjonalisering, 1945-1965," vol. 5, Norsk Utenrikspolitisk Historie (Oslo: Universitetsforlaget, 1997).
[21] Rolf Tamnes, *Oljealder, 1965-1995*, vol. 6, Norsk Utenrikspolitikks Historie (Oslo: Universitetsforlaget, 1997).
[22] "The history of the Armed Forces of Norway"

Several of the security policy related issues are treated more in detail in this analysis than in the foreign policy history account mentioned above. In addition, the works go into detail on the development of the Norwegian command structure, the respective units and their relationship to the overarching development of the Armed Forces writ large, as well as the important evolution and development of the leadership of the armed forces and their connection to the Ministry of Defense and the political establishment. Operations, exercises and interaction with NATO units are also dealt with in detail. Most relevant for this study are the two latest volumes, that is Kjetil Skogrand´s *Alliert i krig og fred, 1940-1970,*[23] and Jacob Børresen, Gullow Gjeseth and Rolf Tamnes´ *Allianseforsvar i endring, 1970-2000*.[24]

Also, Olav Njølstad´s encompassing and detailed biography of the war hero and later defence minister Hauge, *Jens Chr. Hauge – Fullt og helt* from 2008, not only describes in impressive detail the life and work of a formative political figure in the post-war years.[25] It also sheds light on the intense political dynamics in the aftermath of WWII in Norway, and the orientation westwards that would culminate in the NATO membership. As a crucial part of this analysis stands the background for the basing policy and the formal restrictions on allied presence and activities on and from Norwegian soil.

The works of Katarzyna Zysk, professor and deputy director of the institute, have also informed this thesis through providing thorough analysis on Russian military strategic and political developments, developments and modernization of the Russian defence sector, and Russian sea power and maritime security.[26]

Academics serving at the military academies and the staff college of the Norwegian Armed Forces have also made valuable contributions to the analytical literature on the High North. Gjert Lage Dyndal has for some time been an active voice in this regard. In his *How the High North became central to NATO strategy: Revelations for the NATO Archives* published in 2011, he portrays the elements that actually constituted the change in NATO perception of its Northern Flank. He goes into detail on the background for NATO´s Flexible Reponse

[23] Kjetil Skogrand, *Alliert i Krig Og Fred*, Norsk Forsvarshistorie 4 (Bergen: Eide Forlag, 2004).
[24] Jacob Børresen, Gullow Gjeseth, and Rolf Tamnes, *Norsk Forsvarshistorie - Allianseforsvar i Endring, 1970-2000*, Norsk Forsvarshistorie 5 (Bergen: Eide Forlag, 2004).
[25] Olav Njølstad, *Jens Chr. Hauge - Fullt Og Helt*, 4th ed. (Oslo: Aschehoug, 2008).
[26] See for example Katarzyna Zysk, "Russia's Arctic Strategy - Ambitions and Constraints," *Joint Force Quarterly (JFQ)*, no. 57 (2nd Quarter 2010); Katarzyna Zysk, "The Evolving Arctic Security Environment - An Assessment," in *Russia in the Arctic*, ed. Stephen J Blank (Carlisle, USA: Strategic Studies Institute of the US Army War College (SSI), 2011), 91–138; Katarzyna Zysk, "Mot et Moderne Russisk Forsvar? Utviklingstrender i Militær Modernisering Og Strategisk Tenkning," *Norsk Militært Tidsskrift* 183, no. 3 (2013).

strategy, the way the concerns of the Supreme Allied Commander Atlantic (SACLANT) fed into important strategic studies in the 1960s and the awakening to the Soviet strategic submarine threat in the late 1960s, among other elements. These paved the way for the Northern Flan to emerge as an independent strategic theatre of war.[27] Further, in *The rise of the Soviet Navy, a re-visited Western view* he gives an account of how the Soviet Navy under admiral Gorshkov developed into a balanced fleet, particularly suited for its purpose in the High North.[28] In addition, an important collaboration between Dyndal and Eystein Espenes of the Royal Norwegian Air Force Academy provides important insight into the developments of NATO's intelligence focus towards the High North. They examine at the time newly released archive material in order to portray the chronological development in NATO intelligence assessment of the Baltic and the High North. They show that the change in intelligence focus from the southern parts of Scandinavia and the Baltic Sea to the High North occurred in 1956 and 1957.[29] This coincides with the intelligence foundation for the work of the NATO Group of Experts and the common MPA procurement project in the late 1950s and early 1960s, as we shall see.

More recently, John Andreas Olsen has edited three *Whitehall papers* for the Royal United Services Institute (RUSI), which discuss different aspects of geopolitics and strategy in the North Atlantic. In *NATO and the North Atlantic – Revitalizing collective defense* from 2017, the authors underline the importance of maintaining and sustaining the transatlantic link in an increasingly complex and multifaceted security environment, and offer particular analysis on the US, the UK and Norway.[30] In *Security in Northern Europe – Deterrence, defence and dialogue* from 2018, the authors expand the discussion to include the members of the Northern Group and Canada.[31] Together they offer security proposals both for individual nationas and for a collective effort. Finally, in *Future NATO – adapting to new realities* published in 2020, the essays turn to NATO as an organisation and the security landscape it

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[27] Gjert Lage Dyndal, "How the High North Became Central in NATO Strategy: Revelations from the NATO Archives," *Journal of Strategic Studies* 34, no. 4 (2011): 557–85.
[28] Gjert Lage Dyndal, "The Rise of the Soviet Navy, a Re-Visited Western View," *Tidsskrift (Kungliga Krigsvetenskapsakademien)*, no. 3 (September 2013), http://www.academia.edu/5972744/The_rise_of_the_Soviet_Navy_a_re-visited_Western_view.
[29] Øystein Espenes and Gjert Lage Dyndal, "The Changing Focus of NATO-Intelligence - From Southern Scandinavia to the 'High North' at the End of the 1950s," *Tidsskrift (Kungliga Krigsvetenskapsakademien)*, no. 2 (June 2013), http://kkrva.se/hot/2015:2/HoT_2_2015.pdf.
[30] John A. Olsen, ed., *NATO and the North Atlantic - Revitalizing Collective Defence*, Whitehall Paper 87 (London: Royal United Services Institute (RUSI), 2017).
[31] John A. Olsen, ed., *Security in Northern Europe: Deterrence, Defence and Dialogue*, Whitehall Paper 93 (London: Royal United Services Institute (RUSI), 2018).

must face in order to stay relevant.[32] Together, these volumes provide insight in the security terrain that NATO in general, but also the nations surrounding the North Atlantic specifically, must manouever.

Håvard Klevberg´s seminal PhD on the place of historical maritime airborne surveillance in Norwegian security politics, *Maritime surveillance in the North – the 333 squadron in Norwegian security politics* covers in significant detail the development of the Norwegian maritime patrol aircraft community in Norway during the Cold War.[33] He approaches his analysis from three levels. Firstly, he looks at the way maritime air surveillance has played a significant role in Norwegian security politics throughtout the Cold War. Secondly, he looks at how the development of the Norwegian MPA community is closely intertwined with the overarching development of the Norwegian armed forces as a whole, both with regards to intra-service rivalry, to the development of the joint command institutions and command structure, as well as the emergence of the Norwegian Coast Guard. Finally, he discussed how certain individuals during specific periods during the Cold War have been formative for the development of the maritime air operations community in Norway.

This thesis does not challenge existing literature on the geopolitics of the High North. However, it has for the North Atlantic been necessary to describe the development of naval strategy and the role of submarines within it, in order to understand the relevance of airborne ISR in the subsurface domain in the past and the present. The mentioned literature provides the background for the political and strategic context for the development of maritime ISR in the High North. The gaps that this thesis seeks to fill are those of the operational and tactical understanding for maritime surveillance within that context. It is in the shape of the basic tenets that constitute such an understanding, that from a lower level will seek to meet the overarching strategic context, that there is a gap in analysis that must be filled.

1.2.2 Russian submarine and missile development

It is hard to discuss naval warfare, technology and strategy without touching on works by Norman Friedman. His ability to combine historical developments, technological details and insight and strategic aspects of warfare often provides an important contribution to any military discussion in the maritime domain. His work is represented in this thesis by

[32] John A. Olsen, ed., *Future NATO: Adapting to New Realities*, Whitehall Paper 95 (London: Royal United Services Institute (RUSI), 2019).
[33] Håvard Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics" (PhD, History, Oslo, University of Oslo, 2011).

Submarine Design and Development, *The US Maritime Strategy*, and *Seapower and Space* – in addition to a range of articles published in the US Navy journal *Proceedings*. Another prominent naval historian is Norman Polmar, who through both his writings for Jane's, his numerous articles and books on naval affairs have contributed significantly to this thesis. Likewise, Jan Breemer not only contributed to the bastion debate in the 1980s, but followed up on his studies with a range of articles on submarine development and naval strategy, for example *Soviet Submarines – Design, Development and Tactics*. He also wrote one of the Newport Papers issued by the US Naval War College, entitled *Defeating the U-boat – inventing anti-submarine warfare*. Yet another naval historian with an impressive portfolio of titles concerning naval ships and warfare is John Jordan. Currently the editor of the annual release of the *Warships* series by Osprey Publishing, he has written extensively on historical battleship development, including a book on *Soviet Submarines – 1945 to the present*. Most of the authors mentioned also discuss the development of weapons, including missiles fired from submarines. However, contemporary writings on missile development available in open sources are usually from the media, or from online blogs with sources that by definition are impossible to confirm without committing a breach of security oneself. Some blogs and authors stand out with credibility due to their background, and consistency in reporting. Pavel Podvig seems to be one of the most credible sources on Russian strategic force development. His project *Russian Nuclear Forces* runs the blog *russianforces.org*, which posts reports on Russian weapons development with a high degree of currency. His work has also produced the detailed and encyclopaedic book *Russian Strategic Nuclear Forces*, which has informed this thesis substantially.

1.2.3 ASW development in general

A lot about the role of maritime airborne surveillance and reconnaissance can be learned through studies of the Western approach to the Soviet submarine threat during the Cold War. Owen Cote wrote in the early 2000s about the *Third Battle [of the Atlantic]*, where the first and the second battle are considered to be the fight against German submarines in WWI and WWII, respectively. The third battle entailed the tracking and containment of Soviet submarines during the Cold War. Cote's discussion does not apply to maritime airborne surveillance specifically, but he covers the roles that MPA played in concert with submarines and fixed, underwater listening systems such as Sound Surveillance System (SOSUS). The different elements of the ASW effort were dependent on each other, and filled essential roles in order to track enemy submarines in vast masses of water. Cote's work from 2003 is mostly descriptive in nature, but there are principled takeaways from his historical depiction of events. One example is how the lack of ASW capabilities in interaction with improved subsurface technologies led to changes to doctrine and strategy.

Kathleen Hicks et al. of the Centre for Strategic and International Studies (CSIS) published in 2016 a thorough account of the status of underwater warfare in the North Atlantic.[34] The article provides a thorough discussion of the underwater capabilities of the Northern Fleet, and gives an introduction to NATO's present-day approach to the North Atlantic. In order to meet the emerging underwater threat, specific recommendations are provided on restructuring organisations, upgrading capabilities and revising NATO's posture. Although elegantly argued, the article does not provide an explanation as to the fundamental reasons for the requirement for the respective capabilities, to include airborne platforms. Another example of an analysis of the current status of naval affairs in the North Atlantic is the 2019 release of *The New Battle for the Atlantic – Emerging Naval Competition with Russia in the Far North*, by Magnus Nordenman. Motivated by a lack of maritime focus in NATO over the past two decades, Nordenman brings to the fore the re-emerging Russian naval threat in the North Atlantic. Based on discussion with NATO commanders, US Navy officials and Nordic ministries of defence he provides a range of generic recommendations for NATO's and the United States' approach to the North Atlantic. Several of his conclusions are supported by this thesis.

Through the theoretical framework for airborne ISR presented in this thesis new ASW technology can be discussed in a structured context, a framework that has not been available until now. By deconstructing the elements of airborne ISR one can from an objective standpoint discuss the relevancy of the platforms conducting ASW, and thus develop recommendations for a future construct of ISR platforms.

1.2.4 Airborne Intelligence, Surveillance and Reconnaissance (ISR)

Not very much has been written comprehensively on airborne ISR. There are quite a few publications on elements of airborne ISR, such as electronic intelligence, communications intelligence, or imagery intelligence. And there is a substantial array of books on different

[34] Kathleen Hicks et al., "Undersea Warfare in Northern Europe," CSIS International Security Program (Center for Strategic and International Studies, July 2016).

specific aircraft, and a growing literature on unmanned aircraft. However, the most comprehensive publication to this date on the history of airborne ISR as a whole seems to be Tyler Morton's PhD dissertation from 2016 on the historical development of manned airborne ISR in the US Air Force.[35] This work, together with others on airborne surveillance and reconnaissance during World War II and the Cold War, have substantially informed this thesis as to the historical backdrop of the theoretical framework for airborne ISR. The emergence of ISR as a concept in the 1990s will be discussed in section 1.3.2 below.

1.2.5 Maritime airborne surveillance, reconnaissance and patrol

Likewise, little has been written on *maritime* airborne ISR. There are no comprehensive studies on maritime airborne surveillance in the North Atlantic, except for Håvard Klevberg's PhD thesis on Norwegian developments within maritime air operations during the Cold War, mentioned above. Klevberg discusses in his dissertation from 2011 the development of maritime air surveillance in Norway from the inter-war period leading up to WWII until the end of the Cold War.[36] He places the activities of the sole, maritime air squadron of the Norwegian Air Force, the 333 squadron, in a tactical, strategic as well as a political context, and shows how the evolution of Alliance dynamics and bilateral interaction with the USA, and of the Norwegian Armed Forces (in particular the Air Force) shaped the development of maritime air operations for Norway. His work, however, is more of a case-study of the 333 squadron than a conceptual-theoretical study on maritime ISR *per se*, although the former sheds light on the latter in an organizational construct. Moreover, much has happened since the end of the Cold War with regards to maritime airborne surveillance, particularly in the High North, which must be analysed and contextualized. This thesis thus develops the operational and international parts of the discussion that Klevberg initiated in his thesis.

Existing studies typically focus on specific operations and/or aircraft that have been performing those operations. A noteworthy publication is the *Maritime Patrol Aviation*, a magazine that were issued starting in 1988 by VP International, the international MPA alumni with headquarters in Greenwood, Canada. The magazine is a venue for exchanging ideas, doctrinal discussions and lessons learned, as well as noteworthy operations from the maritime air patrol community. In essence constituting an internal discussion forum for the

[35] Tyler Morton, "From Kites through Cold War: The Evolution of United States Air Force Manned Airborne ISR" (PhD, Maxwell AFB, Montgomery, Alabama, Air University, 2016).
[36] Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics."

MPA community, the magazine has articles of significant interest to this study, but has in itself had little impact on the broader discussion on ISR.

If we look at military journals with a broader impact such as the US Naval Institute's *Proceedings*, most articles about maritime air surveillance and reconnaissance were published after the Cold War. They are generally related to the requirements associated with maritime airborne ISR, and the future of that particular profession in times of over-land focus by the rest of the military organization.

Specific writings on maritime aircraft offer insight into operational requirements, in addition to giving some descriptions of specific maritime surveillance operations – these are usually writings that cover the main maritime aircraft operated by the nations that operated the most and the most capable maritime aircraft: the USA and the UK.[37] David Reade offers a thorough study of the history of the P-3 *Orion*, and Tony Blackman has written somewhat more compressed on the history of the *Nimrod*.[38]

One missing piece on maritime airborne surveillance and reconnaissance is a more detailed case-study of the NATO weapons procurement program for MPA in the 1950s, the *Atlantique*. The procurement was described from a Norwegian standpoint by Klevberg and briefly from an airframe development standpoint by Chris Gibson, but a holistic explanation of the background, the details of the negotiations, and the results is missing.[39] Drawing on technical details, minutes from negotiations on aircraft and system requirements, operational characteristics, details on procurement, and documents on the operational background for the NATO acquisition program, this thesis will for the first time offer a holistic explanation of the background, evolution, and results of these efforts. The study points to fundamental elements of the theoretical framework for airborne ISR, which is presented later in the thesis.

The literature on airborne ISR in the High North during the Cold War is sparse and usually focusses on specific MPA operations.[40] They do not provide, in themselves, much discussion

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[37] David Reade, *The Age of Orion - The Lockheed P-3 Story* (Atglen, PA: Schiffer Publishing, Ltd., 1998); Chris Gibson, *Nimrod's Genesis - RAF Maritime Patrol Projects and Weapons since 1945* (Manchester: Hikoki Publications, 2015). For a basic explanation of sonobuoys see Birkeland, "The Potential of LIDAR as an Anti-Submarine Warfare Sensor", 15-25.

[38] Reade, *The Age of Orion - The Lockheed P-3 Story*; Tony Blackman, *Nimrod - Rise and Fall* (London: Grub Street Publishing, 2011).

[39] Gibson, *Nimrod's Genesis - RAF Maritime Patrol Projects and Weapons since 1945*, 104–7.

[40] Examples of such articles are M. Coleman, "Journal 33," *Royal Air Force Historical Society Journal* 33 (2005): 89–102; Jasjit Singh, "Aerial Surveillance for Maritime Security," *Strategic Analysis* 7, no. 12 (1984); David Reade, "Worldwide P-3 Status Report," *Maritime Patrol Aviation*, September 1992, 62–68; David Reade and Bob Harper, "Naval Air Station Keflavik, Iceland," *Airborne LOG*, no. Fall 1994 (1994): 8–11.

of overarching tenets of maritime surveillance operations. Nor do they offer insight into the ways in which maritime surveillance operations interacted with the rest of the intelligence community, tasking, analysis, or the dissemination of maritime airborne intelligence products. This thesis places maritime airborne ISR operations into a contextual and theoretic framework, and thus provides a basis for discussing the requirements for maritime airborne ISR for the future.

Harald Håvoll's study of the future Norwegian airborne maritime surveillance on behalf of the Norwegian Foreign Policy Institute in Oslo in 2015 aims to provide the basis for an informed discussion on future requirements for maritime long-range surveillance.[41] Håvoll's report describes the basic components of maritime surveillance with regards to capabilities and sensors. His report does not, however, place Norwegian maritime airborne ISR in an expanded, organisational context, except for opening for the option of combining unmanned systems with manned MPA. Meanwhile, Norwegian officer Jan Egil Rekstad's 2018 master's thesis examines the P-8 *Poseidon* and the potential for trilateral partnership between the US, the UK and Norway on maritime surveillance in a contemporary context. Although not set in a theoretical framework, he discusses speed, range and altitude for maritime aircraft, networked operations, joint ASW, and presents a good operational discussion on submarine prosecution.[42] The study points to the inherent potential in three key nations flying the same aircraft, but overestimates the continuity and persistency in presence and search capabilities the P-8 can provide. The discussion on maritime surveillance and its role in deterrence is good but short, and deserves further examination.

In sum, it can be argued that current writings on maritime airborne ISR in the High North lack contextualization within a theoretical framework. Little to no link is made between airborne ASW efforts and a general understanding of airborne ISR. This is a weakness that the maritime airborne ISR community must confront as soon as possible if they are to stay relevant. This thesis aims to bridge some of this gap.

[41] Harald Håvoll, "Airborne Maritime Surveillance and ASW - Status and Development: Consequences for Norway" (Norsk Utenrikspolitisk Institutt (NUPI), 2015).

[42] Jan Egil Rekstad, "P-8 and the Trilateral Partnership - The Operational Significance and Influence on Norwegian Security Policy" (Master's Thesis, Oslo, The Norwegian Drfence University College, 2018).

1.3 Method

1.3.1 Outline of the study

This thesis focuses on of the historical development of MPA operations in the North Atlantic, which together with the overarching historical development of airborne intelligence collection facilitate the establishment of a theoretical framework for airborne ISR. Any discussion of these developments must be situated within a broader framework that highlights the evolution of the geopolitical context in the North Atlantic, including the evolution of Soviet/Russian grand and naval strategy, the place of submarines within that strategy, and NATO responses to them. Parallel to this, the discussion also pays attention to crucial technological and operational developments on the part of both Russian submarines and MPAs (as well as other relevant surveillance elements). A structured depiction of these historical developments assists in establishing a theoretical framework for airborne ISR. It is within this framework that we can then objectively discuss the requirements for future ASW capabilities in airborne ISR in the High North.

There is no internationally recognized definition of the *High North*. The term North can be somewhat misleading in general geographical naming conventions, all the while it can be applied in relative terms: An Italian travels north to Denmark, and a Norwegian travels south to Denmark. The North Sea, which is the basin between the UK, the European mainland and Scandinavia, is situated south of the Norwegian Sea. The High North is for the sake of this thesis defined as the ocean and land areas north of the Arctic circle, which is a very long distance towards North for most of the world's population.

1.3.2 ISR as a concept

The term ISR was not in use until the 1990s. Before this, the common terms were "intelligence collection", "surveillance", and "reconnaissance", often prefixed by the word "airborne". In the maritime domain, the terms "maritime surveillance and reconnaissance" and "maritime patrol" have been used interchangeably. The concept of ISR evolved in a time where maritime surveillance and reconnaissance was overshadowed by modern expeditionary warfare in the Balkans and the Middle East in the 1990s. As warfare has evolved since the Cold War, so has our understanding of intelligence support to operations, and intelligence being integrated into operations. In the beginning of the 1990s, the main foe for the West seemingly disappeared, and the decisive naval battles, the great land campaigns, and the fight for air superiority seemed to turn into anachronisms. Warfare became limited in time, scope and space, and armed forces were forced to think *joint*. Expeditionary warfare in the 1990s (Gulf War I, Somalia, the Balkans) became the contemporary way of fighting wars, and intelligence stepped up as more of a core tenet of modern warfare as opposed to the more classic interpretation of intelligence as having an auxiliary, supporting role.[43] In addition, there was an explosion in the use of unmanned aircraft in support of ground operations in the 1990s and early 2000s. The availability of ISR products from the tactical to the strategic level has been a giant leap forward for military organizations, although the immense amounts of information accessible also pose significant challenges. It was in this context that "ISR" grew into its own, and became an integrated part of the "net-centric warfare" movement. "ISR" as a term came into daily usage in the mid-1990s, after first being coined by the United States Vice Chairman of the Joint Chiefs of Staff, Admiral Owens, pointing to ISR as a vital component of modern warfare, implemented through the concept of net-centric warfare.[44] A network-centric approach to warfare is essentially the military embodiment of information age concepts. It is the linkage of computers, communications, sensors and military units in order to improve efficiency and effectiveness of military operations.[45] Or as John Ferris puts it, it is "*the idea that armed forces will adopt flat structures, working in nets on the internet, with soldiers at the sharp end able to turn data processing systems at home into staffs through 'reachback', real time, immediate and thorough inter-communication.*"[46] In short, it is about gathering, interpreting, disseminating, and acting upon information in the battlefield – faster than your opponent. The tenets of netcentric warfare are thus a networked force in order to improve information sharing, which in turn will enhance the quality of information and shared situational awareness, which will enable collaboration, self-synchronization, sustainability and speed of command, which finally will increase mission effectiveness.[47] Critical voices in the early and mid-2000s pointed to important elements of command and warfare in general being eroded in favour of an emphasis on quantitative measurements (number of targets hit, numbers of areas covered through surveillance etc.), and what some

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[43] Gregory Elder, "Intelligence in War: It Can Be Decisive," *Studies in Intelligence* 50, no. 2 (2006); Brian P. Tice, "Unmanned Aerial Vehicles - The Force Multiplier of the 1990s," *Air & Space Power Journal* 5, no. 1 (1991).
[44] David A. Deptula and R. Greg Brown, "A House Divided - The Indivisibility of Intelligence, Surveillance and Reconnaissance," *Air & Space Power Journal* 22, no. 2 (Summer 2008).
[45] Clay Wilson, "Network Centric Warfare: Background and Oversight Issues for Congress" (Washington, D.C.: Congressional Research Service, June 2, 2004), CRS-2.
[46] John Ferris, "Netcentric Warfare, C4ISR, and Information Operations: Towards a Revolution in Military Intelligence?," *Intelligence and National Security* 19, no. 2 (2004): 199–225, 199.
[47] John Luddy, "The Challenge and Promise of Network-Centric Warfare" (Arlington, VA: Lexington Institute, February 2005), 3.

commentators have termed the "*fetishisation of speed and tacticisasion of strategy*."[48] Netcentric warfare is not the topic of discussion for this thesis; however, any discussion of modern ISR must take into account developments of modern armed conflict as a whole, in order to make the gathered intelligence products actionable to the rest of a joint force.

The development of ISR in the 1990s occurred with maritime airborne ISR standing on the sidelines. As warfare became more expeditionary and focused on counterinsurgency, and the level of foreign submarine activity was in free-fall, the open ocean MPA community found itself in search of a mission. This sudden identity crisis led to more and more MPAs executing surface and over-land surveillance and reconnaissance, in place of what historically had been their primary mission – anti-submarine warfare.[49] This ambiguity is one of the factors that makes the study of modern maritime ISR an interesting topic for discussion, all the more so as Russian submarine activities are once more on the rise.

To the extent possible, this thesis will rest on definitions endorsed by NATO. NATO defines *surveillance* as

> *"the systematic observation of aerospace, surface, or subsurface areas, places, persons, or things, by visual, aural, electronic, photographic, or other means."*[50]

This definition covers those activities concerned with observing objects, people, and areas *over time*, in support of building empirical knowledge on an adversary. *Reconnaissance,* meanwhile, is defined as

> *"a mission undertaken to obtain, by visual observation or other detection methods, information about the activities and resources of an enemy or potential enemy, or to secure data concerning the meteorological, hydrographic, or geographic characteristics of a particular area."*[51]

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[48] See for example Ferris, "Netcentric Warfare, C4ISR, and Information Operations: Towards a Revolution in Military Intelligence?", 201.

[49] Scott Jasper, "Does Maritime Patrol Have a Future?," *United States Naval Institute Proceedings* 123, no. 4 (April 1997); Birkeland, "The Potential of LIDAR as an Anti-Submarine Warfare Sensor", 54-44; Perkins, "Alliance Airborne Anti-Submarine Warfare - A Forecast for Maritime Air ASW in the Future Operational Environment", 45-46.

[50] AAP-6, "NATO Glossary of Terms and Definitions" (NATO Standardization Agency, April 3, 2013), 2-S-15.

[51] AAP-6, 2-R-4.

Reconnaissance is thus information gathering in more specific terms. An asset or a person is tasked to observe a *specific* adversary person, unit, or activity, at a *given time and place*. Finally, *intelligence* builds on these collection activities, and is defined as

> *"the product resulting from the processing of information concerning foreign nations, hostile or potentially hostile forces or elements, or areas of actual or potential operations. The term is also applied to the activity which results in the product and to the organizations engaged in such activity."*[52]

Collection is carried out through the overarching activities of *surveillance* and *reconnaissance* – the products stemming from those activities will then be analysed and contextualized, eventually facilitating *intelligence*.[53] The three are thus inherently indivisible.[54] This indivisibility has matured into the *concept* "ISR" over the past two decades, although never maturing and developing into a theory. Doctrine, yes eventually, but not *theory* as an academic would understand it. Although the term *ISR* has not yet matured into an official NATO definition, the United States Department of Defence defines *ISR* as

> *"an activity that synchronizes and integrates the planning and operation of sensors, assets, and processing, exploitation, and dissemination systems in direct support of current and future operations. This is an integrated intelligence and operations function."*[55]

This definition underlines the integrated relationship between ISR and ASW. As will be emphasized in the new theoretical framework of this thesis, ISR is the foundation for ASW, and it is futile to discuss ASW without a thorough understanding of ISR.

There is no internationally acknowledged definition of *airborne ISR*. However, as the definition of ISR has been given above, the question then becomes with what type of asset can this activity be executed if it is *airborne*. Without going into the technical differentiation between classifications of aircraft that is commonly established by aviation authorities, this thesis simply refers to aircraft that depends on lift from the air. For the sake of this discussion

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52 AAP-6, 2-I–6.

53 The collection of intelligence is carried out in the framework of the respective intelligence disciplines (HUMINT, GEOINT, SIGINT, OSINT, MASINT, TECHINT, ACINT), which will not be elaborated on at this stage. For details, see for example US DoD (2012) Joint Pub. 2-01 "Joint and National Support to Operations".

54 Deptula and Brown, "A House Divided - The Indivisibility of Intelligence, Surveillance and Reconnaissance."

55 US DoD, "Joint Publication 1-02 - Department of Defense Dictionary of Military and Associated Terms", 116.

it is important to note that satellites do not fly through the air, but they have become significant contributors to overall intelligence gathering from an elevated position.

1.3.3 ASW defined

Any discussion on maritime airborne ISR will (or should) include a discussion on the requirement for ASW capabilities, as the surveillance of and warfare against adversary submarines have historically been a significant, though not the only, part of maritime airborne surveillance. The NATO definition of ASW is:

> *"operations conducted with the intention of denying the enemy the effective use of their submarines"*[56]

Clearly, ASW is not solely executed by aircraft. On the contrary, the main ASW force has traditionally been surface vessels with hull mounted sonars and towed arrays, and submarines. Airborne ASW assets include ship-based helicopters, ship-based fixed-wing aircraft, shore-based helicopters and shore-based maritime patrol aircraft. The only airborne platform designated for large area, long-range ASW, however, has been MPAs, and this thesis provides a detailed case study of MPA operations in the High North.

As part of an introduction to maritime airborne ISR it is necessary to have a common understanding of the term *patrol*, as it is used extensively to describe the role of many maritime airborne ISR missions. NATO defines the term *patrol* as:

> *"a detachment of ground, sea, or air forces sent out for the purpose of gathering information or carrying out a destructive, harassing, mopping up, or security mission."*[57]

The term *maritime patrol* is ingrained in military terminology, but is not properly defined in military doctrine. The understanding of maritime patrol is one of active observation of a given area, conducted by a unit that is capable of *engaging* hostile units within that area. The more passive surveillance, reconnaissance and general monitoring of ISR is not considered *patrol* in the full sense of the term, however, the surveillance and reconnaissance parts comprise significant parts of the act of patrolling an area. Mainly, the difference between a

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[56] AAP-6, "NATO Glossary of Terms and Definitions," 2-A-16.
[57] NATO, "AAP-6 - NATO Glossary of Terms and Definitions" (NATO Standardization Agency, April 3, 2013), 2-P-2.

maritime *surveillance* aircraft and a maritime *patrol* aircraft is just this: the ASW capability. As a continuation of this, if the aircraft is capable of searching for, finding, tracking, and subsequently engaging enemy submarines, the aircraft can be considered a maritime *patrol* aircraft, or MPA. The reason that this matters is that NATO members poured significant money and resources into procuring, maintaining, and operating MPAs during the Cold War, but the inventory of MPAs took a significant downturn after the Cold War. An important part of discussions related to future maritime airborne surveillance is the requirement for an ASW capability. With all the costs associated with operating an MPA fleet, this is an important political and military-strategic decision in either direction. This question goes to the core of the discussion on future ISR in the High North.

Airborne ASW is complicated business. The flying crew must understand the environment they are working in and they need to have a working knowledge of the particular equipment they use and how well it might function. Speed of reaction, flexibility to change operating areas quickly and efficiently, and the ability to deploy sophisticated buoys are all an advantage to the aerial ASW platform. The aircrew has an array of additional sensors on board that will help them accomplish their mission, be it covertly following the enemy submarine or hunting it down in order to neutralize her. As submarines have become quieter, in addition to operating in unpredictable patterns and large operating areas, the task of searching for, locating and tracking a modern submarine has grown more challenging, even with state-of-the-art sensors and computers. It is important to note that ASW is not necessarily about neutralizing the enemy submarine by sinking it with a torpedo. It also involves putting on an extensive search that the submarine commander is aware of, and thus has to evade or move around or through in order to accomplish his or her mission. The use of active sonar sensors in the water is one way of informing the submarine of the ASW force's presence. And when a naval force must traverse a given part of the ocean to reach an operational area, the water space ahead of the force must be searched for any threats. This is often termed *sanitization*. ASW forces will operate ahead of the naval force to ensure that there are no enemy submarines operating enroute. These are but a few examples of ways for airborne ASW assets to hinder a submarine from operating effectively.

1.3.4 Types of submarines

ASW, of course, has had to adapt to the evolution of submarines. This will be discussed in greater depth in the chapters that follow. Suffice it to say here that early submarines were diesel-electric, but as the nuclear powers developed smaller and more efficient reactors, the desire to move faster and longer with bigger submarines without replenishment over an extended period of time could be satisfied. Most submarines carrying ballistic missiles (SSBN) are nuclear powered and are able to operate almost anywhere in the world for months at a time. Attack submarines can be nuclear (SSN) or diesel-electric (SSK). SSKs usually do not operate very far from the shore due to their smaller size and manoeuvrability, in addition to their requirement to replenish diesel, a need the SSNs don't have. Some new submarines have Air Independent Propulsion (AIP), and are powered by fuel-cells that are charged without air. These submarines are as quiet as the SSKs.[58] Submarines that carry guided missiles can be conventional (SSG) or nuclear powered (SSGN), and are often in a modern context termed multi-role submarines, as they also usually carry a substantial load of torpedoes.

1.3.5 Sources

Primary sources for this study include declassified documents retrieved through archival research, interviews with knowledgeable persons, and official transcripts, reports, and communiques from national governments and NATO.[59] Three particular archives have been used for this thesis. The NATO archives in Brussels, the National Archives in Kew, London, and the archives of the US Navy and the Naval History and Heritage Command in Washington, D.C. In order to properly analyze and understand the political as well as operational context from a Norwegian standpoint, it would be necessary to access Norwegian archives in Oslo. This was not possible in the given timeframe due to severe Covid-19 restrictions. In order to shed light on and verify those important viewpoints, this will be done at a later stage. In the meantime, much of the Norwegian political discussion will rest on research by Klevberg and Tamnes, in particular. One of the challenges of this work has been that most documents are declassified only after 30 years, meaning that it has been at times difficult to retrieve relevant sources for the post-Cold War period. Archival sources are therefore prominent in the Cold War chapters of this thesis, while interviews and published primary sources feature more heavily in the post-Cold War chapters.

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[58] Birkeland, "The Potential of LIDAR as an Anti-Submarine Warfare Sensor," 13.

[59] An ethics consent was granted by the School of Humanities at the Universtity of Glasgow for these interviews.

In using open and published sources it is increasingly important to consider what platform is providing the information, from online blogs on modern weapons systems and newspapers to forums that are essentially propaganda, posing as credible news agents. In between all this, the respective intelligence agencies, such as the US Navy's Office of Naval Intelligence (ONI) and the Norwegian Intelligence Service (NIS) both provide unclassified intelligence assessments. Such assessments have been valuable for confirming or rejecting, and assessing the reliability of information and trends that can be extrapolated from other open, especially online sources.

For the historical chapters, US intelligence estimates have been widely used. These estimates oftentimes informed the NATO commands extensively both due to their quality and scope, but also due to the fact that key NATO commanders were and are American. Most of these intelligence estimates from the Cold War have been made publicly available over the past decade, leading to a succession of relevant documents that support the understanding of the general developments of the military dynamic in specific areas of the Alliance.

Russian literature and sources could have given another dimension to the discussions on Russian strategy developments. However, as this author is not capable of reading Russian, it would have been too time and resource demanding to locate and translate the relevant material for this purpose.

Probably the most comprehensive, modern study on specific requirements for airborne, long-range ASW capabilities was published the summer of 2016 by NATO's Joint Air Power Competence Centre (JAPCC).[60] The study is highly descriptive and borrows analysis of future trends in geopolitical dynamics as well as weapons development from other sources. It does, however, give clear recommendations within NATO's DOTMLPFI framework for future airborne ASW capabilities.[61] The study describes the organizational set-up of NATO in the face of the Soviet submarine threat during the Cold War, and emphasizes the requirement to establish a similar organization today due to increased proliferation of modern submarines the world over. It is a case study of NATO airborne ASW capabilities, and points to several important factors within maritime airborne ISR, although essentially only focussing on one aspect of it, namely ASW. In itself, the study is also too specific on NATO as an organization

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[60] Perkins, "Alliance Airborne Anti-Submarine Warfare - A Forecast for Maritime Air ASW in the Future Operational Environment."

[61] Doctrine, Organization, Training, Materiel, Leadership & Education, Personnel, Facilities, Information/Interoperability (DOTMLPFI)

to provide actual, generic input to a general theorization of airborne ISR. The study does, however, provide important empirical support to general observations, such as the requirement of airborne ASW units to perform quick-responding, long-range missions over and close to the water. There is no discussion, however, as to how modern long-range ASW fits into an overarching ISR framework.

Writings on the status and future of MPA can also be found in official studies and government discussions on the requirements associated with maritime surveillance and reconnaissance. Industry discussions on the requirements of MPA are naturally shaped by the fact that the author is coloured by the requirement to sell a product – few would be surprised to find that Boeing recommends Norway to have a full MPA capability (i.e. the P-8 *Poseidon*, which they produce) or that Northrop-Grumman suggests that the UK should acquire the MQ-4 *Triton* unmanned aerial system. Others have a more neutral voice, commenting on government decisions, white papers and reviews.[62]

From government sources we can find transcripts of discussions in parliaments, such as the statements of Angus Robertson (MP) on the lack of UK maritime surveillance capabilities given in 2012. Obviously, parliament discussions aren't the appropriate venue for discussing the theoretical framework of maritime airborne ISR, but the focus of such discussions and statements shows the aspects that are being emphasized at the political level.[63]

1.4 Disposition

This thesis chronologically builds towards the main discussion of the future role of ASW in airborne ISR in the High North in the final chapter. Chapter 2 establishes the historical backdrop to the maritime surveillance effort in the North Atlantic during the early Cold War. Chapter 3 is a case study of the NATO procurement program *Atlantic,* which started in 1957. Chapter 4 analyses the 1960s, when Norway was given new maritime aircraft to monitor Russian activity in the High North, but was not sufficiently capable to deliver intelligence from the subsurface domain. Chapter 5 examines the evolution of airborne anti-submarine warfare in the North Atlantic during the final decades of the Cold War. The USA, the UK and

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[62] See for example James Bosbotinis, "The SDSR and the Future of British Airborne ISTAR," *DefenseIQ* (blog), June 12, 2015, http://www.defenceiq.com/air-forces-and-military-aircraft/articles/the-sdsr-and-the-future-of-british-airborne-istar.

[63] Sue Robertson, "Defence Committee - Future Maritime Surveillance," Written Evidence (Government of the United Kingdom, Defence Committee, September 19, 2012).

Norway all flew capable aircraft and cooperated to hold the Russian submarines at risk. In allowing us to chart and assess the ways in which geopolitical, strategic, operational, tactical as well as technological changes affected the effective execution of airborne ISR and ASW measures, these historical chapters enable us to identify and isolate some of the fundamental elements of airborne, maritime ISR. Chapter 6, meanwhile, focuses on the post-Cold War era, which saw a sharp downturn in Russian naval activity following the collapse of the Soviet Union. This led to fundamental changes in how Western maritime patrol aircraft were utilized in operations and for peacetime surveillance. The chapter ends with a changed geopolitical situation and a renewed focus on the maritime domain and the subsurface threat. Together with literature on general airborne surveillance and reconnaissance, these historical chapters then provide the foundation for a novel theoretical framework for airborne ISR presented in chapter 7. The benefit of this framework is that it provides tools to properly discuss the requirements for surveillance and reconnaissance, and ASW in the North Atlantic, and how those requirements can be met. Finally, chapter 8 contains the main discussion on the role of ASW in airborne ISR in the High North. Here, the historical elements together with technological characteristics, in the context of the theoretical framework, provide the building blocks for the main arguments of this thesis.

2. The formative years: 1945-1960

2.1 Introduction

The history of submarines is closely intertwined with the history of the forces that have been tasked to neutralize them. There are many entities that must function well in concert with each other in order to "find, fix and finish" a submarine, and over the course of the Cold War one of the most prominent assets for conducting ASW were MPA. The ASW efforts in the Atlantic Ocean in the 20th century were termed the "Battles of the Atlantic".[64] The First battle aimed to secure allied civilian and military shipping during World War I. The Second battle involved the safeguarding of the sea lines of communication across the Atlantic from German U-boats during World War II. The Third battle was about holding at risk the Soviet submarines that posed a threat of an initial nuclear strike on the United States and Europe, and that aimed at assuring the Soviets a second-strike capability during the Cold War.

The Northern Fleet on the Kola peninsula expanded significantly in the 1940s and 50s, and the role of Russian submarines grew in importance. In NATO, ASW technology was steadily advancing based on a momentum carried on from WWII. The fifteen years between the end of WWII and 1960 stand out as formative due to early evolution in nuclear capabilities, the foundation of NATO, the consequences of the Korean War to naval strategy on both sides of the Iron Curtain, and the general development in subsurface technology, both for the hunter and the hunted.

The Norwegian government was in the first years after WWII reluctant to become too dependent on Great Power associations in either direction, but were approaching 1950 increasingly engaged in strengthening the Atlantic connection.[65] The single most central factor of Norwegian security politics became a reality in April 1949, when Norway became a founding member of NATO. The years following WWII saw the development of the Norwegian basing policy and the balancing act in the North: integration towards the West and thus deterrence towards the East, and screening towards the West through restricting Allied movements and presence on Norwegian soil and thus reassurance towards the East.

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[64] Owen R. jr. Cote, "The Third Battle - Innovation in the U.S.Navy's Silent War Struggle with Soviet Submarines," *Naval War College Newport Papers*, no. 16 (2003): 2; James Foggo and Alanik Fritz, "The Fourth Battle of the Atlantic," *United States Naval Institute Proceedings* 142, no. 6 (June 2016).

[65] Njølstad, *Jens Chr. Hauge - Fullt Og Helt*, 405–25; Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 150.

In the 1940s, the lack of Norwegian capabilities to monitor the military developments in the Barents Sea and on the Kola peninsula became evident through American surveillance aircraft flying from Norwegian bases into the area of intelligence interest. From the mid-1950s and onwards, Norwegian authorities enforced more explicit restrictions on Allied movements and presence in Norway, due to a raised awareness of the requirement for low tensions in the North. This political move would raise the focus on maritime surveillance in the High North. In the aftermath of WWII, the focus of the Norwegian government, particularly in the North, was on rebuilding the nation, rather than establishing and improving the ability to follow the military build-up on the Kola peninsula. A growing paradox became evident: an increase in Allied interest in the military developments in the High North and a decreasing Norwegian capability to monitor them. Maritime air operations in the High North would, starting in the 1950s, become a central factor in the bilateral relation between Norway and the United States. The obvious lack of Norwegian capabilities in all aspects of maritime air operations, led in the late 1950s to efforts to bring in new MPA to the Norwegian inventory.[66]

This chapter provides an historical back-drop to the evolution of maritime airborne ISR in the North Atlantic. Not so much a discussion of the basic tenets of airborne ISR, it provides essential background for the more detailed discussion that follows in the coming chapters. The chapter shows the growing importance of submarines in the Soviet Union’s strategic posture, and it shows that the most common response in NATO to the submarine threat, to the Third battle of the Atlantic, was the establishment of a credible MPA force.

2.2 The Northern Fleet build-up

The build-up of the Soviet Northern Fleet on the Kola Peninsula really started after WWII. However, Stalin’s grandiose vision stemming from the 1930s of an ocean-going navy had to contend with the traditional Russian defensive focus, in addition to the obvious, harsh economic realities that followed the war. Plans to build aircraft carriers and battleships were therefore discarded in favour of submarines and heavy cruisers.[67] After the Korean War, two fundamental factors stood out for the development of submarines for the Soviet Union. First,

[66] Klevberg, “Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics,” 139, 157–67.
[67] Gjert Lage Dyndal, “The Northern Flank and High North Scenarios of the Cold War” (Peripherie oder Kontaktzone? Die NATO-Flanken 1961 bis 2013, Zentrum für Militärgeschichte und Sozialwissenschaften der Bundeswehr, Potsdam, Germany, 2013), 8.

the Korean War itself cemented the place of the US Navy's aircraft carriers in the evolving nuclear strategy as a launch platform for nuclear strikes against the Soviet Union.[68] The Soviets could no longer focus on defending their national and regional sea spaces: The threat had to be met at sea, long before the carriers came within striking distance of the Soviet mainland. This was a task for a robust and capable submarine service. Second, the death of Stalin in 1953 enabled a general review of Soviet strategy in general, and naval development specifically. The new head of the Navy, Admiral Gorshkov, emphasized the value of single units with strategic impact, in particular submarines, and oversaw a robust expansion of the submarine fleet in his first years as head of the navy.[69]

Gorshkov's massive submarine-building programme had the overall aim of disputing sea control with NATO navies.[70] It was becoming increasingly clear for the Soviet Union that any contest of control of the Atlantic would be fought by the Northern Fleet, which had access to the only guaranteed year-round ice-free ports of the Russian Navy.[71] Western intelligence also picked up a significant increase in the level of submarine training, and a general extension of peacetime patrol areas far beyond traditional Russian patrol areas close to their own coastal waters.[72]

The Potsdam agreement after WWII had ensured that the Soviet Navy received several Axis submarines as a share of the war spoils, including several advanced German *Type XXI* submarines.[73] After the reconstruction of war-damaged Soviet shipyards in the first five years following the war was completed, new submarine construction commenced. Several classes of diesel-electric propulsion were constructed in the 1950s. The benefits of nuclear over conventional propulsion, however, were recognized early: increased transit speed, range, and

[68] John Jordan, *Soviet Submarines - 1945 to the Present* (London: Arms & Armour Press, 1989), 46; Jan S. Breemer, *Soviet Submarines - Design, Development and Tactics* (Surrey, UK: Jane's Information Group Ltd, 1989), 103.
[69] Natalia Yegorova, "Stalin's Conception of Maritime Power: Revelation from the Russian Archives," *Journal of Strategic Studies* 28, no. 2 (2005): 158–59; Sergei Chernyavskii, "The Era of Gorshkov: Triumph and Contradictions," *Journal of Strategic Studies* 28, no. 2 (2005): 287–93; Jordan, *Soviet Submarines - 1945 to the Present*, 41.
[70] Dyndal, "The Northern Flank and High North Scenarios of the Cold War", 10.
[71] SG 161/8 (Part II), "The Soviet Bloc Strength and Capabilities 1955-1959" (NATO, March 18, 1955), 124–30, NATO, online archive.
[72] Mats Berdal, "Forging a Maritime Alliance - Norway and the Evolution of American Maritime Strategy 1945-1960," *Forsvarsstudier* 4 (1993): 24–41.
[73] For excellent introductions to the Whiskey, Zulu, Quebec, Romeo and Foxtrot classes, see Norman Friedman, *Submarine Design and Development* (London: Conway Maritime, 1984), 100–101; Jordan, *Soviet Submarines - 1945 to the Present*, 22; Breemer, *Soviet Submarines - Design, Development and Tactics*, 80; Defense Intelligence Agency (DIA), "Russia Military Power - Building a Military to Support Great Power Aspirations" (Defense Intelligence Agency, 2017).

unprecedented endurance. The Soviet Navy thus began developing a reactor for nuclear propulsion in 1953. The development of the *November* class submarine was given high political priority, and was rushed into production to such a degree that the prototype stage was bypassed altogether. This led to a leaky and unreliable propulsion system. Although the *November* only carried torpedoes, her commissioning in 1958 was a significant milestone. The submarine worked in tandem with the *Foxtrot* class in scouting far at sea.[74]

In 1954, the US Director of Central Intelligence (DCI) assessed through his National Intelligence Estimate (NIE) that the Soviets "*almost certainly*" would have a requirement for submarine-launched nuclear missiles for attacks on NATO. It was assessed as inevitable that nuclear missiles with an increasing range fired from submarines would pose a substantial threat by 1958.[75] Both the US and the Soviet Union were already in possession of nuclear weapons, with the latter having detonated their first bomb in 1949. Pointing to this threat, the main advantage of submarine-launched missiles was the remote likelihood of interception of the launch platform. As a final recommendation, the NIE stated that the "*primary defensive reliance would have to be placed on anti-submarine warfare.*"[76] The assessment was that the effectiveness of the Soviet submarine force would increase significantly.[77] Initial investigations into the feasibility of placing ballistic missiles on Soviet submarines date back to the year of the first Soviet nuclear detonation in 1949. As missile and rocket technology matured, test firings were carried out on submarines that were converted and configured for the new mission.[78] The *Zulu V* became the first Soviet SSBN in 1956. This was a major step forward for the submarine service, although the *Zulus* had to fire their SS-N-4 missiles (range 300-350 nautical miles) from the surface. [79]

The construction of the first purpose-built strategic ballistic missile submarine, the *Golf* class, was initiated in 1958. With a diesel-electric propulsion and carrying three SS-N-4 missiles, the *Golf* had to traverse the Atlantic and surface fairly close to the US coastline in order to fire her missiles. This made her extremely vulnerable to adversary anti-submarine forces. The

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[74] Jordan, *Soviet Submarines*, 45.
[75] Director of Central Intelligence (DCI), "NIE 11-6-54 - Soviet Capabilities and Probable Programs in the Guided Missile Field," National Intelligence Estimate (Director of National Intelligence, October 5, 1954), CIA, Online archive, 3, 12.
[76] NIE 11-6-54., 24.
[77] NIE 11-3-55, "Soviet Capabilities and Probable Soviet Courses of Action through 1960" (Director of National Intelligence, May 17, 1955), CIA, Online archive., 2-3.
[78] Pavel Podvig, ed., *Russian Strategic Nuclear Forces*, 2004 paperback edition (Cambridge, MA: MIT Press, 2001), 237; Friedman, *Submarine Design and Development*, 103.
[79] Jordan, *Soviet Submarines - 1945 to the Present*, 57; Podvig, *Russian Strategic Nuclear Forces*, 283–86.

Soviet Navy continued to develop a submarine that could launch her missiles from underneath the waterline, and at a greater distance.[80] Meanwhile, the US Navy deployed the *Polaris A-1* missile with the *George Washington* class submarine in 1960, capable of underwater launch and a range that was four times that of the Soviet SS-N-4. Underwater launch became a reality for the Soviets in the early 1960s, with retrofitted *Golf* class submarines with the D-4 system enabling underwater launch from a depth of 40-50 meters.[81] The nuclear-powered *Hotel* class was set in production a year after the *Golf* class, essentially constituting a *Golf* class with a nuclear reactor. The *Hotel* was also retrofitted to carry the D-4 launch system, enabling it for underwater launch of the SS-N-4 missile.[82]. The *Hotel* still had to manoeuvre close to the US coastline.

Experimentation with Soviet cruise missiles did not gain traction as early as it did in the USA, but was initiated nonetheless in the mid-1950s. The SS-N-3C *Shaddock* land-attack cruise missile had a range of 400 nm and was armed with a nuclear warhead. It was fitted on *Whiskey* class submarines in 1956-57.[83] This was the precursor to the modern Russian submarines in the 2000s with significant cruise missile capabilities.

In 1956, the Soviet Naval High Command determined that the submarine fleet was to begin long-range patrols, in order to establish a Soviet blue water presence across the globe.[84] Sporadic and experimental in nature, the missions seem to have been more for establishing an institutional foundation for later missions than for actual operational effect. Regular patrols did not take shape until ten years later. More common were missions along the European coastlines, interfleet transfers of submarines, and exercises in the Baltic and the North Atlantic.

2.3 Western strategy and anti-submarine warfare

A growing concern over the general Soviet naval expansion among NATO countries led to the establishment of the Atlantic Command under one Supreme Commander in 1952,

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[80] Friedman, *Submarine Design and Development*, 103; Podvig, *Russian Strategic Nuclear Forces*, 286–90; Jordan, *Soviet Submarines - 1945 to the Present*, 61–62.
[81] Podvig, *Russian Strategic Nuclear Forces*, 237–38, 317.
[82] Friedman, *Submarine Design and Development*, 103; Jordan, *Soviet Submarines - 1945 to the Present*, 62–63; Podvig, *Russian Strategic Nuclear Forces*, 290–93.
[83] Jordan, *Soviet Submarines - 1945 to the Present*, 66.
[84] Gary E. Weir and Walter J. Boyne, *Rising Tide - The Untold Story of The Russian Submarines That Fought The Cold War* (New York: Basic Books, 2003), 43.

SACLANT.[85] In the mid-1950s, the intelligence focus of the Americans and NATO started to include assessments of Soviet Northern Fleet expansion and operations in the North Atlantic.[86] The Soviet Navy was assessed to have "*the greatest submarine capability in the history of naval warfare*", and the primary capability was directed "*against NATO sea communications.*"[87] This was also reflected in the NATO strategic concept *MC 14/2* of October 1956. Although best known for outlining the overarching strategy of "Massive Retaliation", the strategic concept detailed the importance of sea lines of communication, and the crucial role that the North Atlantic region would play for anti-submarine forces due to the expanding Soviet submarine force and the increasing importance of the Northern Fleet.[88] Emphasis was given to the importance of constituting a credible deterrent, as well as the "*ability to carry out an instant atomic counteroffensive by all available means*."[89] As NATO strategy progressed, there was an increasing requirement to monitor not only the development of adversary weapon systems, but also their method of delivery. The growing submarine threat prompted discussions in NATO on the Alliance's ability to monitor and, if necessary, neutralize Soviet submarines. The Alliance's assessments of its own measures to meet the threat highlighted a particular lack of maritime patrol aircraft.[90]

As World War II ended and a great portion of ASW dedicated vessels were decommissioned, the Americans in particular had channelled resources into improving ASW technology to replace dwindling assets. Between 1943 and 1950, developments included improved ASW radars, sonars, weapons and tactics. In addition, more revolutionary technology was developed, such as passive acoustic arrays and an entirely new vessel, the ASW submarine.[91]

It was recognized during WWII that significant numbers of aircraft were required for surveillance in the Atlantic, and that these aircraft could not work alone. During WWII, the German submarines were hunting Allied shipping vessels, the latter giving a clear indication

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[85] Mats Berdal, "Forging a Maritime Alliance - Norway and the Evolution of American Maritime Strategy 1945-1960," *Forsvarsstudier* 4 (1993), 13.
[86] See for example Øystein Espenes and Gjert Lage Dyndal, "The Changing Focus of NATO-Intelligence - From Southern Scandinavia to the 'High North' at the End of the 1950s," *Tidsskrift (Kungliga Krigsvetenskapsakademien)*, no. 2 (June 2013), for an extensive discussion on increased intelligence emphasis given to the Northern Flank in the time period around 1956/57.
[87] NATO, "SG 161/10 - The Soviet Bloc Strength and Capabilities 1957-1961 - Part I," March 20, 1957, Electronic Document Folder: IMS/MC-MCM-SG/1953-1970, NATO Archives, Brussel, 19.
[88] NATO, "MC 14/2 - The Overall Strategic Concept for the Defence of the NATO Area," October 14, 1956, Electronic Document Folder: IMS/MC-MCM-SG/1953-1970, NATO Archives, Brussel, 14, 16, 25, 26.
[89] MC 14/2, 12.
[90] AR(56)GENERAL-WP/1, "Report on the 1956 Annual Review," November 23, 1956, 2, Electronic Document Folder: IMS/1955-1959, NATO Archives, Brussel.
[91] Cote, "The Third Battle - Innovation in the U.S.Navy's Silent War Struggle with Soviet Submarines," 14.

of where the enemy submarines would likely be operating. During the Cold War, the search for Soviet submarines required some sort of cueing in order for aircraft to track them down. This cueing would come in the shape of permanently stationed listening devices on the sea bed.[92]

Passive acoustic technology had been under development during the 1940s, but it was the program initiated in 1950 by the US Navy's Office of Naval Research (ONR) on the SOSUS that would change the ASW scene for decades to come. The new technology facilitated detecting hostile submarines passively at ranges unheard of until then. The low-frequency sound propagation phenomenon of *convergence zones* led to sound traveling deep down into the abyss, only to be bent upwards again towards the surface, leading to sensors being able to detect a submarine at approximately 30 nm. Up until the early 1950s, the best ranges experienced were around 10,000 yards, or approximately 5 nm. The new ASW submarines thus became a credible defensive asset in detecting approaching enemy submarines, and the network of SOSUS arrays on the sea bed was able to detect enemy submarines at even greater ranges. The post-war *modus operandi* of MPA searching for submarines was to focus on cueing from signals intelligence (SIGINT) platforms that had picked up submarine communications, then use the radar to vector in on snorkelling or surfaced submarines, and subsequently get in position for an attack with the use of homing torpedoes.[93] Now, ASW submarines together with static, passive acoustic sensors of the SOSUS provided the MPA community with essential cueing for their much narrower search areas, enabling them to save fuel and resources, and arrive at a position closer to the target more rapidly than before. After WWII the development of passive sonobuoys had nearly stopped, but the success of the SOSUS system gave sonobuoy development a necessary push forward. Sonobuoys were developed based on SOSUS passive acoustic principles and improved onboard processing capabilities.

Probably the most distinct feature of airborne ASW is the dropping of sonobuoys in order to search for frequencies emitted by the submarine.[94] Submarines are mechanically driven, and emit sounds from their machinery in almost all circumstances. The sounds come from external units such as the propeller(s) and hydroplanes, or they come from internal equipment

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[92] Cote, 24.
[93] David Owen, *Anti-Submarine Warfare - An Illustrated History* (Annapolis, MD: Naval Institute Press, 2007), 164–67; Cote, "The Third Battle - Innovation in the U.S.Navy's Silent War Struggle with Soviet Submarines," 31.
[94] Birkeland, "The Potential of LIDAR as an Anti-Submarine Warfare Sensor," 15.

such as electrical generators. The aircraft drops disposable sonobuoys into the water, which function as a floating microphone listening for sounds from the ocean. After dropping the buoys, several factors complicate matters. Sea-life, shipping-traffic, surface winds, and seismic activity are examples of what is referred to as *ambient noise*.[95] One of the challenges is to distinguish between ambient noise and the frequencies emitted by the submarine. Submarine commanders, meanwhile, will try to "hide" the sounds of the submarine among these ambient frequencies. Oceanographic factors such as salinity, temperature and pressure impact how sound moves through the water. They differ according to time of day, proximity to lakes and fjords, littoral waters as opposed to the open ocean, seasonal changes to temperatures and seasonal changes to currents and winds.

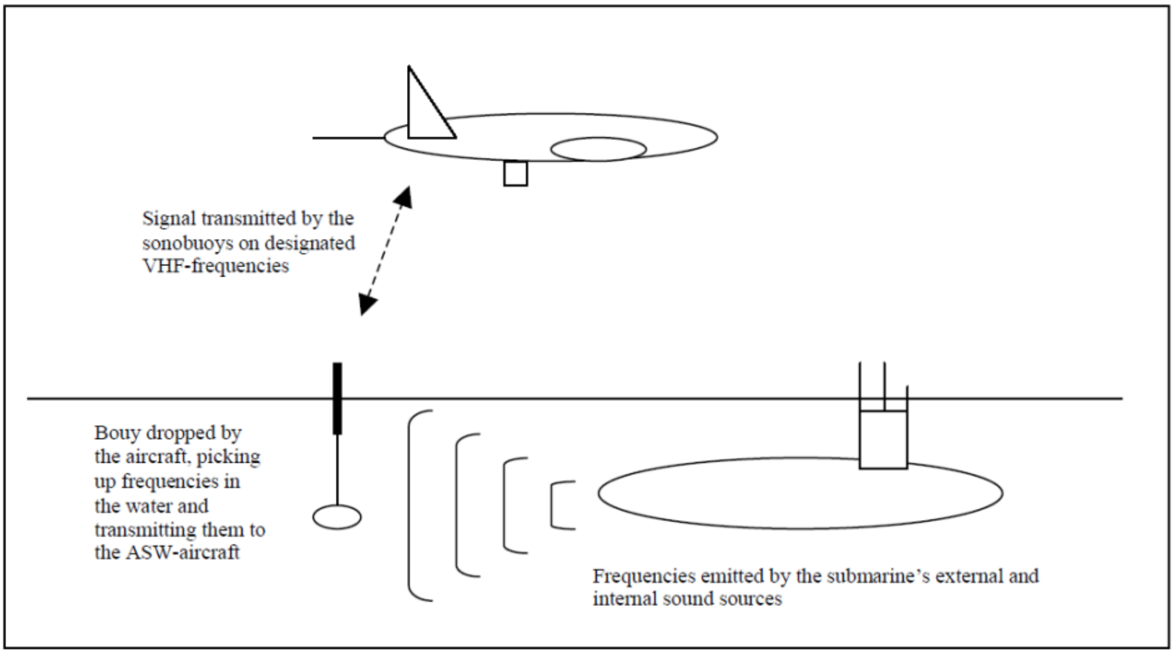

Figure 2-1. Acoustic sensors[96]

If a sonobuoy is only able to listen for submarine frequencies and other sounds in the water, it is usually referred to as a *passive* bouy. Bouys that transmit a sonar sound around it function almost as an underwater radar that sends out an electronic signal in order to receive an echo of the emitted sound returned by the submarine. These buoys are referred to as *active* sonobuoys. With knowledge of the local water conditions, and the speed of sound through it, the distance and possibly the direction of the submarine from the buoy can be instantly

[95] Birkeland, 15.
[96] Birkeland, 16.

calculated, thereby accelerating target localization.[97] The downside to an active "hit" like this is that the submarine will be warned that it has been detected.

The continued development of sonobuoys meant that MPAs could fly to the last known position of the submarine, known as a *datum,* provided by the SOSUS system, and continue the passive search with the use of sonobuoys. Acoustic techniques required high level skills by the operators, and it took a long time to gain proficiency in operating the equipment. Extensive experimentation was thus undertaken in the late 1950s in order to improve both equipment, operator techniques and integrated tactics with submarines and the SOSUS community.[98] As a nuclear submarine, the *November* class was able to defeat traditional ASW tactics that were based on radar and active sonar (due to the speed of the nuclear submarine, the sonars of the surface ships were not able to stay focused on her position), but she was vulnerable to the new passive acoustic technology. The Soviets did not focus much on quieting measures for their submarines, which made Soviet nuclear submarine classes very much detectable by passive means. The process of quieting submarines was costly, took time and resources, and considerable investment in research. Quieting of emitted noise was also based on a significant attention to detail during the manufacturing process, something that worked against the usual Soviet rush to field new systems, as exemplified by the *November* class.[99] The Soviets were more concerned about water resistance, which detracted from speed, than they were about noise from water flow and machinery. By the time Soviet nuclear submarines initiated their operations in the North Atlantic and the Pacific in the late 1950s and early 1960s, the Americans and their Allies had developed an extensive ASW network through a triad of ASW submarines, the SOSUS, and MPAs.[100]

American P2V *Neptune* MPA operations were initiated in 1947. The aircraft was very advanced both in range and in sensor suite, but it was also costly to operate. The *Neptune* required extensive training to operate, and an elaborate ground support organization. In 1952, the first US Navy *Neptune* squadron deployed to Naval Air Station Keflavik on Iceland, in order to be closer to the operating areas of the growing Soviet submarine fleet.[101] Tracking of

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[97] R.A. Mason, *Air Power - An Overview of Roles* (London: Brassey's Defence Publishers, 1987), 104.
[98] Podvig, *Russian Strategic Nuclear Forces*, 276–77; Cote, "The Third Battle - Innovation in the U.S.Navy's Silent War Struggle with Soviet Submarines," 31–33.
[99] Jordan, *Soviet Submarines - 1945 to the Present*, 54; Cote, "The Third Battle - Innovation in the U.S.Navy's Silent War Struggle with Soviet Submarines," 39, 45.
[100] Cote, "The Third Battle - Innovation in the U.S.Navy's Silent War Struggle with Soviet Submarines," 38–40.
[101] "Command History Report (CHR) for VP-7 (1952)" (US Navy, 1952), 7, FOIA case number: DON-NAVY-2018-001782, Naval History and Heritage Command; Reade and Harper, "Naval Air Station Keflavik, Iceland," 11; Warner Borgeld, "Keflavik - from the Past to the Present," *Maritime Patrol Aviation*, 2004, 39; Michael D.

Russian submarines by ASW units from NATO nations in the North Atlantic was commonplace by the late 1950s. The first few years operating out of Keflavik required familiarization with the harsh weather environment in the North Atlantic, familiarization with new ASW equipment and perfecting ASW tactics.[102] And American *Neptune* aircraft flew extensively in the North Atlantic, not only based on Iceland, but also periodically based in Norway.[103]

After WWII, the United States recalled the lend-lease agreement on the B-17s and B-24s that formed the backbone of the Royal Air Force's (RAF) Coastal Command inventory. This caused the RAF to order nearly thirty aircraft of a maritime version of the Avro *Shackleton* in 1949. Although the first *Shackletons* arrived in 1951 and initiated operations and exercises on a small scale the year after, it would take several years before the fleet was operational. Thus, between 1952 and 1956, the British also flew *Neptunes* in the maritime patrol capacity. The *Shackleton* became sufficiently operational in 1956 for the remaining *Neptunes* to be returned to the USA.[104] Through similar arrangements as the Americans, the British also flew out of Norwegian airfields in the 1950s to cover the expanding Soviet naval operations.[105]

After WWII, the Norwegian maritime surveillance aircraft returned to Norway after serving under the British Coastal Command. The *Catalina* flying boats were utilized for everything but maritime surveillance and reconnaissance, such as postal flights and general transportation sorties, flights in support of fishery surveillance, and in support of clearing mines from WWII.[106] Adding to this, the *Catalinas* were put on readiness for Search-And-Rescue (SAR) tasks, which had the Norwegian maritime surveillance and reconnaissance community drift further away from their wartime tasks: early warning and anti-submarine

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Roberts, *Dictionary of American Naval Aviation Squadrons - Volume 2*, vol. 2 (Washington, D.C.: Naval Historical Center, 2000), 62, 71, 81, 760.

[102] "Command History Report (CHR) for VP-10 (1955)" (US Navy, 1955), FOIA case number: DON-NAVY-2018-00574, Naval History and Heritage Command; "Command History Report (CHR) for VP-21 (1959)" (US Navy, 1959), FOIA case number: DON-NAVY-2018-00574, Naval History and Heritage Command.

[103] For an elaborate account of the development and service life of the P2V *Neptune* Maritime Patrol Aircraft, see Wayne Mutza, *Lockheed P2V Neptune - An Illustrated History* (Atglen, PA: Schiffer Publishing, Ltd., 1996).

[104] Several aircraft of the original 52 *Neptunes* delivered had been crashed or written off. For a detailed overview of the development and operationalization of the Shackleton MPA, see Chris Ashworth, *Avro's Maritime Heavyweight: The Shackleton* (Bourne End: Aston Publications Limited, 1990).

[105] This thesis will not discuss the American background for acquiring the *Neptune* nor the British background for acquiring the *Shackleton*. Suffice it to say, they were flying operationally and were middle-aged aircraft not requiring immediate replacement when other alliance partners started collectively looking for replacement aircraft for their increasingly obsolete aircraft in the mid- and late 1950s. This collective effort will be discussed in the next chapter.

[106] Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 139–43.

warfare operations. In a time of significant development of the Royal Norwegian Air Force, maritime air operations were throughout the 1940s put aside to the benefit of the fighter aircraft community.[107]

After WWII, the ideas and functions that formed the basis for the allied fusion of operational intelligence (OPINTEL) sources perfected during the war were enhanced by new technology.[108] In 1948, the Americans and the British had signed an agreement on intelligence sharing with specific regards to OPINTEL sharing of naval intelligence, building on broader Anglo-American intelligence sharing agreements.[109] This sharing was crucial for a seamless integration of resources put into detecting and tracking Soviet submarines during the Cold War. NATO did not have any intelligence assets of its own, and was dependent on national intelligence efforts feeding into the Alliance's operations and the planning of these. Arrangements for the bilateral sharing of intelligence functioned to the benefit of NATO in the sense that they raised the quality of the intelligence products. They were not, however, driven and organized by NATO *per se*.[110]

When the nuclear-powered submarine *USS Nautilus* was commissioned in 1954, the speed and lack of requirement to surface for air provided an indication of how difficult it would be to track future enemy nuclear submarines. But it was also discovered that nuclear submarines were quite noisy, even when they were submerged, because of the reactor coolant pumps which operated continuously and the reduction gears which reduced the steam turbine shaft output revolutions.[111] This knowledge led to the Western ASW posture of combining dedicated ASW submarines, MPAs and the SOSUS as the dominant tools in the search and tracking of adversary submarines. Thus, the US Navy Chief of Naval Operations (CNO) gave orders in 1960 to track every Soviet missile-carrying submarine that was operating within range of the United States.[112] And in order to stay ahead of Soviet submarine developments,

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[107] Klevberg, 147–55.
[108] Christopher Ford and David Rosenberg, *The Admiral's Advantage - U.S. Navy Operational Intelligence in World War II and the Cold War* (Annapolis, MD: Naval Institute Press, 2005), 34–35.
[109] Richard J. Aldrich, *GCHQ - The Uncensored Story of Britain's Most Secret Intelligence Agency* (London: Harper Press, 2011), 89; Ford and Rosenberg, *The Admiral's Advantage - U.S. Navy Operational Intelligence in World War II and the Cold War*, 38.
[110] For articles on intelligence sharing within NATO, see for example Adriana N. Seagle, "Intelligence Sharing Practices within NATO: AN Englisg School Perspectvie," *International Journal of Intelligence and Counterintelligence* 28, no. 3 (2015); Jan Ballast, "Merging Pillars, Changing Cultures: NATO and the Future of Intelligence Cooperations within the Alliance," *International Journal of Intelligence and Counterintelligence* 31, no. 4 (2018).
[111] Cote, "The Third Battle - Innovation in the U.S.Navy's Silent War Struggle with Soviet Submarines," 21.
[112] Michael A. Palmer, *Origins of the Maritime Strategy - The Development of American Naval Strategy, 1945-1955*, Reissue edition (Annapolis, MD: Naval Institute Press, 1990), 92–93.

NATO established an ASW Research Centre in 1959. The centre was proposed by SACLANT in order to streamline Alliance research and development for the advancement of ASW capabilities.[113] Submarines and ASW were thus taking centre stage in day-to-day operations, in intelligence discussions, and doctrinal development early in the Cold War.

2.4 The Norwegian balancing act – integration and screening

There were few explicit national requirements in Norway for maritime surveillance in the High North in the late 1940s. NATO intelligence focused on a potential Soviet invasion of the European heartland on the continent.[114] And with the lack of explicit tasking, the maritime airborne surveillance capability was organisationally, technologically, and with regards to competence and skills in free fall.[115] The USA and the UK, however, were increasingly concerned about the Soviet build-up in the High North, and the lacking Norwegian surveillance efforts in the north prompted increasing surveillance activity by the Americans and the British in the late 1940s. The increased Allied activity in general shone a light on the Norwegian geopolitical and military-strategic placement. The Norwegian position in geopolitics has been a balancing act between integration towards the West and assurance towards the East. This duality produced a policy vis-à-vis allied partners of *integration/deterrence* and *screening/reassurance*. Norway would integrate with the West and NATO, in order to assure her own security, and NATO membership would constitute a deterrent effect in itself. But at the same time, Norway would screen her partners in the sense of limiting foreign activity and basing on Norwegian soil, thereby also reassuring the Soviets. Norway thus hoped to raise the threshold for any Soviet aggression through Western integration. At the same time, restrictions were placed on NATO presence and activity in order to maintain low tensions in the High North. The formal Norwegian basing policy was explicitly proclaimed in February 1949, where the government stated that Norway "*will not open her bases to foreign powers on Norwegian territory as long as Norway is not subject to*

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[113] AC/137-R/3, "Science Committee - Summary Records of Meetings Held at the Palais de Chaillot, Paris, 5-8 January 1959" (North Atlantic Treaty Organization (NATO), January 19, 1959), 30–33, CD: IS-AC-0385, NATO Archives, Brussel; C-M(59)39, "Standing Group - SACLANT Anti-Submarine Warfare Centre" (NATO, April 14, 1959), 1, CD: IS-AC-0385, NATO Archives, Brussel; C-M(59)39, "Standing Group - SACLANT Anti-Submarine Warfare Centre."

[114] Espenes and Dyndal, "The Changing Focus of NATO-Intelligence - From Southern Scandinavia to the 'High North' at the End of the 1950s," 32–33.

[115] Svein Duvsete, "Fra Luftforsvar Til Strategisk Angrep. Norsk Luftmilitær Doktrine 1945-1955," *Forsvarsstudier* 2 (1998): 97–98.

attack or a threat thereof."[116] The intention of the policy was to keep foreign powers from *permanently* basing forces on Norwegian soil; exercises would thus be allowed. Only two months later, Norwegian foreign and security policy reached its most significant historical milestone when Norway signed the North Atlantic Treaty. Now, the friendly aircraft flying surveillance missions in the High North were alliance partners, and the Norwegian government saw the need to strengthen the restrictions it had put in place through the basing policy, as we shall see.

It was not until the outbreak of the Korean War in 1950, however, that the Norwegian government initiated its own regular surveillance missions in the High North. Russian involvement in the Korean War was by some suspected to be a distraction in order to tie up Western military resources in the Far East, and NATO closely monitored Russian movements elsewhere in order to notice the run-up to what could be the main event on the European continent.[117] The newly initiated Norwegian surveillance missions aimed to monitor Soviet movements on and outside the Kola peninsula. But the squadron and the maritime air operations community had been marginalized due to prioritizing the Norwegian fighter aircraft capability, in addition to other national, organizational factors.[118] The MPAs were old; there was a significant lack of personnel; and those that were available were poorly trained. The *Catalinas* had functioned in ASW operations during World War II mostly through visual sightings and torpedo attacks against surfaced submarines. Although the Norwegian *Catalina* aircraft contributed to surveillance also after WWII, the role of early warning had to be performed almost exclusively by American and British aircraft in the North Atlantic.[119] In parallel to Norwegian operations up north, the British established routine monitoring of the Baltic Sea outlets, where the situation was not to be underestimated.[120] In April 1950, Soviet Union fighter aircraft shot down a US Navy PBY4-2 *Privateer* maritime patrol aircraft over the Baltic.[121] Two years later, a Soviet fighter aircraft shot down a Swedish SIGINT aircraft, killing everyone on board. Only days later, a Swedish *Catalina* flying boat searching for the missing aircraft was shot at by yet another Soviet fighter aircraft

[116] Tamnes, "Integration and Screening - The Two Faces of Norwegian Alliance Policy," 60–61.
[117] J.L. Gaddis, *Strategies of Containment. A Critical Appraisal of Postwar American National Security Policy* (Oxford: Oxford University Press, 1982), 114.
[118] Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 158–61.
[119] Klevberg, 180.
[120] Aldrich, *GCHQ - The Uncensored Story of Britain's Most Secret Intelligence Agency*, 117–19.
[121] Aldrich, 116.

and had to make an emergency landing.[122] A defected Polish pilot later explained that the Soviet fighter pilots were under orders to shoot down any aircraft that did not obey orders to land, whether or not they had opened fire.[123]

The level of Norwegian surveillance efforts, meanwhile, were deemed unacceptable both with regards to regularity and capabilities, and NATO proposed in 1951 to deploy two maritime surveillance squadrons to Norway in order to increase the surveillance capability in the North.[124] The Norwegians rejected the proposal on the basis of the aforementioned basing policy.[125] Norwegian authorities considered acquiring the advanced maritime patrol aircraft P2V *Neptune* for surveillance in the High North, but the *Neptune* demanded highly skilled and experienced personnel and was expensive to operate and maintain.[126] The Norwegians were lacking in the former, and could not afford the latter. Surveillance missions thus continued with the outdated *Catalinas*.

During the establishment of the command structure in 1951, Norway was placed under the command area for the Supreme Allied Commander *Europe* (SACEUR), and not SACLANT. The fact that Norway was under the geographical command of SACEUR underlines that the strategic emphasis of the Alliance was on defending against a Soviet thrust through mainland Europe. In the late 1950s, the North Atlantic and the Arctic had not yet received as much strategic planning attention, and was considered a part of the Northern Flank to the European mainland theatre of war. Only in the late 1960s would the naval threat from the Soviet Northern Fleet manifest itself to such a degree that the High North came to be considered a theatre of war in its own right.[127] SACLANT had, however, been given the responsibility for allied reconnaissance in the Atlantic. And with military cooperation through the mechanisms of the Alliance came increased NATO activity in Norway: more exercises; more equipment flowing in to the country through the Mutual Defence Assistance Program (MDAP); and a general increase in foreign presence. The weak Norwegian contribution to maritime surveillance, in particular, led to an increase in Allied maritime surveillance activity in the

[122] Matthew M. Aid and Cees Wiebes, eds., *Secret of Signals Intelligence During the Cold War and Beyond* (London: Frank Cass, 2001), 234; Norman Polmar and John F. Bessette, *Spyplanes - The Illustrated Guide To Manned Reconnaissance And Surveillance Aircraft From World War I To Today* (Minneapolis, USA: Quarto Publishing Group Inc, 2016), 69.
[123] Aldrich, *GCHQ - The Uncensored Story of Britain's Most Secret Intelligence Agency*, 125–27.
[124] Tamnes, *The United States and the Cold War in the High North*, 117.
[125] Tamnes, 117.
[126] Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 194, 221.
[127] For an explanation of the evolution of the Northern Flank in NATO strategy, see Dyndal, "How the High North Became Central in NATO Strategy: Revelations from the NATO Archives."

High North. The Allied desire to conduct surveillance missions out of Norwegian airfields towards the East, in combination with the Norwegian requirement for stability and predictability in the High North, led to bi- and tri-lateral arrangements for surveillance.

In spite of scarce resources, the NIS were active and provided credible and sought-after services, particularly in the High North. This led to the NORUSA-agreement of 1954, where the Norwegians provided intelligence to the Americans and the latter provided equipment to the former in exchange.[128] The agreement initially concerned communications intelligence (COMINT) but expanded to more fields of intelligence cooperation in the following years. This was the starting point for the close relationship between American and Norwegian intelligence agencies. By the end of the 1950s, the NIS had established itself as a reliable intelligence provider to the Norwegian government as well as to Allies. To an increasing degree, the NIS worked to keep Allies out of areas where it could handle the information gathering tasks by itself.[129]

In 1955, the Americans requested the Norwegian government to operate their much more capable P2V *Neptune* out of bases in Northern Norway, since their home-base of Keflavik, Iceland, was too far away to give any meaningful time in the operations area up north. Among the requested airbases were Andøya, which then just recently had been built with funding through the NATO infrastructure program for several reasons.[130] The Soviet build-up caused SACLANT to demand increased surveillance in the North, in general. Also, he required a dedicated base for conducting anti-submarine warfare in the North, and finally, he required a base for offensive strikes into the Soviet Union in the North.[131] The Americans also saw, from a national perspective, that the requirements for information on Soviet activities north of the Kola peninsula had grown significantly. The Norwegians, however, still did not have the capacity to meet the requirements for early warning, updated targeting information, and an updated foundation for war plans for the High North.[132] The arrangement that was sought was to fly American aircraft to Norway in order to familiarize the aircrews with bases and topography, as they would have to operate out of these bases in wartime.It was, however,

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[128] Olav Riste and Arnfinn Moland, *Strengt Hemmelig - Norsk Etterretningstjeneste 1945-1975* (Oslo: Universitetsforlaget, 1997), 132–37.
[129] Tamnes, *The United States and the Cold War in the High North*, 173–74; Riste and Moland, *Strengt Hemmelig - Norsk Etterretningstjeneste 1945-1975*, 129–55.
[130] K. Vengstad, “Fleksibilitet Og Slagkraft. Luftforsvaret Og NATOs Infrastrukturprogram 1950-1957,” *Forsvarsstudier* 3 (2006): 70–72.
[131] Vengstad, 70–72.
[132] Robert S. III Hopkins, *U.S. Strategic Aerial Reconnsaissance and the Cold War, 1945-1961* (University of Virginia, 1998), 41–42.

understood that the arrangement would meet general surveillance requirements for the Americans as well. The flights to and out of Norway would take place approximately every three weeks. The arrangement was approved by the Norwegian government in 1955, and was called *Neptune Journey*.[133] This bilateral agreement was to become the cornerstone for American-Norwegian cooperation with regards to airborne maritime surveillance. Radio communication procedures improved significantly, as did flight safety and tactical procedures for flying in the High North.[134]

Several NATO exercises in the North Atlantic in the early 1950s operated with a 24 degrees East longitude delineation as the easternmost restriction for naval vessels and aircraft, based on concerns about reactions from the Soviet Union to increased Western activity in the High North.[135] The 24-degree restriction grew into an accepted standard for tasking foreign aircraft in Norway, but the final push for a formal restriction was the American request for a simplified authorization procedure for foreign air operations in Norway. The restriction was finally declared a national policy on 21 January 1959.[136] The 24-degrees East restriction was thus established as the easternmost limitation for any surveillance carried out by allied partners flying out from Norwegian soil, including *Neptune Journey* flights.[137] And Norwegian bases were not to be used by Allies conducting operations that involved overflights of Soviet territory. This mechanism was to become a practical example of the balancing act in Norwegian security policy between integration and screening.[138] Inadvertently, the Norwegian government made airborne maritime surveillance efforts into a primary agent for security policy in the High North.[139]

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133 Tamnes, *The United States and the Cold War in the High North*, 118; Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 175.

134 Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 177–78.

135 Tamnes, "Integration and Screening - The Two Faces of Norwegian Alliance Policy," 60–61; Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 168; Eriksen and Pharo, "Kald Krig Og Internasjonalisering, 1945-1965," 1997; Knut Egeland Moen, "Selvpålagte Restriksjoner i Nord, 1945-65" (Oslo: Institutt for Forsvarsstudier, 1998), 44. Enforced during exercise *Lifeline*, *Sea Enterprise*, *Air Enterprise* and *Fox Paw in 1955*

136 Knut E. Moen, "Norway's Self-Imposed Restrictions in the High North, 1945-65," *Forsvarsstudier*, no. 5/1998 (1998): 44–49.

137 Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 177.

138 Egeland Moen, "Selvpålagte Restriksjoner i Nord, 1945-65," 44–49; Tamnes, *The United States and the Cold War in the High North*, 175; Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 181–82.

139 For an outstanding discussion on Norwegian internal politics and dynamics in the development of airborne maritime surveillance while simultaneously standing up the Norwegian Air Force post-World War II, see Håvard Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics."

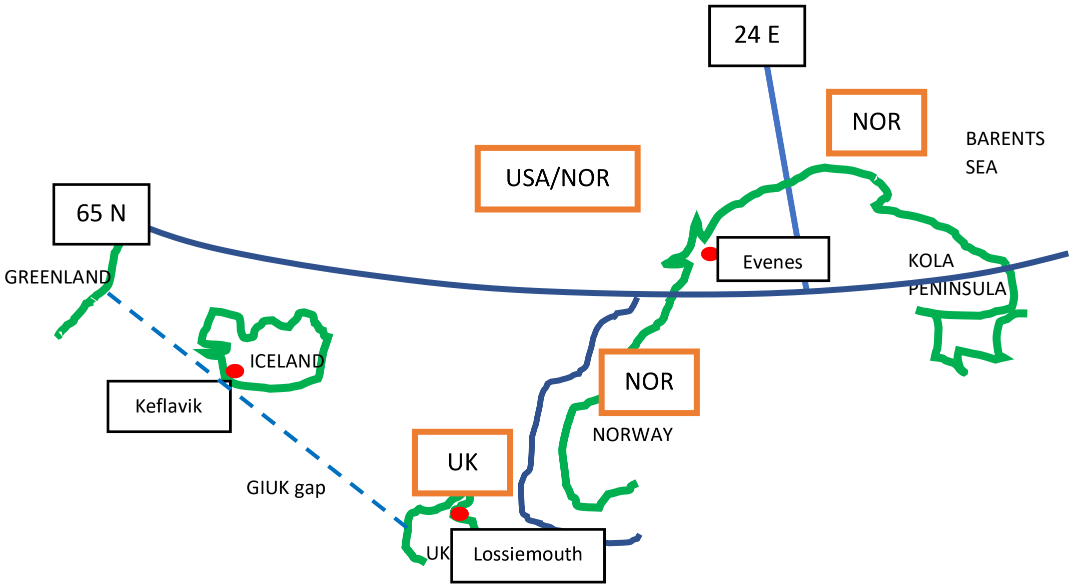

Figure 2-2. Delineation of geographical responsibility

Where the *Neptune Journey* arrangement was meant to meet general requirements for surveillance, there was a growing requirement for specific coordination with regards to surveillance of specific Soviet exercises when they took place. The three most active nations in this regard were the USA, the UK, and Norway. Early in 1959, coordination culminated in a trilateral agreement *Exercise Popeye*. The orders divided the ocean areas that were mostly used by the Soviets for exercises into three parts: The Norwegians would be responsible for the Skagerrak basin along the coast up to 65-degrees North out to 60 nautical miles from the shore; the Norwegians and the Americans would share responsibility for the Norwegian Sea and the Barents Sea; and the British would be responsible for the Norwegian Sea below 65-degrees North outside 60 nautical miles from the Norwegian shore.[140] *Exercise Popeye*, together with *Neptune Journey*, provided the foundation for bi- and trilateral cooperation of surveillance missions in the High North throughout the Cold War.

It was clear to everyone involved in monitoring the High North that the Norwegian *Catalina* aircraft were wholly inadequate for the task due to the lack of capable sensors onboard. By the end of the 1950s, the number of American *Neptune* flights increased from two to three a month to approximately eight missions a month covering the North Atlantic. In addition, the Americans flew RB-47 SIGINT surveillance aircraft over the Barents Sea, along the Soviet coast of the Kola peninsula and Novaya Zemlya. The RB-47 aircraft initially flew out of the

[140] Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 178–79.

UK, but soon thereafter also Alaska and Greenland, in order to reach further into and along Soviet territory. The RB-47 were supported by tanker aircraft facilitating the long sorties.[141] Due to the poor Norwegian capabilities, early warning missions in the High North and in the Norwegian Sea were by the end of the 1950s in their entirety flown by British *Shackleton* and American *Neptune* aircraft.[142] As for Norway and many other alliance partners, there was a dire need for a new aircraft to conduct airborne maritime ISR.

2.5 Chapter conclusion

The Norwegian balancing act in the High North led to formal policy, where no foreign power was allowed to permanently place troops, aircraft or equipment on Norwegian soil. And for air operations specifically, the 24-degree East restriction kept foreign surveillance aircraft from taking off from Norwegian bases and flying east of 24-degrees East. The intent of these restrictions was to maintain a predictable interaction and low tensions between NATO and the Soviet Union in the Northern Fleet's backyard. As we shall see, this put pressure on the Norwegian government to acquire the appropriate tools to monitor Soviet naval movements and operations. In keeping track of the Soviet submarine threat, the West deployed an extensive array of ASW measures. The sea-bed deployed SOSUS low frequency arrays acted as cueing mechanisms for more flexible assets such as MPA, which were becoming an increasingly capable tool. Arrangements were in place for Allied temporary deployments to Norway in order to streamline the maritime airborne surveillance and reconnaissance effort.

The fifteen years that followed WWII were formative for the two main arguments in this thesis, and the two lines of thought are closely intertwined. First, the strategic argument is underpinned by the growing importance of submarines with regards to the naval and nuclear threat from the Soviet Union. Second, technological aspects emerged to the fore through the innovative environment that existed in the aftermath of WWII. Research on acoustic technology had gained momentum during the war and was able to maintain traction in the years that followed. Based on experience from WWII and the technology development that took place after the war, the notion established itself in NATO of MPAs as the *go-to* platform for effective long-range ASW. MPAs were the natural solution to the strategic submarine

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[141] Hopkins, *U.S. Strategic Aerial Reconnsaissance and the Cold War, 1945-1961*, 53–54; DUPI, "Grønland under Den Kolde Krig. Dansk Og Amerikansk Sikkerhedspolitik 1945-68" (Copenhagen: Dansk Udenrigspolitisk Institut, 1997), 315–16; Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 175–81.
[142] Tamnes, *The United States and the Cold War in the High North*, 116–17.

challenge, and this seems to have shaped the strategic-technological dynamics within ASW for the remainder of the Cold War.

3. A common NATO Maritime Patrol Aircraft

3.1 Introduction

MPAs had been established during WWII as a key factor in combating enemy submarines, and procuring the required aircraft inventory for the Alliance was considered to be of crucial importance. By the mid-1950s, discussions on the Soviet submarine threat had been ongoing for some time, and the 1956 Annual Review confirmed that NATO capabilities were not robust enough to address the threat in case of war. The Alliance recognized that there was an "*overall deficiency of maritime patrol aircraft*" in NATO European countries, and most nations relied on the MDAP to "*bridge the gap between NATO requirements and aircraft availabilities.*"[143]

In the 1950s, NATO conducted several major exercises in the North Atlantic and in Norway, as a part of the containments strategy towards the Soviet Union. These exercises further led to the explicit restrictions on Allied troops and aircraft in the northernmost parts of Norway, with the overarching political aim to maintain low tensions in the High North. Simultaneously there was a mounting pressure on Norwegian authorities to acquire the appropriate tools to conduct maritime surveillance on the Northern Flank. The organizational understanding for the requirement in the Armed Forces was lacking, however, as was the political will to prioritize surveillance on behalf of the Alliance. It was from a political standpoint more important to ensure stability in the North than to venture off with a new and expensive capability based on external pressure, and without an internal desire to build the capability up. The weapons assistance program from the US would be the releasing factor in this dynamic, as we shall see.

The case study in this chapter allows us to identify the basic elements of the theoretical framework presented later in this thesis. It is an historical depiction of the fundamental discussion required to establish the appropriate platform to meet an emerging submarine threat.

[143] AC/126-D/1 (REV), "The Group of Experts on Maritime Patrol Aircraft - The Status of Development of Maritime Patrol Aircraft," June 28, 1957, 1, CD: IS-AC-0385, NATO Archives, Brussel., 1.

3.2 The NATO 1956 Annual Review

Although there had been several reviews preceding it, the 1956 Annual Review of NATO's force structure and capabilities relative to that of the Soviet Bloc painted a grim picture.[144] Among the shortfalls depicted, the only military capability that is *specifically* mentioned in the document's main body is the large reductions and shortfalls in MPA, with no improvement in sight before 1959 or 1960.[145] From a defence planning standpoint, the Alliance acknowledged the "*insidious changes in Soviet tactics*" together with a "*growing awareness of the mounting costs of modern forces*" for the Alliance members. The NATO leadership thus began to emphasize the requirement to handle defence challenges "*collectively and with a sense of urgency*."[146] It was underlined that the "*problems of the development and production of modern weapons are far beyond the capacity of most NATO countries to resolve single-handed*."[147] International cooperation should be explored at every opportunity for the development of modern military equipment. In November 1956, NATO military commanders recommended that the North Atlantic Council (NAC) consider international collaboration for MPA procurement.[148] Building on the military comments, the report from the Defence Planning Committee on the 1956 Annual Review suggested that "*common action might also be most helpful in overcoming the deficiencies in maritime patrol aircraft*."[149]

3.3 Establishment of the Group of Experts

The NAC recognized in December 1956 the need to replace the P2V *Neptune* MPA that were in service with several European nations, due to the age of the airframe and its sensors. Based on challenges related to logistics and operational cooperation for MPAs during WWII, there was a desire to seek a common aircraft type across the Alliance. If NATO was to operate in a unified manner, common solutions and standardized equipment would be necessary.[150] Based on efforts within the field of general anti-submarine research, the French Delegation

[144] IPT 098-195, "Military Comments on the 1956 Annual Review - Note by the International Planning Team," November 8, 1956, 3–10, Electronic Document Folder: IMS/1955-1959, NATO Archives, Brussel., 3-10.
[145] AR(56)GENERAL-WP/1, "Report on the 1956 Annual Review," 2., 2.
[146] AR(56)GENERAL-WP/1, 1., 1.
[147] AR(56)GENERAL-WP/1, 4., 4.
[148] IPT 098-195, "Military Comments on the 1956 Annual Review - Note by the International Planning Team," 10., 10.
[149] AR(56)GENERAL-WP/1, "Report on the 1956 Annual Review," 4., 4.
[150] Chris Gibson, *Nimrod's Genesis - RAF Maritime Patrol Projects and Weapons since 1945* (Manchester: Hikoki Publications, 2015), 96.

proposed to establish a Group of Experts to study the feasibility of providing "*suitable maritime patrol aircraft for the NATO forces.*"[151] It was widely accepted that it would be too costly for a single nation to develop and procure maritime surveillance aircraft in the relatively small quantities required.[152] The proposal was agreed by the Defence Planning Committee on 5 March 1957.

An aircraft with operational versatility, capable of operating in all conditions of weather, was in itself considered to be a complex system through its wide array of sensors and equipment. Based on experience from civilian manufacturing of aircraft, a lead time of approximately 10 years was to be expected, an expectation later revised to 8 years.[153] This lead time, together with the costs associated with research and development (R&D) of entirely new systems, led to discussions in the Group on whether it was feasible to initiate an entirely new project to meet operational requirements. An alternative could be a study of already existing aircraft covering the same roles, which might prove more productive and economical.[154] The possibility to fulfil NATO operational and national requirements by procuring an aircraft already in production was indeed examined, but it was decided that no existing aircraft fully met the initially agreed upon operational requirements from August 1957.[155] It is worth noting that at the time of these investigations the US Navy P-3 *Orion* program was underway, but had not yet been firmly established. However, the American requirements that led to the development of the P-3 *Orion* were considered to be in excess of European needs, and consequently "*uneconomical for operation by European governments*."[156] The decision was made in December 1958 to go ahead with a unique design, and the Group of Experts encouraged the initiation of design studies within the respective nations.

[151] AC/126-D/1 (REV), "The Group of Experts on Maritime Patrol Aircraft - The Status of Development of Maritime Patrol Aircraft.", 1.
[152] AC/126-D/1 (REV), 3.
[153] AC/126-D/1 (REV), "The Group of Experts on Maritime Patrol Aircraft - The Status of Development of Maritime Patrol Aircraft," 4.
[154] AC/126-D/1 (REV), 4.
[155] AC/126-D/5, "Group of Experts on Maritime Patrol Aircraft - Report to the Armaments Committee - 16th December 1958," December 16, 1958, 4, CD: IS-AC-0385, NATO Archives, Brussel., 4.
[156] AC/126-D/5, "Group of Experts on Maritime Patrol Aircraft - Report to the Armaments Committee - 16th December 1958.", 4.

3.4 A question of range

The starting point for the discussion on numbers of aircraft was a questionnaire that the nations had responded to in relation to the 1956 Annual Review.[157] The questionnaire was specifically related to the Alliance's force goals for 1957. The requirements for MPAs were as follows:

Country	Long Range	Short Range
Denmark	4	-
France	60	-
Germany	-	10
Italy	40	-
Netherlands	8	8
Norway	24	-
Portugal	24	-
United Kingdom	88	-
Total	248	18

Table 3-1. Initial requirements based on ARQ(56)[158]

The explicit difference between long range and short range was not clear at the point of answering the questionnaire, although existing airframes provided a guide. Short range ASW aircraft of modern design were the French *Alize*, the British *Fairey Gannet* and *Short Seamew,* the American *Tracker* and the Italian *P155-AS.* The endurance of these aircraft varied between 4 and 9 hours, with the ability to cover between 750 nm and 1,400 nm, depending on the speed of the aircraft.[159] In the context of short-range ASW, the use of helicopters operating from aircraft carriers and from the shore was being examined and there seemed to be a relatively wide choice of modern aircraft to fill this particular role. It was therefore suggested to defer the considerations of short-range aircraft pending the completion of the long-range ASW project.[160]

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[157] Annual Review Questionnaire: ARQ(56)
[158] This overview is depicted in the minutes of "AC/126-D/1 (REV)", and shows the national answers to the questionnaire. The overview shows only European requirements, and it is unclear why neither Canadian nor American requirements are portrayed. One suggestion is that the intention with the survey was to examine the potentially different requirements with regards to long and short-range aircraft, where it would be plausible to assume that the Canadians and Americans only required long-range aircraft. They would thus fall outside the purview of the survey. Then again, the responses suggest, as is clear from the discussions within the Group of Experts as well, that the delineation between long and short-range was not at all defined by the collective.
[159] Simon Mitchell, ed., *Jane's Civil and Military Aircraft Upgrades 1994-95* (Coulsdon, UK: Jane's Information Group Ltd, 1994), 57–58; Owen Thetford, *British Naval Aircraft Since 1912* (London: Putnam, 1978), 190; Jerry Proc, "CS2F TRACKER," *RADIO COMMUNICATIONS AND SIGNALS INTELLIGENCE IN THE ROYAL CANADIAN NAVY* (blog), February 18, 2019, http://jproc.ca/rrp/rrp3/tracker.html.
[160] AC/126-D/1 (REV), "The Group of Experts on Maritime Patrol Aircraft - The Status of Development of Maritime Patrol Aircraft," 2., 2.

The available long-range maritime patrol and reconnaissance aircraft in the late 1950s were the Canadian *Argus*, the American *Marlin*, the American *Neptune*, and the British *Shackleton*. The endurance of these aircraft spanned from 13 hours to 19 hours, with a range between 2,000 nm and 5,300 nm.[161] Operational commanders were invited to provide specific operational requirements and specifications to the Group of Experts.[162] Based on early discussions between the NATO commands there emerged a general NATO requirement for a *medium* range MPA.[163] This was supported by neither Britain nor the USA, who both saw the emerging threat in the North Atlantic as requiring longer range for any NATO MPA.

It seems clear that nations forwarded their views based on their own geographical situation. Britain was adamant that the MPA required significant range in order to cover their areas of responsibility in the Atlantic Ocean. Italy saw no need for any range on those scales, and advocated early on a shorter range for Mediterranean operations. The Soviet build-up in the North and increasing Soviet submarine activity in the Atlantic meant that any Alliance MPA would necessarily require more than the minimum range necessary for Mediterranean operations, in order to bring some credibility to meet the submarine threat elsewhere as well.[164] This balancing act between national and Alliance requirements meant that the Group of Experts opted to focus on "medium range" requirements.

In order to further distil the requirements for the nations, two different types of missions were foreseen. First, a type of mission where the MPA would fly 700 nm to an operating area, operate for three hours, and have a minimum of ten hours endurance at sea level. Second, a mission where the MPA would fly 1,000 nm and operate for four hours, with a minimum endurance of 14 hours at sea level.[165] The discussion on range requirements included strong stands for both an "*Atlantic type*" (long-range) and a "*Mediterranean or enclosed-water type*"

[161] David Donald, *The Encyclopedia of World Aircraft* (Etobicoke, Ontario: Prospero Books, 1997), 118; Stewart Wilson, *Combat Aircraft since 1945* (Fyshwick, Australia: Aerospace Publications Pty Ltd, 2000), 82; Barry Jones, *Avro Shackleton* (Ramsbury, UK: Crowood Press, 2002), 108. For unknown reasons the Marlin was considered a long-range aircraft, even though it only had an endurance of 8-9 hours.
[162] The Standing Group (SG) acted as a link between the Military Council and the Regional Planning Groups and the Defense Planning Commiittee.
[163] AC/126-R/1, "Group of Experts on Maritime Patrol Aircraft - Summary of the First Meeting, 16 April 1957," April 23, 1957, 3–4, CD: IS-AC-0385, NATO Archives, Brussel.
[164] See for example AC/137/D/20, "Statement on Future Trends in Anti-Submarine Warfare Made at the Second Meeting of the Science Committee by the SACLANT Representative" (NATO, July 17, 1958), CD: IS-AC-0385, NATO Archives, Brussel.
[165] AC/126-D/2, "Group of Experts on Maritime Patrol Aircraft - Desired Operational Characteristics," August 22, 1957, CD: IS-AC-0385, NATO Archives, Brussel., 3.

(intermediate/short-range), with all delegations from an economic standpoint discarding the idea to develop two separate aircraft in order to service the two missions.[166]

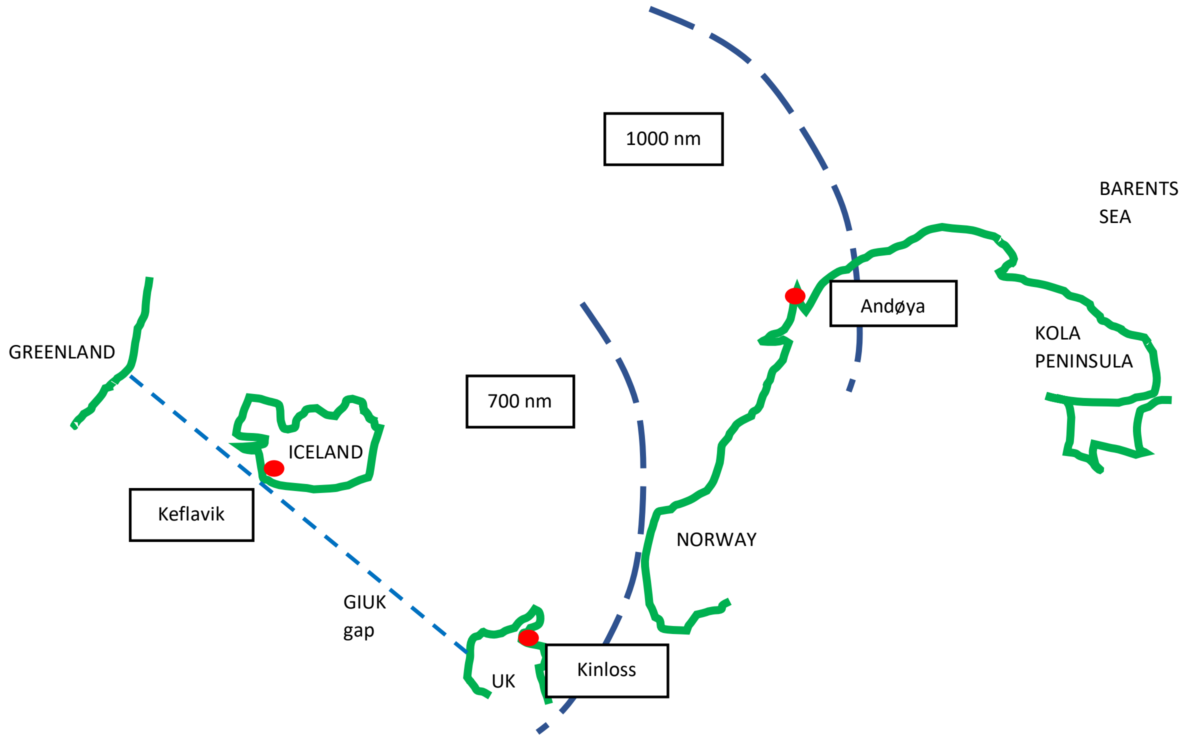

Figure 3-1. Ranges for a common MPA based on Iceland.

In Mediterranean terms, these distances mean that an MPA based in Sicily would be able to operate just south of the Southern coast of Turkey for three hours in the first instance, and off the coast of Syria in the second. In North Atlantic terms, the missions proposed meant that an MPA based on Iceland would be able to operate off the Western coast of Norway in the first instance and outside the Northern coast of Norway in the second. The group settled, with the exception of Italy, on a "*medium range aircraft*."[167] The medium range was set to mean 8 hours patrol at 600 nm, alternatively 4 hours patrol at 1,000 nm.[168]

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[166] AC/126-R/4, "Group of Experts on Maritime Patrol Aircraft - Summary Record of Meeting on 10 March 1958," March 10, 1958, 3, CD: IS-AC-0385, NATO Archives, Brussel., 3.
[167] AC/126-R/4, "Group of Experts on Maritime Patrol Aircraft - Summary Record of Meeting on 10 March 1958.", 4.
[168] AC/126(DS)R/1, "Group of Experts on Maritime Patrol Aircraft - Sub-Group on Design Studies - Summary of Meeting Held on 10-11 March 1958," March 11, 1958, 8, CD: IS-AC-0385, NATO Archives, Brussel., 8.

3.5 Roles and missions

It was emphasised initially that the *sole mission* for the aircraft would be ASW.[169] Any additional missions that would include reconnaissance, mining and other types of warfare should only be performed to the extent that such missions could be executed with the ASW equipment and sensors that were already installed.[170] However, in the proposed requirements forwarded on 11 October 1957 the role of the aircraft was slightly widened. The Group of Experts saw that it would be inefficient use of resources to send such capable aircraft hundreds and at times thousands of miles out to sea in order to perform one, sole mission (ASW).[171] Additionally, the financial discussions demanded that "*in the interests of economy, it should also have a transport capability*."[172] However, the American delegation, which found itself in a fundamentally different situation with regards to their national economy than did the Europeans, did not agree to this added capability. The Americans, even after it became clear that they would not procure the aircraft, rejected the notion that an added role would be transportation. The American delegation would permit "*no compromise of function of ASW to provide defensive and transport capabilities*", and the Americans took a strong stands as they provided significant funding for the project, regardless of US procurement.[173] In the final specifications of March 1958, the role of the NATO MPA would read:

> *"The aircraft will be used for the detection, the localisation and the destruction of submarines, and for general maritime reconnaissance."*[174]

However, the Europeans were able to squeeze in several secondary roles. Four were specifically mentioned: search-and-rescue; shadowing-and-attack (which in modern terms can be translated into Anti-Surface Warfare [ASuW]); minelaying; and finally, light

169 AC/126-D/2, "Group of Experts on Maritime Patrol Aircraft - Desired Operational Characteristics," 3.
170 AC/126-D/2, "Group of Experts on Maritime Patrol Aircraft - Desired Operational Characteristics." 3.
171 AC/126-R/2, "Group of Experts on Maritime Patrol Aircraft - Summary Record of the Meeting Held at Palais de Chaillot, Paris, 11 October 1957," October 23, 1957, 11, CD: IS-AC-0385, NATO Archives, Brussel., 11.
172 AC/126-R/3, "Group of Experts on Maritime Patrol Aircraft - Summary of Meeting Held on 16 and 17 January 1958," January 17, 1958, 15, CD: IS-AC-0385, NATO Archives, Brussel., 15.
173 AC/126-D/3, "Group of Experts on Maritime Patrol Aircraft - Desired Operational Characteristics of the Maritime Patrol Aircraft," December 3, 1957, Addendum 4, 2, CD: IS-AC-0385, NATO Archives, Brussel; Reade, *The Age of Orion - The Lockheed P-3 Story*, 8., Addendum 4, 2.
174 AC/126(DS)R/1, "Group of Experts on Maritime Patrol Aircraft - Sub-Group on Design Studies - Summary of Meeting Held on 10-11 March 1958," 5.

transport. The transport mission was meant to include a number of ground crew, a certain amount of ground equipment, and a spare engine, for what is termed self-deployment.[175]

3.6 Operational characteristics and specifications

High *speed* for the aircraft was recognized as important for "*early development of a contact*", in other words to get to the position of the submarine and accumulate sufficient information on the target for an attack. The minimum cruising speed was set to 225 knots at sea level, and a cruising speed of "*not less than 300 knots*" in general.[176] The aircraft was to have a service ceiling of at least 20,000 feet, and was to have good manoeuvrability at 5,000 feet at low speeds. Performance for take-off and landing also indirectly set the fundamental requirements for the weight of the aircraft.

There were few discussions on the *sensor* suite of the NATO MPA. The required sensors were those of the standard suite of the time: underwater acoustic sensors; a good radar (primary detection method of the previous war); electronic emission sensors (referring to the electronic warfare that played such a key role during WWII); exhaust-sniffing equipment (searching for exhaust from submarines running their diesel engines on the surface); and a powerful search light for surface searches at night and in poor weather.[177] All the sensors noted were representative of a fully equipped MPA in the late 1950s. A robust inventory of sonobuoys would take the NATO ASW aircraft into the nuclear age with regards to sensors, which now would have to search for submarines with nuclear propulsion that were submerged for extended periods of time. Both the USA and the Soviet Union had operationalized nuclear propulsion in submarines in 1958. A strict criterion was established when it came to weight and growth potential. The American delegation provided advice based on their own extensive aircraft production experience, stating a maximum weight limitation due to growth potential and general performance.[178]

In addition, the disposable stores to be carried were torpedoes, depth charges, and air-to-ground guided weapons. Pertaining to attack capabilities, the requirement was for the MPA to

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[175] AC/126(DS)R/1, "Group of Experts on Maritime Patrol Aircraft - Sub-Group on Design Studies - Summary of Meeting Held on 10-11 March 1958.", 11.
[176] AC/126(DS)R/1, 7., AC/126-D/2, "Group of Experts on Maritime Patrol Aircraft - Desired Operational Characteristics," 3.
[177] AC/126-D/2, "Group of Experts on Maritime Patrol Aircraft - Desired Operational Characteristics.", 4.
[178] AC/126-R/4, "Group of Experts on Maritime Patrol Aircraft - Summary Record of Meeting on 10 March 1958," 10.

be able to make two separate attacks using depth bombs or homing weapons, to include atomic weapons.[179] The initial requirements developed on operational characteristics also stated that armaments, which in this context means self-protection, would not be necessary. However, the German representative to the group emphasized that the "*particular circumstances in which the German Air Force would operate such aircraft*" would pose specific requirements with regards to armament. The Baltic and the North Sea areas were "*particularly vulnerable to shore based aircraft and it was obviously necessary to provide at least a minimum degree of armament as a protection against attack from hostile units*."[180] In view of the shoot-downs of Western intelligence flights by Soviet fighter aircraft in the Baltic during the early 1950s, the German concerns were understood by all.[181] The Germans recommended that the aircraft armament should include guided air-to-air missiles. In the end, missiles were not included. Instead, wiring would be in place for the respective nation to fit the aircraft with such weapons if deemed necessary.[182] In all the documents detailing the Group of Experts' efforts, the discussion on armaments seems almost anecdotal. Nations other than Germany showed less concern over armaments, presumably because operating far into the Atlantic or Mediterranean posed less of a direct threat to the aircraft than did missions in the Baltic.

The Group of Experts also did not spend much time discussing the requirements for *communications* equipment. Satellite communications were years from achieving operational capability, and the use of data link was still a decade or so away from being operational. The first mention of requirements for communications capabilities occurred when proposing the initial, desired operational characteristics in August 1957. The Group of Experts emphasized that the aircraft normally will operate individually, "*but provisions are required for communications and co-ordinating with surface, air, shore and submarine units. A desired feature is the ability to act as an inflight area co-ordinator at a scene of action.*"[183] Although not stated explicitly, this would require several tactical radios in the VHF and UHF range in order to coordinate efficiently between several assets simultaneously. It would also require at

[179] AC/126-D/2, "Group of Experts on Maritime Patrol Aircraft - Desired Operational Characteristics.", 4.
[180] AC/126(DS)R/1, "Group of Experts on Maritime Patrol Aircraft - Sub-Group on Design Studies - Summary of Meeting Held on 10-11 March 1958," 9.
[181] Paul Lashmar, *Spy Flights of the Cold War* (Phoenix Mill: Sutton Publishing Limited, 1996), 42; Robert S. III Hopkins, *Spyflights and Overflights - US Strategic Aerial Reconnaissance - Volume I 1945-1960* (Manchester: Hikoki Publications, 2016), 185-189.
[182] AC/126(DS)R/1, "Group of Experts on Maritime Patrol Aircraft - Sub-Group on Design Studies - Summary of Meeting Held on 10-11 March 1958," 9.
[183] AC/126-D/2, "Group of Experts on Maritime Patrol Aircraft - Desired Operational Characteristics," 3.

least one long-range radio covering the HF range, in order to enable aircraft-to-shore communications when operating far out to sea. The ability to transmit detection data was also brought forward, although the Group did not elaborate on what type of transmission this was meant to be. The final operational requirements demanded that "*the aircraft is to be fitted with radio equipment for communicating with ships, submarines and shore bases at long range*."[184]

3.7 The final decision

The letter to industry was sent out in March 1958, with a deadline for submissions of design proposals of 21 June 1958.[185] After evaluating the 16 proposals received from industry across the Alliance, the working group unanimously decided on one design, namely the French Breguet 1150, later called *Atlantic*.[186] One of the deciding factors was that the Breguet 1150 offered more working space and room for expansion for future equipment.[187] Other important factors were flexibility in weapons load and a high capacity for sonobuoy storage.

As a next step, the national requirements for number of aircraft were further adjusted. As mentioned above, Britain, Canada, and the United States would not procure the NATO MPA. USA did, however, contribute funds to the development of the aircraft.[188] In the final specification letter sent to the aircraft industry, the potential contractors had been asked to plan for the production of anything between 100 and 200 aircraft. And in order to ensure international cooperation, the production plans had to include "*existing or proposed plans for*

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[184] AC/126-R/3, "Group of Experts on Maritime Patrol Aircraft - Summary of Meeting Held on 16 and 17 January 1958," 21.
[185] AC/126(DS)R/1, "Group of Experts on Maritime Patrol Aircraft - Sub-Group on Design Studies - Summary of Meeting Held on 10-11 March 1958."
[186] AC/126-D/5, "Group of Experts on Maritime Patrol Aircraft - Report to the Armaments Committee - 16th December 1958," 6; AC/126(DS)R/4, "Group of Experts on Maritime Patrol Aircraft - Sub-Group on Design Studies - Summary Record of Meeting 9-10 July 1958," July 10, 1958, 126, CD: IS-AC-0385, NATO Archives, Brussel.
[187] AC/126-D/6, "Group of Experts on Maritime Patrol Aircraft - NATO Multilateral Procurement and/or Production for a Maritime Patrol Aircraft," November 10, 1958, 3–4, CD: IS-AC-0385, NATO Archives, Brussel., 3-4.
[188] AC/126-R/3, "Group of Experts on Maritime Patrol Aircraft - Summary of Meeting Held on 16 and 17 January 1958," 3–4.

international co-operation with at least one firm in another country."[189] The final required numbers established by the Group of Experts would read:[190]

Country	Number	Country	Number
Belgium	6	Italy	0
Canada	0	Netherlands	20
Denmark	0	Norway	6
France	70	Portugal	12-24
Germany	18	United Kingdom	0
USA	0		

Table 3-2. Final requirements established by the Group of Experts

For the maritime nation of Norway, the number six stands out as low. The number of six aircraft was a continuation of the number of *Catalina* aircraft, and the Norwegian Defense Staff did not see how they could afford to raise their ambition in this field.[191]

NATO Command:	SACLANT		SACEUR		CHANNEL		TOTAL	
Year:	*1958*	*1963*	*1958*	*1963*	*1958*	*1963*	*1958*	*1963*
Belgium	--	--	--	--	0	0	0	0
Canada	28	40	--	--	--	--	28	40
Denmark	0	0	0	0	--	--	0	0
France	23	32	24	30	4	11	51	73
Germany	--	--	0	24	--	--	0	24
Greece	--	--	0	0	--	--	0	0
Italy	--	--	18	27	--	--	18	27
Netherlands	0	0	--	--	8	12	8	12
Norway	--	--	9	9	--	--	9	9
Portugal	18	24	--	--	--	--	18	24
Turkey	--	--	0	0	--	--	0	0
U.K.	72	72	16	16	16	17	104	105
U.S.A.	216	261	54	54	--	--	270	315

Table 3-3. The Minimum Essential Force Requirements, 1958-1963 (issued January 1958).[192]

The SACLANT representative to the Group of Experts underlined that there was an urgent military requirement for this aircraft to become operational in quantity by 1964 in order to

[189] AC/126(DS)R/1, "Group of Experts on Maritime Patrol Aircraft - Sub-Group on Design Studies - Summary of Meeting Held on 10-11 March 1958," 20.
[190] AC/126-D/5, "Group of Experts on Maritime Patrol Aircraft - Report to the Armaments Committee - 16th December 1958," 7.
[191] Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 198–99.
[192] Notice that Norway falls under the responsibility of SACEUR (European continent), and not yet under SACLANT (the Northern Atlantic), underlining the focus of a mainland invasion by the Soviets, making Scandinavia a flank in the North. See further discussion in previous chapter.

meet the overall NATO operational requirements in MC-70.[193] The force requirements for MPA laid out in MC 70 in early 1958 were as depicted in the figure above.[194] In the end, France, (West) Germany, the Netherlands, Italy, Portugal and Belgium actually procured the NATO-developed maritime patrol aircraft *Atlantic.*[195]

3.8 The Norwegian decision to acquire Albatross MPA

The Norwegian *Catalina* fleet was in dire need of replacement. In 1952, the Norwegian government through the MDAP process sought to procure American *Albatross* maritime patrol aircraft as a replacement, an amphibious aircraft with long endurance able to support a wide array of tasks.[196] The *Albatross* was not, however, configured for ASW. Overhauled *Catalinas* were lent to Norway in 1952 as a temporary solution to the capability issues in the north while discussions continued for a long-term replacement. The S-2 *Tracker* was an early candidate for a replacement aircraft. It was small, but constructed specifically for ASW operations. It was made for flying off US aircraft carriers, and was able to both find and attack enemy submarines. Being based on a carrier, it was constructed with limited space in mind, and at 1.250 nm in range it had significantly shorter endurance than the *Neptune* (3.450 nm) and other, larger aircraft. Regardless, it was made available for Norway through the MDAP.[197]

British aircraft were considered, but neither the *Short Seamew* nor the *Fairey Gannet* met the overarching requirements for range, and they were too expensive compared to any MDAP solution. By 1955, the pressure was mounting from NATO operational entities as well as from the Americans for modernizing the Norwegian maritime air surveillance fleet. The ageing *Catalinas* were spending more time in the hangar being serviced than they were flying, in addition to not being equipped with the appropriate modern sensors required for maritime surveillance in the High North. The intelligence services that the *Catalinas*

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[193] AC/126-R/5, "Group of Experts on Maritime Patrol Aircraft - Summary Record of Meeting 22-24 October 1958," October 24, 1958, 4, CD: IS-AC-0385, NATO Archives, Brussel., 4.
[194] MC 70, "A Report by the Military Committee to the North Atlantic Council on The Minimum Essential Force Requirements, 1958-1963," January 29, 1958, Annex 2 to Appendix E, 2-4, Electronic Document Folder: IMS/1955-1959, NATO Archives, Brussel., Annex 2 to Appendix E, 2-4.
[195] Dassault Aviation, "Atlantic - Origins and Context" (Dassault Aviation), accessed March 23, 2017, http://www.dassault-aviation.com/fr/passion/avions/dassault-militaires/atlantic/; Mutza, *Lockheed P2V Neptune - An Illustrated History*, 222; Gibson, *Nimrod's Genesis - RAF Maritime Patrol Projects and Weapons since 1945*, 106.
[196] Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 198–201.
[197] Michael Green, *United States Naval Aviation 1911-2014* (Barnsley: Pen & Sword Aviation, 2015), 122; Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 204.

provided were thus inadequate.[198] This external pressure for increased military surveillance collided with the Norwegian perception of their maritime air assets as *utility* aircraft supporting a wide array of tasks, to include a heavy focus on maritime SAR. In a case of intra-service rivalry, the Navy argued for an aircraft with ASW capabilities, and the Air Force leadership argued against ASW (they thought ASW should be left to more capable and knowledgeable allies).[199]

The *Neptune* aircraft was considered for its range, but it was assessed as much too complicated to operate for Norwegian air crews, and too demanding for Norwegian infrastructure, organization and logistics to handle. It was also important to the Norwegian Defense Staff to procure an aircraft that would not affect the resources required to run the fighter aircraft service. In an attempt to gather loose threads in the discussion between NATO and national requirements, the Air Force declared in 1956 that the main task for Norwegian maritime surveillance aircraft was "*to conduct surveillance on the Norwegian coast and adjacent areas, and to early detect a seaborne invasion force*."[200] The operational requirement with regards to range was thus set to 900 nm. The *Tracker* was unable to meet this requirement.[201] The 900 nm requirement was established in parallel to the NATO MPA project and the establishment of the bi- and trilateral agreements for maritime airborne surveillance mentioned before.

The common procurement project for a maritime patrol aircraft in NATO came at the perfect time, so it is worth commenting briefly on the Norwegian interaction with the project, or lack thereof. Norwegian delegations were present for the first meeting in April 1957 and took part in the discussion on how to move forward to establish a common requirement.[202] But as discussions with the Americans progressed in the context of the MDAP where aircraft would be provided at no cost, Norwegian participation in the NATO project ended. The final meeting Norwegian delegates took part in was the meeting of 23 October 1957. At this meeting, the Norwegian delegates were unwilling to take part in the discussion on range requirements for the new aircraft, due to the "*not yet established Allied and national operational requirements for Norwegian areas of interest*."[203] This reflected both the chaotic

[198] Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 198.
[199] Klevberg, 198–209.
[200] Klevberg, 205.
[201] Klevberg, 200–205.
[202] AC/126-R/1, "Group of Experts on Maritime Patrol Aircraft - Summary of the First Meeting, 16 April 1957."
[203] Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 194.

national process in Norway with leadership shying away from decision making, but also a noticeable lack of competence in the field. It should be noted that this was also the time that Norwegian authorities were in the discovering phases of their own "areas of interest" in the High North, and a Norwegian awakening to the emerging military threat on the Kola peninsula.

The Norwegian exit from the NATO common MPA procurement program seems to rest on three factors. First, economic constraints meant that the replacement aircraft would have to come through the MDAP.[204] Second, the 900 nm range requirement put forward by the Norwegian Air Force in 1956 meant that the final 700 nm requirement for what would become the NATO *Atlantic* MPA came up short. Finally, the situation with regards to strategy, ambition, and requirements for the Norwegian maritime air fleet was in the 1950s so chaotic, and the individual knowledge in maritime air matters so low, that any further participation in the project was likely futile.

The northern command for NATO, the Commander Allied Forces North (COMAFNORTH), was in charge of all NATO forces operating in and out of the northernmost parts of the Alliance, and was subordinate to SACEUR. The headquarters, situated in Oslo, Norway, produced a report in December of 1957 that addressed the different requirements for maritime surveillance and early warning, and recommended the *Albatross* for Norway, which stood out as a compromise of range, sensors, and economy in maintenance.[205] MDAP required that the aircraft would be American made. With an ambition to acquire an aircraft that would cost approximately the same to operate as the *Catalinas* did, the *Albatross* seemed to be a viable and sustainable choice for the Norwegian government.

Further complications arose when the Americans rejected the notion of the Norwegians flying in the High North without an ASW capability; the *Albatross* was a surface surveillance aircraft. The requirement for ASW in the north was also emphasized by SACEUR himself in 1958.[206] After arguing the pros and cons for almost a year, the Norwegians decided to go back to the original proposal for the *Tracker*, in spite of the short range, because of the ASW capability. But, in the winter of 1960, the producer of the *Albatross*, Grumman, notified Norwegian authorities that they were able to modify the *Albatross* to include ASW

[204] AC/126-R/2, "Group of Experts on Maritime Patrol Aircraft - Summary Record of the Meeting Held at Palais de Chaillot, Paris, 11 October 1957," 8.
[205] Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 211–12.
[206] Klevberg, 222.

capabilities. This would give the Norwegians an ASW capable aircraft with significant range, more capable than the *Tracker*, however not as capable as the *Neptune*. The Norwegians changed their minds yet again, and decided to procure the *Albatross*, moderately modified for ASW.[207]

3.9 Chapter conclusion

The common NATO MPA procurement project facilitated four nations fulfilling their MPA force requirements to the Alliance. The NATO developed MPA was faster, had longer endurance, and better manoeuvrability than the P2V *Neptune* it was meant to replace. It also seems likely that the group development and procurement was the best way forward for the nations that resulted in procurement of the *Atlantic* from an acquisition standpoint. The NATO MPA project achieved what it set out to do; it facilitated several nations meeting their force requirements against a significant naval threat to the Alliance. Three big nations pulled out due to national projects of greater magnitude and technological scope, one small nation pulled out because of negotiations on a different aircraft within the MDAP framework, several nations never took part due to the lack of NATO force requirements, and the rest of the nations specifically mentioned in MC 70 ended up procuring the *Atlantic* at some point.

The Alliance discussions in the late 1950s allow us to identify the basic tenets of airborne surveillance aircraft. These were: range, speed, altitude, sensors, communications, and armament (self-protection). Of these, the question of *range* was most extensively discussed. This is ultimately the factor that lays the foundation for where, how far away and for how long a maritime surveillance mission is capable of operating. Nations bordering the Atlantic demanded longer range than the nations bordering the Mediterranean. As we shall see in the coming chapters and the final discussion, range has historically been, and will in the future be, crucial to how an airborne surveillance asset can approach the hunt for adversary submarines. This timeless tenet played a crucial role in the late 1950s, and continues to do so today.

[207] Klevberg, 211–29.

4. Foundation for long-range ASW – 1961-69

4.1 Introduction

Although the Soviet approach to shipbuilding and naval strategy fluctuated somewhat in the decade and a half following WWII, the importance of submarines was, as a whole, on the rise. The 1960s would see a continued ambivalence as to the primary mission of Russian submarines. However, with missile technology increasingly taking centre stage in the arms race between the superpowers, submarines established themselves further as cornerstones of Soviet naval strategy.

The shoot-down of the U-2 over the Soviet Union and the RB-47 over the Barents Sea in 1960 caused the Norwegian government to panic. All maritime surveillance missions, Norwegian as well as Allied taking off from Norway, were forbidden for a month, in fear of more incidents. When the missions were yet again continued, they were conducted under stricter restrictions than earlier, that is to say that the appetite of the Norwegian government to approve Allied surveillance missions taking off from Norway into the Barents Sea was significantly reduced. The situation in the North made both the defence minister as well as the prime minister personally involved in the approval process for several of the surveillance missions.[208] The reluctance on the part of the Norwegian government to allow allied activities to be conducted from Norwegian soil into the Barents Sea almost by accident made Norwegian surveillance and intelligence operations in the High North into a security policy commodity.[209] This dynamic would take center stage when the defence ministers of the United States and Norway both personally negotiated the terms of the Norwegian procurement of the P-3 *Orion*, which became operational late in the decade.

The decade in question also experienced shifts in Western and NATO strategy, resulting in a more defensive naval posture in the North Atlantic. Surface force operations were pulled further back, and an increasing reliance was put on barriers consisting of aircraft and seabed hydrophones. However, the posture of maritime airborne surveillance and reconnaissance units did not decline in tandem with the overall naval posture. In response to the expanding nature of Soviet submarine operations, the main nations handling maritime surveillance in the High North did so largely through the use of MPAs. And although the respective MPAs had

[208] Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 183, 252.
[209] Klevberg, 250–51.

significant range, the sheer size of the patrol areas required close international cooperation. This requirement brought the Norwegian basing policy under increasing pressure in the 1960s. At the same time, developments within the fields of sensors and communications improved search and tracking of submarines, and facilitated closer collaboration between different aircraft.

4.2 Soviet naval strategy and submarine capabilities

At the turn of the decade, Soviet Premier Krushchev was concerned that each service of the armed services were carving out independent strategic nuclear missions for themselves. This led to the organisation of all strategic ballistic missile capabilities under one entity, the Strategic Rocket Forces in late 1959.[210] The strategic nuclear mission was thus removed from the submarine force and placed more or less exclusively on land. The Intercontinental Ballistic Missile (ICBM) was now the strategic weapon of choice, with the first Soviet Union's and the world's first ICBM becoming operational in January 1960.[211] The shift toward ICBM created a void in the mission portfolio of Soviet submarines, but the Soviet Navy did not have to search for a new mission for long. The US Navy had in the years following the Korean War put into service new super-carriers of more than 60,000 tons. These could carry long-range nuclear bomber aircraft such as the A-3 *Skywarrior* with a range of 1,200 nm.[212] The only effective weapon against the super-carriers was by the Soviets deemed to be the anti-ship stand-off cruise missile. And the only two credible weapon-platforms for this missile were considered to be long-range bombers and submarines.[213] The policy change therefore did not degrade the continued value of the submarine insofar as naval strategy was concerned. Naval exercises and submarine operations continued, as did missile development for submarines, although development of strategic ballistic missiles fired from submarines had been temporarily halted.

The first nuclear-powered *Echo* class submarine was completed in 1960, carrying SS-N-3 *Shaddock* land-attack cruise missiles.[214] However, with the policy changes at hand the anti-

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[210] Jan S. Breemer, "Estimating the Soviet Submarine Missile Threat: A Critical Examination of the Soviet Navy's SSBN Bastion Strategy" (PhD, International Relations, University of Southern California, 1987), 61; Friedman, *Submarine Design and Development*, 103–4; Jordan, *Soviet Submarines - 1945 to the Present*, 71–71.
[211] Podvig, *Russian Strategic Nuclear Forces*, 121.
[212] Palmer, *Origins of the Maritime Strategy - The Development of American Naval Strategy, 1945-1955*, 90; Jordan, *Soviet Submarines - 1945 to the Present*, 77–78; Cote, "The Third Battle - Innovation in the U.S.Navy's Silent War Struggle with Soviet Submarines," 60.
[213] Jordan, *Soviet Submarines - 1945 to the Present*, 78.
[214] Jordan, 68.

carrier mission was to be pursued, leading to the construction of *Echo II* submarines with SS-N-3A *Shaddock* anti-ship missiles becoming operational in 1962. Several of the *Golf* class SSBNs were converted into *Golf II* multi-role cruise missile submarine (SSGN) configurations carrying the new SS-N-5 *Sark* ballistic missile, and the *Hotel* class SSBNs were converted into *Hotel II* class SSGNs carrying the same missile.[215] The SS-N-5 *Sark* had a range of 700 nm/1,300 km, and was the first Soviet ballistic missile that could be launched from a submerged position. It became operational in 1963, some three years after the American *Polaris* missile with similar launch capabilities.[216] But the move to a new mission also brought technical and tactical challenges, the most prominent of which was targeting for the anti-ship missiles. Even with an intricate network of shore-based direction-finding radio stations, airborne sensors such as the *Bear D* long-range maritime reconnaissance and targeting aircraft, and designated targeting submarines such as the *Whiskey Canvas Bag* class, it still would be a challenge to efficiently target adversary carrier strike groups. It took between 20-30 minutes on the surface to prepare the launch of an SS-N-3A missile. This in itself made them vulnerable to detection by ASW forces, but in addition, in that time a carrier group sailing at 25 knots would have changed its position by at least 8 nm.[217] Faster moving nuclear submarines and targeting sensors in space would aim to remedy such challenges.

The speed and mobility required by submarines hunting fast-moving aircraft carriers was facilitated by nuclear reactors. New weapons systems such as the US Navy *Polaris* submarine pointed to "limited" nuclear wars as more plausible than a complete nuclear exchange.[218] This complicated the Soviet policy decision to rely on land-based ICBM's entirely for a nuclear exchange, and thoughts on operating strategic submarines carrying nuclear ballistic missiles re-emerged in the mid-1960s. The Cuban missile crisis had emphasized the requirement for improvements to the naval force.[219] When Brezhnev took over from Krushchev as Soviet premier in 1964, Admiral Gorshkov could as the head of the Soviet Navy pursue his ambition of a nuclear role for his submarine force. Although the Soviet Naval High Command also wanted long-range patrols to be initiated as early as 1956, regular patrols by Soviet

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[215] Jordan, 74; Ford and Rosenberg, *The Admiral's Advantage - U.S. Navy Operational Intelligence in World War II and the Cold War*, 41.

[216] Podvig, *Russian Strategic Nuclear Forces*, 237–38; Weir and Boyne, *Rising Tide - The Untold Story of The Russian Submarines That Fought The Cold War*, 109–10; Friedman, *Submarine Design and Development*, 103.

[217] Jordan, *Soviet Submarines - 1945 to the Present*, 88–91; Friedman, *Submarine Design and Development*, 104.

[218] Jordan, *Soviet Submarines - 1945 to the Present*, 95–96; Breemer, "Estimating the Soviet Submarine Missile Threat: A Critical Examination of the Soviet Navy's SSBN Bastion Strategy."

[219] MC/CS 42, Summary Record (20 Dec. 1968), NATO Archives, quoted in Dyndal, "How the High North Became Central in NATO Strategy: Revelations from the NATO Archives."

submarines off the coast of the USA did not commence until 1966, likely due to the combination of the overarching focus given to land-based missiles (ICBM) and the still nascent strategic submarine capability.[220]

In 1967, the new *Yankee* class SSBN became operational. The *Yankee* carried the new nuclear ballistic missile SS-N-6 *Serb* with an initial range of 1,300 nm/2,400 km, which was a significant improvement. The new SSBN was quieter, moved faster, and had immense firepower onboard with a significant range. The SSBNs had become truly strategic.[221] The range of the SS-N-6 meant that although the *Yankees* had to cross the GIUK gap, they could fire their missile much further away from the US coastline. The *Yankee*s patrolled in dedicated areas holding the US coast at risk starting in the summer of 1969.[222] Up until then, *Golf* and *Hotel* class submarines had patrolled sporadically in the Atlantic. Patrol patterns would consist of one *Yankee* submarine north and one south of Bermuda, and *Hotel* and *Golf* submarines stationed east of Nova Scotia and west of the Azores. Later, this was increased to three *Yankee* class submarines on station in the Atlantic.[223] Although improved, the range of the SS-N-6 was not sufficient to keep the *Yankees* out of American ASW defences. The *Yankee*/SS-N-6 combination was thus viewed as an interim solution, awaiting more capable systems that would facilitate strategic submarines operating closer to home-waters and still able to fire ballistic missiles at the US mainland. This would become reality with the *Delta* class carrying SS-N-8 missiles in 1973.

The *Charlie* class SSGN also entered service in 1967. The *Charlie* was nuclear powered and carried the supersonic SS-N-7 *Starbright* anti-ship missile with a range of 30-35 nm. The missile could be fired from beneath the surface, forcing new methods of protecting American carrier groups. The result was ASW helicopters and ASW fixed-wing aircraft on carriers, in

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[220] Secondary sources diverged on this point. Pavel Podvig, *Russian Strategic Nuclear Forces*, 239; Cote, "The Third Battle - Innovation in the U.S.Navy's Silent War Struggle with Soviet Submarines," 20; Jordan, *Soviet Submarines - 1945 to the Present*, 96; Friedman, *Submarine Design and Development*, 104–5; AIR 27/2978, "Operational Records - 201 Squadron - 1961-1963" (UK Ministry of Defense, 1963 1961), UK National Archives, Kew; AIR 27/2979, "Operational Records - 201 Squadron - 1963-1965" (Royal Air Force, 1965 1963), UK National Archives, Kew; AIR 27/3161, "Operational Records - 201 Squadron - 1966-1968" (Royal Air Force, 1968 1966), UK National Archives, Kew. First with *Golf* and *Hotel* class submarines, and then there is a consensus on the commissioning of the *Yankee* class in 1967-69, with operational patrols commencing in 1969.

[221] Dyndal, "How the High North Became Central in NATO Strategy: Revelations from the NATO Archives," 572.

[222] Podvig, *Russian Strategic Nuclear Forces*, 274.

[223] Breemer, "Estimating the Soviet Submarine Missile Threat: A Critical Examination of the Soviet Navy's SSBN Bastion Strategy," 81–82; Friedman, *Submarine Design and Development*, 105–6; Jordan, *Soviet Submarines - 1945 to the Present*, 96–99.

addition to new passive acoustic sensors for the surface fleet.[224] The silent, high-speed *Los Angeles* class attack submarine would clear the waters ahead of the force.[225] The *Charlie* was, however, just as dependent on external targeting data as her predecessors, making her vulnerable to detection as she had to raise mast to receive updated targeting information.[226] The Soviets attempted to engage surveillance satellites in the role of cueing the *Charlies* instead of their MPA force, but technological challenges with the satellites kept the SSGN force dependent on target cueing by land-based aircraft.[227] The *Victor* class carried anti-ship and anti-submarine torpedoes, as well as the SS-N-15 *Starfish* ASW missile.[228] ASW missiles are fired from a torpedo tube that leaves the water and flies a distance in the air, before re-entering the water and functioning like a torpedo, alternatively like a depth charge. The *Victor* was built to support strategic operations as an escort, working to hunt down enemy submarines and protecting the *Yankee* SSBN whilst on patrol.[229]

4.3 Evolution of Western naval strategy

After the Second Berlin Crisis in 1958, discussion on engagements short of total war led to the general threat of a massive retaliatory response to any hostile action losing its credibility.[230] But changes to the overarching strategy of Massive Retaliation met with resistance, particularly in Europe, where much of the reasoning was that the threat of a massive American retaliatory response was the only language the expansionist communists in Moscow would understand.[231] It was when the French opted out of the NATO military command structure in March 1966 that the door opened to a change in NATO's overarching strategy. The strategy included improved intelligence and early warning, prompt coordinated

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[224] Cote, "The Third Battle - Innovation in the U.S.Navy's Silent War Struggle with Soviet Submarines," 61–63.
[225] Friedman, *Submarine Design and Development*, 72; Jordan, *Soviet Submarines - 1945 to the Present*, 103–8.
[226] Jordan, *Soviet Submarines - 1945 to the Present*, 108.
[227] Norman Friedman, *Seapower and Space* (Annapolis, MD: Naval Institute Press, 2000), 155–72.
[228] Jordan, *Soviet Submarines - 1945 to the Present*, 108–10; Friedman, *Submarine Design and Development*, 106.
[229] Jordan, *Soviet Submarines - 1945 to the Present*, 113–15.
[230] See for example Bernard Brodie, *Strategy in the Missile Age*, 8th ed. (Princeton, NJ: Princeton University Press, 1991), 174–77; Thomas C. Schelling, *Strategy of Conflict* (London: Oxford University Press, 1970), 230–38; Friedman, *Submarine Design and Development*, 99.
[231] Gregory W. Pedlow, "NATO Strategy Documents 1949-1969," October 1997, NATO, online archive, http://www.nato.int/docu/stratdoc/eng/intro.pdf; Tamnes, *The United States and the Cold War in the High North*, 196–98; Dyndal, "How the High North Became Central in NATO Strategy: Revelations from the NATO Archives," 565.

action in the period of warning time, increased readiness, flexibility, and other elements, and would be known as *Flexible Response*.[232]

SACLANT initiated two studies in 1965, in order to raise awareness of the expanding Soviet fleet.[233] NATO estimates indicated that approximately 134 submarines, some 80% of the Soviet total operational submarine inventory, would be used for rocket attacks against the US coastline, against the NATO Strike Fleet or against Western sea-lines of communications (SLOC) in a war. The task of keeping track of them and providing early warning was thus formidable.[234] It was with the operationalization of the *Yankee* class that the NATO intelligence community really awoke to the threat.[235] The nuclear powered strategic submarines operated with increasing speeds, with missiles with increasing range, and they were capable of underwater launch. SACLANT continued to warn about the expansionist Soviet Navy in early 1968.[236] The expanded pattern of operations had removed the previous warning time that would be provided by the Soviets to NATO, as the former had been focussing on activities in home waters. Now, SACLANT warned, the Soviets were able to launch attacks with much less or no warning. Submarines in particular were able to deploy for extended periods of time without any supply or support, patrolling off the US coast with ballistic missiles.[237] The SACLANT studies significantly influenced discussions held two years later on a renewed NATO maritime strategy. The *Yankee* class patrols brought about a fundamental shift in perception of the North Atlantic and the northern flank of NATO. The Russian Navy now posed a continuous threat to both the European and the American mainland. This prompted SACLANT to establish the Standing Naval Force Atlantic (STANAVFORLANT) in 1968, with Alliance nations rotating contributions of assets. Also, SACLANT pointed to a severe lack of NATO surveillance to monitor the expanding Soviet activities, and emphasized multinational measures and intelligence sharing between national commands and NATO Commanders.[238] SACLANT's efforts prompted NATO Secretary

[232] NATO, "MC 48/3 - Measures to Implement the Strategic Concept for the Defence of the NATO Area" (North Atlantic Treaty Organization (NATO), December 8, 1969), Electronic Document Folder: IMS/MC-MCM-SG/1953-1970, NATO Archives, Brussel; Pedlow, "NATO Strategy Documents 1949-1969," XXV.
[233] Dyndal, "How the High North Became Central in NATO Strategy: Revelations from the NATO Archives," 568.
[234] Riste and Moland, *Strengt Hemmelig - Norsk Etterretningstjeneste 1945-1975*, 220.
[235] Podvig, *Russian Strategic Nuclear Forces*, 238–39.
[236] C-R(68)5, "Summary Record of a Meeting of the Council Held at the Headquarters, Brussels, on Wednesday, 24th January at 10.15 A.M." (NATO, February 7, 1968), Electronic Document Folder: IMS/MC-MCM-SG/1953-1970, NATO Archives, Brussel.
[237] C-R(68)5.
[238] NATO IMSM-483-68 (rev), Memorandum on 'Status reports' (12 November 1968), and NATO IMSWM-362-68, Memorandum on 'Status Report' for DPC in Ministerial Session (23 December 1968), quoted in

General Manilio Brosio to call for further studies into the nature of the threat in the North Atlantic.[239] The studies assessed that forces operating in the North Atlantic were necessary for a prolonged conflict, in order to meet the threat of maritime air forces seeking control of the ocean areas in the north. If Soviet forces also operated with submarines in support of their aircraft, the survivability of NATO aircraft carriers would decrease. SACLANT thus claimed it an imperative to contain and destroy Soviet submarines as far forward as possible.[240]

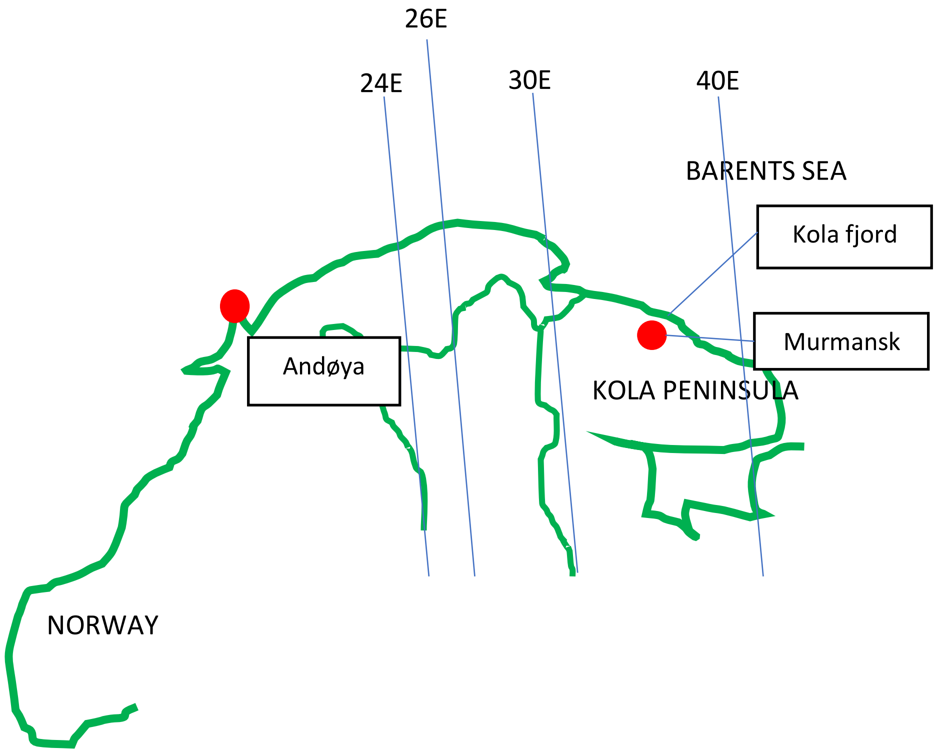

Figure 4-1. Overview of longitudinal delineation of Norwegian restrictions towards allied aircraft.

On 1 May 1960, a U-2 surveillance aircraft was shot down over the Soviet Union, with plans to land in Bodø, Norway. Not long thereafter, an American RB-47 reconnaissance aircraft flying from the UK was shot down over the Barents Sea. These incidents influenced the Norwegian Government's decision to alter the existing restrictions on foreign aircraft flying from Norwegian soil. As tensions did not just rise over land, starting on 25 October 1960, Allied aircraft taking off from Norway were formally no longer permitted to fly beyond 24 degrees East, even over *international waters*, without the explicit consent from the

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Dyndal, "How the High North Became Central in NATO Strategy: Revelations from the NATO Archives," 573; Eric Grove and Graham Thomson, *Battle for the Fjords* (Annapolis, MD: Naval Institute Press, 1991), 14.

[239] NATO PO/68/117, 13 February 1968, quoted in Dyndal, "How the High North Became Central in NATO Strategy: Revelations from the NATO Archives," 575.

[240] Grove and Thomson, *Battle for the Fjords*, 14–15, 23.

Norwegian Government.[241] However, due to delays in the delivery of the *Albatross* aircraft to the Norwegian Air Force in 1961, there was an increased requirement for support from allied partners to cover surveillance operations in the High North. This support fell under the aforementioned arrangements of *Neptune Journey* and *Exercise Popeye*. In addition to these two arrangements, yet another regime for tri-lateral cooperation between the USA, the UK, and Norway on airborne maritime surveillance came into being. *Exercise Cold Road* was established in 1961 to assure sufficient coverage in the High North in the transition from *Catalina* to the new *Albatross* for Norway.

The *Cold Road* arrangement distinguished itself from the other two in that it represented a more systematic approach to the planning of surveillance missions, where a given number of flights were *planned* well in advance, whereas the other two arrangements functioned as a regime for *approving* allied surveillance flights. In the months between July 1960 and the winter of 1961, the Norwegian *Catalinas* were taken out of service, and the *Cold Road* arrangement was implemented. Even though the *Cold Road* regime underlined that the 24-degree restriction remained in effect, the transition period came with relaxations. On several occasions, the British and Americans were allowed to operate to 26 degrees East, and at times even further east. Some Allied missions based in Norway were authorized to 30 degrees East, one even to 40 degrees East, but such missions were subject to high-level authorization.[242] When the *Albatrosses* were operational in Norway, the strict enforcement of the 24-degree restriction went back into place. Although not fully ASW capable, the *Albatrosses* provided important surveillance information from the High North.

Norwegian authorities asked for British and American assistance in covering the High North with surveillance flights during the transition to *Albatross* aircraft, and it was the British that conducted most of those missions.[243] British air crews flew from their bases in the UK to the North Atlantic and carried out their surveillance missions in the assigned areas, regularly stopping in Bodø in Northern Norway for the night. At times, selected members of the crew would visit the Norwegian Maritime Headquarters (MHQ) for discussions and information exchange.[244] When the British were tasked by their own headquarters, they usually flew

[241] Tamnes, *The United States and the Cold War in the High North*, 183.
[242] Tamnes, 184; Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 254–55.
[243] Although Canadian aircraft took part in the surveillance efforts in the Atlantic, they were not a part of the Cold Road arrangement.
[244] AIR 27/2978, "Operational Records - 201 Squadron - 1961-1963."

further south than the Norwegians normally did. But when they operated out of Norwegian bases on Norwegian tasking orders, they tended to cover areas further north and east, although not further east than 24 degrees.[245] The British could also be requested by headquarters in alliance nations to cover Russian naval activity further to the West between Norway and Iceland, sometimes with several aircraft simultaneously if the naval activity was of significant size and scope.[246]

Yet another arrangement for international coordination and cooperation for aerial maritime surveillance was the *Box Car* agreement. This was put in place during the Norwegian upgrade to the *Albatross* in 1960-61 in order to structure the landing of allied surveillance aircraft on Norwegian and Danish airfields.[247] The *Box Car* agreement was thus an agreement for surveillance in more *southern* areas of responsibility in the Atlantic, such as the Norwegian Sea and Skagerrak. It was supported significantly by the British for several years beyond the Norwegian transfer to *Albatross* aircraft and the new aircraft becoming fully operational in 1963. Operational records depict regular British sorties almost every month under the arrangement.[248]

The British effort in support of *Cold Road* surveillance also increased in the years that followed. In the mid-1960s it became commonplace with routine expansion of the areas covered, especially Westwards. This meant that British aircraft could fly under the *Cold Road* arrangement first from the UK to Keflavik, Iceland, and then from Keflavik to Andøya or Bodø in Norway, before leaving Norway to return to the UK in a three-day operational roundtrip.[249] At times the *Shackleton* crews were tasked for more than one mission out of Norway, which meant that they would transit to Norway while carrying out a mission, stay in Norway and typically perform a mission a day for several days, and then return to the UK on an operational transit.[250] The number of British missions under the *Cold Road* arrangements decreased sharply in the fall of 1965, as the Norwegian *Albatrosses* were increasingly capable of covering their own, assigned areas.[251]

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[245] AIR 27/2978.
[246] AIR 27/2978.
[247] Aircraft from US, UK, Canada, and eventually West Germany and the Netherlands. See Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 326.
[248] AIR 27/2979, "Operational Records - 201 Squadron - 1963-1965"; AIR 27/3161, "Operational Records - 201 Squadron - 1966-1968."
[249] AIR 27/2979, "Operational Records - 201 Squadron - 1963-1965."
[250] AIR 27/2979.
[251] AIR 27/2979.

With the new aircraft came sensors that were a significant improvement to the *Catalinas*, although not by any means on par with the American *Neptunes* or *Orions*. The combination of the lack of ASW and ELINT capabilities in the Norwegian *Albatrosses* and the self-imposed restrictions for Allied surveillance aircraft brought the Norwegian basing policy under pressure. However, Allies monitored and followed Russian exercises and international deployments, but the strategic, nuclear threat came from ICBMs on *land* after the SRF had been established. It wasn't until 1967 and the *Yankee* patrols that the requirements for continuous ASW really set in in the North Atlantic.

4.4 The evolution of NATO ASW and MPA capabilities

In anticipation of quieter submarines, there was a steady improvement of Western ASW technology's ability to detect Russian submarines in the 1960s. At the core of the modern ASW operations stood barrier operations, with SOSUS arrays on the sea bed providing cueing of approaching submarines to other platforms. The first arrays were placed out from Argentia not far from the US coastline, but the new technology now facilitated a more forward leaning approach to the search. In 1964, a SOSUS array was placed between Andøya, Bear Island and Svalbard, covering the entrance into the Atlantic for the Northern Fleet.[252] The Norwegian BRIDGE system was a sea-bed system similar to SOSUS and the two worked in tandem, with BRIDGE contributing significantly to the search efforts.[253] In 1965 another SOSUS array was placed between Greenland, Iceland, and the UK, in the so-called GIUK gap. SOSUS was a cornerstone in the search for and detection of Soviet submarines, but utilization of the acoustic data had to be handled so as not to disclose the SOSUS capabilities and whereabouts. The estimated position of the adversary submarine was revealed indirectly to the aircraft crew through other sources. Some intelligence officials even actively prohibited the use of SOSUS data by ASW aircraft, in fear of disclosing their acoustic capabilities to the Soviets.[254]

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[252] Olav Riste and Arnfinn Moland, *Strengt Hemmelig - Norsk Etterretningstjeneste 1945-1975* (Oslo: Universitetsforlaget, 1997), 215–32; Cote, "The Third Battle - Innovation in the U.S.Navy's Silent War Struggle with Soviet Submarines," 41; Owen Wilkes and Nils Petter Gledistch, *Onkel Sams Kaniner - Teknisk Etterretning i Norge* (Oslo: Pax Forlag, 1981), 125–27.

[253] Kjetil Skogrand, Olav Njølstad, and Rolf Tamnes, "Hot Spot - Cold War, the High North, and Grand Strategy," *Institutt For Forsvarsstudier (IFS) Info* 5/1998 (1998): 22–23.

[254] Riste and Moland, *Strengt Hemmelig - Norsk Etterretningstjeneste 1945-1975*, 219; Ford and Rosenberg, *The Admiral's Advantage - U.S. Navy Operational Intelligence in World War II and the Cold War*, 37.

The US Navy introduced the P-3 *Orion* operationally in the summer of 1962. The aircraft had the most capable ASW suite available in addition to a new radar, but crucially the *Orion* had computers with an unprecedented processing capability for the onboard computers. The *Orion* hit the track running with significant involvement in the Cuban Missile crisis of October that year.[255] The new MPA commenced operational sorties in the North Atlantic soon thereafter. With the P-3 *Orion* becoming operational, further integration of SOSUS with MPA assets provided a high level of awareness of Russian submarine movements. This removed the hunter-killer role of ASW dedicated aircraft carriers in the 1960s, and led to the removal of the ASW dedicated aircraft carriers altogether in the 1970s.[256]

When the *Yankee* class initiated their strategic patrols, Western ASW forces had embraced a *barrier* approach in full. SOSUS was up and running, the integration with the MPA community was functioning, and forward deployed ASW optimized attack submarines were operating in trail of the great Soviet missile platforms. The ASW barrier strategy was the framework within which Alliance ASW forces in the North Atlantic operated. They detected and tracked Soviet strategic submarines more or less continuously as they initiated their patrols in the late 1960s off the US coast.[257]

Towards the late 1960s, the Norwegians initiated negotiations with the Americans for procurement of the P-3 *Orion*. The developments of the 60s had emphasized the requirement for capable ASW aircraft in the North Atlantic, and the Norwegians were given a significant reduction in procurement costs from the Americans based on an explicit bilateral arrangement for sharing of intelligence gathered by the new aircraft.[258] Norway finally had the right aircraft to conduct maritime airborne ISR in the High North, not just in terms of range, but also in terms of sensors and communications.

The British *Shackletons* were by the late 1960s becoming outdated in most respects, and compared to the P-3 *Orion,* the *Shackleton's* ASW performance was poor. However, the British were still capable of conducting ASW operations as they operated a relatively high

[255] "Command History Report (CHR) for VP-56 (1962)" (US Navy, 1962), FOIA case number: DON-NAVY-2018-00574, Naval History and Heritage Command.
[256] Cote, "The Third Battle - Innovation in the U.S.Navy's Silent War Struggle with Soviet Submarines," 50–51.
[257] Larry Robideau, "Third Battle for the North Atlantic 1962-1991," *Cold War Times* 6, no. 1 (February 2006), http://www.coldwar.org/text_files/coldwartimesfeb2006.pdf; Podvig, *Russian Strategic Nuclear Forces*, 240; Cote, "The Third Battle - Innovation in the U.S.Navy's Silent War Struggle with Soviet Submarines," 52.
[258] Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 333–35.

number of aircraft.[259] At times the *Shackletons* operated in cooperation with the much faster *Victor* bomber aircraft which flew at high altitude and provided radar cover, with the *Shackletons* investigating contacts.[260] In any case, the process to find a new maritime surveillance aircraft for the British was initiated in 1963.[261] Close interaction with Allies also helped prepare the British air crews for the new equipment that was inbound with their new MPA, the *Nimrod*.[262] The Royal Air Force took delivery of the first *Nimrod* in October 1969.[263]

Moreover, the early 1960s also witnessed the launch of the first reconnaissance satellites. The *CORONA* imagery intelligence (IMINT) satellite of August 1960 was predated by more than a month by the US Naval Research Laboratory's ELINT satellite, the *Galactic Radiation and Background* (GRAB) in June 1960.[264] Intended to map Soviet air defence radars that couldn't be reached through long-range ELINT flights along the Soviet border, *GRAB* marked the dawn of what would become a crucial part of modern reconnaissance and surveillance: satellite systems. In time, ELINT satellites were to eventually provide between 80 and 90 percent of surface vessel OPINTEL for the US Navy.[265] Although more Western SIGINT satellites were launched in the 1960s they were mostly focussing on activities on the Soviet land mass, and not naval activities.[266] And although communications satellites were operationalized in the 60s, they were in naval terms dedicated for supporting fleet flag ships and carriers.[267] Satellites focussing on naval reconnaissance were to a larger extent fielded in the 1970s.

All in all, the 1960s witnessed improvements for the MPA force with regards to computer and signal processing, signal integration and time compression, miniaturization of electronics and improvements in sonobuoy technology.[268] The automation of sensor products started in

[259] Gjert Lage Dyndal, "Land Based Air Power or Aircraft Carriers? The British Debate about Maritime Air Power in the 1960s" (PhD, History, University of Glasgow, 2009), 194–98.
[260] AIR 27/3162, "Operational Records - 201 Squadron - 1969-1970" (Royal Air Force, 1970), UK National Archives, Kew.
[261] Blackman, *Nimrod - Rise and Fall*, 14.
[262] AIR 27/3162, "Operational Records - 201 Squadron - 1969-1970."
[263] Blackman, *Nimrod - Rise and Fall*, 18–25.
[264] Pat Norris, *Spies in the Sky - Surveillance Satellites in War and Peace* (Chichester, UK: Praxis Publishing Ltd, 2008), 26.
[265] Press Release, "GRAB Satellite Declassified - NRL Built and Deployed First Reconnaissance Satellite System" (U.S. Naval Research Laboratory, June 17, 1998), https://www.nrl.navy.mil/media/new-news-releases/1998/grab-satellite-declassified--nrl-built-and-deployed-first-reconnaissance-satellite-system.
[266] Friedman, *Seapower and Space*, 102–10.
[267] Friedman, 77.
[268] Robideau, "Third Battle for the North Atlantic 1962-1991."

the 1960s, and is an important factor for airborne ISR assets in modern surveillance operations. Automated intelligence processing systems were introduced, as were (at the time) high-speed data links between aircraft, and between aircraft and headquarters.[269] But most of the automated processing capability took place at processing facilities ashore. Experiences from supporting the war in Vietnam provided important lessons for the fusion of all source data for naval OPINTEL.[270] It was in the late 1960s that the electronic intelligence (ELINT) specific maritime aircraft EP-3 *Aries* was developed, specializing in collecting electronic intelligence in the maritime domain.[271]

4.5 The deployment of NATO MPA capabilities

An increase in Soviet operational naval activities in the North Atlantic took place in the middle of the 1960s, leading to a significant increase in reporting on Soviet submarine activity by MPA aircrews.[272] From the mid-1960s, moreover, American aircrews took part in intelligence gathering operations on the suspected air-submarine manoeuvre by Soviet forces against transiting US aircraft carriers.[273] This could be seen as reaction to the fielding of tactical submarines with anti-carrier missiles in the Soviet Navy discussed above. The primary mission for MPAs was ASW and intelligence gathering against the Soviet submarine fleet.[274]

During the Soviet naval exercise in the North Atlantic in August 1963, several Allies flew out of Norwegian bases to collectively cover the Russian activities. *Shackleton* aircraft took part in this surveillance activity, named *Operation Bargold* by the British. By this time the Norwegian *Albatrosses* were operational and flew together with the British and the Americans. Canadian aircraft took part as well, but these flew from bases outside Norway, as they were not a part of the *Cold Road* arrangement. Tasking was efficiently coordinated between the maritime headquarters (MHQ) in Bodø and the UK MHQ in Rosyth, and

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[269] Ford and Rosenberg, *The Admiral's Advantage - U.S. Navy Operational Intelligence in World War II and the Cold War*, 46–47.
[270] Ford and Rosenberg, 53–54.
[271] Reade, *The Age of Orion - The Lockheed P-3 Story*, 106–7.
[272] See for example "Command History Report (CHR) for VP-23 (1965)" (US Navy, 1965), FOIA case number: DON-NAVY-2018-00574, Naval History and Heritage Command.
[273] "Command History Report (CHR) for VP-44 (1967)" (US Navy, 1967), FOIA case number: DON-NAVY-2018-001782, Naval History and Heritage Command.
[274] "Command History Report (CHR) for VP-21 (1960-1965)" (US Navy, 1965 1960), FOIA case number: DON-NAVY-2018-001782, Naval History and Heritage Command; "Command History Report (CHR) for VP-5 (1960-1963)" (US Navy, 1963 1960), FOIA case number: DON-NAVY-2018-001782, Naval History and Heritage Command.

intelligence reports were shared between the nations after the sorties. There were yet to be established rigid and strict procedures for this sharing of intelligence, and the information flowed relatively seamlessly between the participants.[275]

Many within the ASW community emphasized that the primary search sensor in the hunt for submarines was still radar (in order to find surfaced submarines at periscope depth) and vision. But increasing activities with more capable submarines in the Northern Fleet initiated discussions both in Norway as well as in NATO on both ASW equipment and national competency levels on modern ASW. During *Operation Bargold* in 1963 the British and the Americans performed well with regards to detecting Russian submarines, but the Norwegian *Albatrosses* were unable to detect any submarines at all.[276] They simply did not carry the appropriate ASW sensors to do the job required. However, with the increasing Soviet activities in the Barents Sea, which occurred to a high degree beyond the approved areas of Allied aircraft, the Norwegian *Albatrosses* were able to deliver much needed surveillance of Soviet surface activities. And even though the strongest feature of the *Albatross* aircraft was *surface* surveillance, the aircraft was at times capable of providing intelligence on submerged submarines as well. One such instance was the collection of acoustic details on the relatively new *Echo II* submarine in 1965. However, the Norwegian ASW shortfalls in the High North were deemed a critical problem to the Alliance in general, and the United States in particular.[277] *Operation Adjutant* in the summer of 1964 was a follow-up of *Bargold* the previous year, and had the objective of shadowing the Northern Fleet as they exercised off the coast of Norway. The British aircrews were also to cooperate with a submarine barrier situated between Bear Island and the Norwegian coast. The *Shackleton* post-mission report was filled with sightings of Russian naval vessels that would normally not be seen further south.[278] Coordinated surveillance operations took place again in 1965, through *Operation Beresford*. British authorities emphasized that "*these exercises give us a unique opportunity to observe Soviet ships, submarines, and aircraft at work in this vital sea area, to assess their capabilities under operational conditions, and to judge their current state and development of their equipment and tactics*."[279] The crews flew under national control, but coordination

[275] Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 289.
[276] Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 290.
[277] Tamnes, *The United States and the Cold War in the High North*, 216; Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 302.
[278] AIR 27/2979, "Operational Records - 201 Squadron - 1963-1965."
[279] DEFE 24/20, "British Surveillance Efforts against the Soviet Northern Fleet - Summer Exercises 1965" (UK Director of Naval Intelligence, 1965), UK National Archives, Kew.

between the respective national MHQ's de-conflicted areas among themselves.[280] The operational report claimed that the surveillance was a "*marked success*," and that the "*volume of intelligence gained in the operation is the greatest and most valuable since these operations were instituted*."[281]

On an overarching level, the Norwegians, the Americans and the British came to an understanding for a tri-lateral coordination of anti-submarine intelligence collection in the Norwegian Sea with emphasis on the exploitation of the underwater sensor at Andøya. This specific coordination of intelligence had been established in 1965, and was termed *Operation Canasta*.[282] More specifically, with the Norwegian acquisition of the P-3B *Orion* as a baseline, the NORCANUSUK Agreement between Norway, Canada, the USA and the UK was signed in 1969. The agreement delineated the responsibility to conduct maritime surveillance in the North Atlantic and the High North. Norway was to maintain surveillance of the "*north-eastern waters.*"[283] The NORCANUSUK Agreement further supported that Norwegian aircraft were in charge of the High North east of 24 degrees East. In 1969, however, the British would yet again fill in the gap left in surveillance by the turnover in Norwegian capabilities, this time from the *Albatross* to the *Orion*. British aircrews deployed in August 1969 to Bodø for *Operation Knockabout*, the code for the deployment of Coastal Command units for shadowing of the Soviet fleet exercises.[284] As the Soviet force moved south, British aircraft based in Scotland took over. As the force moved north-west, American aircraft based on Iceland took over.[285]

The surveillance flights in the early 1960s were mostly coordinated in advance. British aircrews flying *Shackletons* out of Kinloss, Scotland, were tasked by the MHQ in Pitreavie, Rosyth, close to Edinburgh, Scotland. The Headquarters in Pitreavie also served as the NATO entity responsible for maritime air operations in the North Atlantic, as *Commander Maritime Air Northern Sub-Area*. First answering directly to *Commander-in-Chief Eastern Atlantic Area* (CINCEASTLANT) under SACLANT, maritime air operations came under

[280] DEFE 24/20, "Operation Beresford - Planning Guide" (UK Director of Naval Intelligence, 1965), Section 1A, para 7, UK National Archives, Kew.
[281] DEFE 24/20, "Operation Beresford - Letter from Deputy Director of Naval Intelligence to the Ministry of Defence" (UK Director of Naval Intelligence, October 5, 1965), UK National Archives, Kew.
[282] Riste and Moland, *Strengt Hemmelig - Norsk Etterretningstjeneste 1945-1975*, 227; Skogrand, Njølstad, and Tamnes, "Hot Spot - Cold War, the High North, and Grand Strategy," 23.
[283] Tamnes, *The United States and the Cold War in the High North*, 213, 216.
[284] AIR 27/3162, "Operational Records - 201 Squadron - 1969-1970."
[285] AIR 27/3162.

centralized control of the maritime headquarters in Northwood, London, in the early 1960s.[286] NATO did not control any assets in peacetime, but coordinated and wrote strategy, plans, doctrine, as well as directing exercises. These command and control entities played important roles in shaping the way the maritime air community interacted. Norwegian aircrews flying *Albatrosses* out of Andøya were tasked by the Maritime Air Operations Centre (MAOC) run by air force personnel, but situated at the Maritime Headquarters in Bodø.[287] The American *Neptunes* were tasked by the *Commander Iceland Sector ASW Group* (CTG 84.1) based in Keflavik, who in his national chain-of-command answered to *Commander Task Force (CTF) 84*, one of the sub-units of *Commander Submarine Forces Atlantic* in Norfolk, USA.[288] The close interaction on national level between the Americans at Keflavik, the British in Rosyth and later Northwood, and the Norwegians in Bodø, was executed outside the formal NATO command structure. The bi- and trilateral interaction facilitated the coordination of maritime air operations in the North Atlantic required for maintaining an overview of the Soviet Navy long-range submarine patrols in the Atlantic. Allied aircraft were regularly tasked by the military authorities of another nation, especially British and American aircraft regularly flying out of Norwegian airfields.

There is little evidence of in-flight coordination between aircraft of different nationalities in the early 1960s, coordination that did not seem to take shape before regular Soviet strategic patrols began in the mid- to late 1960s. And even after this, it was the position, course and speed of the target submarine that was shared in real-time, to the extent that information was available. The intelligence collection of more detailed nature was kept for national analysis.

The North Atlantic ASW environment in the 60s was busy. Over the course of one month in March 1968, one US squadron at Keflavik flew 91 sorties for a total of 784 hours, providing continuous coverage with at least one aircraft over the target submarine for three weeks straight.[289] Over the course of a deployment of five to six months to Keflavik in the late 60s it was common to be in contact with 15-20 submarines.[290] As the Soviet *Yankee* patrols settled

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[286] NATO, *NATO - Facts about the North Atlantic Treaty Organization - 1962* (Paris: NATO Information Service, 1962); Dave Angus, "Command and Control of MPA Assets on the Northern Flank," *Maritime Patrol Aviation* 2, no. 1 (September 1991).
[287] Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 312–15.
[288] Robideau, "Third Battle for the North Atlantic 1962-1991."
[289] "Command History Report (CHR) for VP-24 (1968)" (US Navy, 1968), FOIA case number: DON-NAVY-2018-001782, Naval History and Heritage Command.
[290] "Command History Report (CHR) for VP-24 (1969)" (US Navy, 1969), FOIA case number: DON-NAVY-2018-001782, Naval History and Heritage Command; "Command History Report (CHR) for VP-44 (1969)" (US Navy, 1969), FOIA case number: DON-NAVY-2018-001782, Naval History and Heritage Command.

into routine, the Keflavik squadrons worked in tandem with its Allies to cover the Soviet submarines emanating from the North.[291] Similar to the British squadrons, the US Navy squadrons routinely deployed to allied countries such as Norway, the UK, Denmark, Germany and the Netherlands in order to support local efforts, to practice operating out of foreign airfields, and often times to get closer to the submarine operating areas.[292] Whether the Americans based on Iceland at times flew beyond 24 degrees East based from their home-base or not was not known by Norwegian authorities.[293] American operational records do not reveal any particular reports that would indicate that they did.[294] Norwegian authorities considered loosening the restrictions in the course of the 1960s, moving the restricted line from 24 to 27 degrees, but the *Albatrosses* managed to support intelligence gathering efforts sufficiently for the 24-degree restriction to remain in place.[295] This indicates that the British and American surveillance operations further to the West and south were considered sufficient to execute the barrier strategy against the Soviet submarines.

After the Soviet *Sputnik* launch it was of particular interest to follow Soviet missile development, and British *Comet* ELINT aircraft regularly deployed to Bodø and Andøya in order to fly missions in the Barents Sea, a capability the Albatrosses didn´t have. Approval for this was given through the Prime Minister's Security Council. The Comets flew along the Kola coastline, then up north along the Novaya Zemlya coastline, before returning to Bodø.[296] After a pause from flying these missions in 1960 and 1961 due to the shoot-downs of the U-2 and the RB-47 previously mentioned, the British flights resumed until 1967 when they were denied for the foreseeable future.[297] The denial likely came as Norwegian intelligence capabilities were growing in assertiveness, credibility and general standing. Allied operations in the High North also included RC-135 *Rivet Joint* ELINT operations flown by the Americans.[298] These were, however, flown from the UK and did not fall under the Norwegian restrictions.

[291] "Command History Report (CHR) for VP-24 (1968)."
[292] "Command History Report (CHR) for VP-24 (1968)."
[293] Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 249–50.
[294] Operational records for US Navy squadrons deploying to Keflavik from 1952 to 1994 have been surveyed for this thesis: Naval History and Heritage Command, FOIA case number: DON-NAVY-2018-00574.
[295] Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 318–19.
[296] Blackman, *Nimrod - Rise and Fall*, 69–70.
[297] Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 302–4.
[298] Tamnes, *The United States and the Cold War in the High North*, 216–17.

4.6 Chapter conclusion

In what can be termed a theme of general expansion both in inventory and operational mission portfolio, the strategy and posture of the Soviet Navy fluctuated somewhat in the 1960s. But even if the Strategic Rocket Forces were established early in the decade, the submarines were given back their mission of strategic nuclear strike by the end of the decade, most evidently represented by the operationalization of the *Yankee* class in 1967. Both the anti-carrier submarines and missiles and the strategic nuclear submarines with their missiles were brought forward approaching the 1970s. In spite of fluctuations, the submarine force only strengthened its place in Soviet naval as well as grand strategy throughout the 1960s. And through the 1960s, the Allied approach to the Soviet submarine threat was to stay on top and keep track of Russian submarines on patrol, regardless of the overarching NATO strategy.

The 1960s were also formative for airborne maritime ISR in many ways, particularly in the sense of tri-lateral partnering in the surveillance of Soviet naval operations. MPAs had by then been established as the weapon of choice to meet the submarine threat. Several of the fundamental tenets of airborne ISR can be identified in the dynamics for MPA development and operationalization in the 1960s. For communications, data link was introduced, facilitating more efficient communication and coordination between both tactical units as well as headquarters ashore. The poor ASW suite on the *Albatrosses* put Norwegian flight restrictions for foreign aircraft operating from Norwegian soil under pressure. A combination of the flight restrictions and the poor ASW capabilities of the *Albatross* seems to ultimately have secured the *Orion* deal for the Norwegians in the late 1960s.

The question of range for MPA is subsumed in the overarching dynamics altogether. In order to get more time on station in areas with the most activity, American and British aircraft sought to operate from Norwegian airfields in the north. This was the basis for the bi- and trilateral coordination between these three nations, as manifested through the respective coordination arrangements: *Neptune Journey*, *Exercise Popeye*, *Cold Road*, *Box Car*, and the *NORCANUSUK Agreement*. However, had range not been a factor, the UK and US aircraft could easily have operated from their home bases without being restricted by Norwegian policy in the first place.

5. Western control and the emergence of the Bastion – 1970-1991

5.1 Introduction

As the 1970s began, the SSBNs had taken centre stage in the strategic nuclear stalemate between the USA and the USSR, and the Russian *Yankee* class was conducting more or less continuous patrols in the Atlantic. The *Yankees* were, however, somewhat of an interim solution to the Soviet Union's geography-ASW conundrum. In order to avoid Western ASW defences as a whole, an even more capable platform/missile combination was required. This came through the *Delta* class SSBN/SS-N-8 missile in 1972. This also shifted the strategic posture of the Soviet Navy, and the emergence of what in the West was perceived as a "bastion strategy" was first heavily debated, and then taken as a foundation for Russian naval posture and strategy entering the 1980s. The Soviet bastion approach put the submarines front and centre in assuring their Second-Strike capability, as well as protecting waters close to vital home-bases in the High North.

From 1970 and onwards the Norwegian threat assessments to an increasing degree focussed on the military build-up on the Kola peninsula. Although the strategic nuclear submarines based on Kola did not pose a direct threat to Norwegian soil, they certainly posed a threat to the United States and NATO as a whole. Also, the land and air forces on Kola were focussed on seizing land territory in the northern parts of Norway for two reasons. First, achieving control of Northern Norway would deny the Allies staging bases for air attacks on the Soviet Union. Second, controlling air bases in Northern and Mid-Norway would provide Soviet air forces further reach in their quest for air supremacy in the Northern Atlantic.[299] Through the Soviet Union establishment of the bastion defense in in the mid-1970s, the North Atlantic and the Barents Sea, the value of Norwegian bases increased even more. Norwegian air bases would in case of a Soviet land-grab become an integrated part of the land-based infrastructure that supported Soviet air operations in denying Allied access through the GIUK gap and freedom of manoeuvre in the North Atlantic.[300]

[299] Børresen, Gjeseth, and Tamnes, *Norsk Forsvarshistorie - Allianseforsvar i Endring, 1970-2000*, 36.
[300] Børresen, Gjeseth, and Tamnes, 40–41.

Through the 1970s and 80s, Norwegian authorities were therefore engaged in a policy of invitation towards Allied partners. Through actively inviting Allied partners to Norway and northern waters for presence, exercises and training, Norwegian authorities ensured Allied engagement in the High North.[301] This policy of invitation ensured further Norwegian integration with the Western bloc. However, through upholding the basing policy and self-imposed restrictions, Norway also was able to demonstrate an ability to develop independent security policies, within the framework of the NATO membership.[302]

The 1970s were characterized by negotiations and a somewhat tumultuous relationship on the political level with the Soviet Union in the High North. The decade saw the establishment of vast exclusive economic zones for many coastal states, which led to peaceful agreements between some nations and fierceful disputes between others. The vast ocean areas in the North and their known and potential natural resources had to be handled with care by Norwegian authorities in dialogue with the Russians.[303]

The forward leaning *Maritime Strategy* of the US Navy and CONMAROPS of NATO, however, caused challenges for the Norwegian government. Norway and the High North increased their strategic importance, but this made the balancing act in security policy a challenge. The focus of the Government was on ensuring the credibility and commitment of American and NATO reinforcements through allowing Allied activities to a certain extent, but also maintaining low tensions in the North. A part of the *Maritime Strategy* was to hold Russian submarines at risk before they left home waters, but the Norwegian government pointed towards such operations as destabilizing. At the same time, it was important to make sure Allied navies were part of the continuous presence in the maritime domain in the High North.[304]

The more forward leaning maritime strategy for the US Navy and NATO led to an increase to naval exercises in the Norwegian Sea. The MPA forces of the respective nations maintained their pace of high intensity surveillance of Russian activities, even when that surveillance required following the Russians closer to their homebases. The established 24-degree East restriction would, more than ever, manifest the High North as an area for intelligence gathering more or less exclusively by Norwegian surveillance aircraft. Alliance MPAs were

[301] Tamnes, *Oljealder, 1965-1995*, 6:68.
[302] Børresen, Gjeseth, and Tamnes, *Norsk Forsvarshistorie - Allianseforsvar i Endring, 1970-2000*, 67.
[303] Tamnes, *Oljealder, 1965-1995*, 6:249–55.
[304] Børresen, Gjeseth, and Tamnes, *Norsk Forsvarshistorie - Allianseforsvar i Endring, 1970-2000*, 114.

well set up with capable sensors, communications, and efficient use of range. Towards the end of the 80s, however, these MPAs sensors would be put significantly under pressure.

5.2 Soviet naval strategy and submarine capabilities

From the early 1970s the Soviet strategic submarines would once again play a key role in the defence of the Soviet Union. Other units, from attack submarines to surface vessels, were dedicated to the task of defending those strategic submarines. The idea of the SSBNs providing an assured second-strike capability after a potential pre-emptive counterforce strike by their adversaries was by then embraced in full by the Soviets. However, the Russian strategic submarines had to pass through extensive NATO ASW barriers. Starting in the late 1960s, John Walker of the US Navy submarine service began spying for the Soviet Union, revealing just how vulnerable the Russian SSBNs were to NATO ASW defences.[305] It became clear to the Soviets that the strategic situation was unacceptable. In order to avoid Western forces, the range of the next submarine launched strategic missile would have to be more than three times the range of the SS-N-6 fitted on the *Yankee*. A range of 4,000 nm or more would enable the Russian strategic submarines to remain north of NATO ASW forces in the Atlantic and still constitute a threat to NATO.

Entering the 1970s, the main focus of Western ASW efforts was to track Soviet strategic submarines on patrol. The *Yankee* class was the main threat, but Western ASW technology was ahead of Soviet silencing efforts, and the *Yankee* class was detectable both by SOSUS and by MPA, albeit they had to work in tandem. In addition to being detectable by Western acoustic systems, the *Yankees* were sailing on what became somewhat of a regular patrol pattern. This led to a predictability that the bastion defence would later remove. When the revolutionary SS-N-8 missile was developed, it was simply too large for any existing submarine, and its use by submarines demanded the construction of a larger vessel than the *Yankee*. As the Soviets did not want to disturb ongoing submarine production, they developed the new *Delta* class as a modified version of the *Yankee*.[306] The *Delta I* class SSBN initially carried twelve SS-N-8 missiles with a range of 4,300 nm/7,800 km, and the first submarine

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[305] James Bamford, "The Walker Espionage Case," *United States Naval Institute Proceedings* 112, no. 5 (May 1986): 2; Cote, "The Third Battle - Innovation in the U.S.Navy's Silent War Struggle with Soviet Submarines," 73.

[306] This becomes clear when comparing the Soviet project numeration of the two classes, where the *Yankee* class was given Project 667A, and the *Delta* class Project 667B. For more on the development of these classes, see for example Podvig, *Russian Strategic Nuclear Forces*, 240–43.

was completed in 1972. The *Delta*/SS-N-8 combination had thus more than three times the range of the *Yankee*/SS-N-6 combination. The *Delta II* carried sixteen instead of twelve missiles, and the *Delta III* carried the new SS-N-18, with a range of 3,600 nm/6,500km and 4,400 nm/8,000km, with multiple and single warhead configuration, respectively.[307] The SS-N-18 was the first operational Soviet SLBM with multiple, independently targeted re-entry vehicles (MIRV). The *Delta* carrying the SS-N-8 thereby facilitated a retreat from offensive forward deployments by the *Yankee* class.

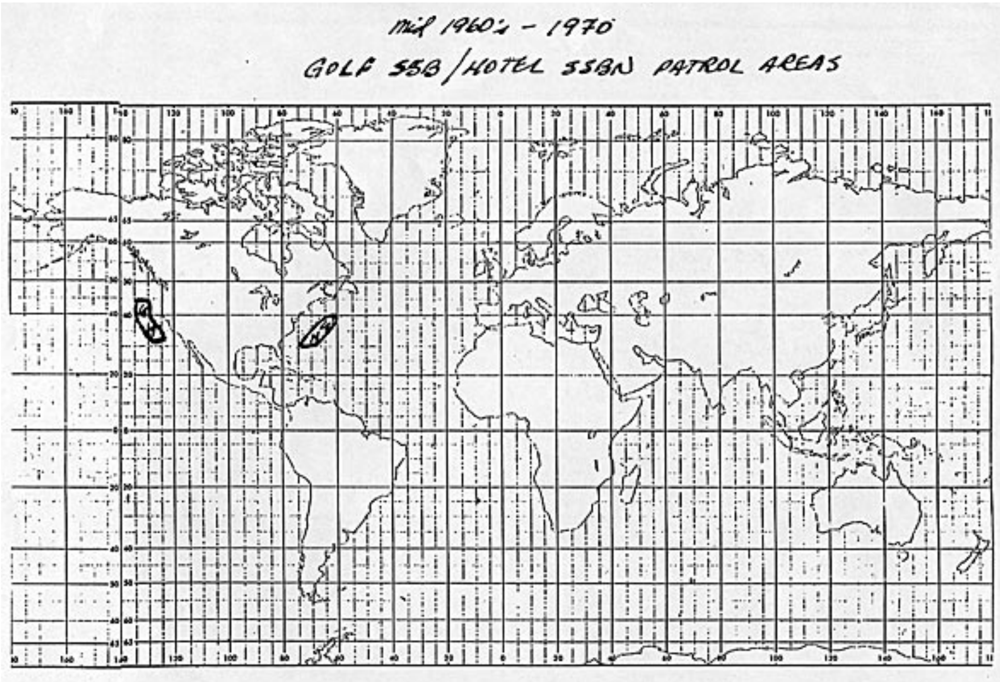

Figure 5-1. Mid-1960s – 1970. Golf SSB/Hotel SSGN patrol areas.[308]

[307] Podvig, 330–31.
[308] Office of Naval Intelligence, *Overview of Soviet Union Ballistic Submarine Patrol Areas - 1960s-1980s* (Washington, D.C., 2000), National Museum of American History, https://americanhistory.si.edu/subs/work/missions/warfare/index.html (.

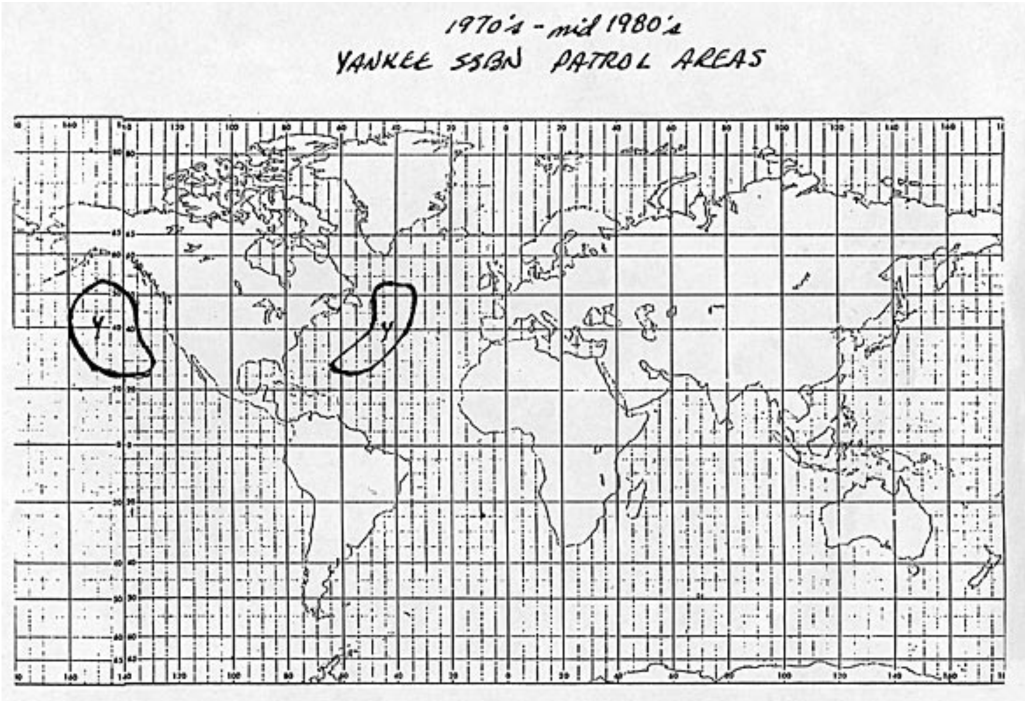

Figure 5-2. 1970s – mid-1980s. Yankee SSBN patrol areas.

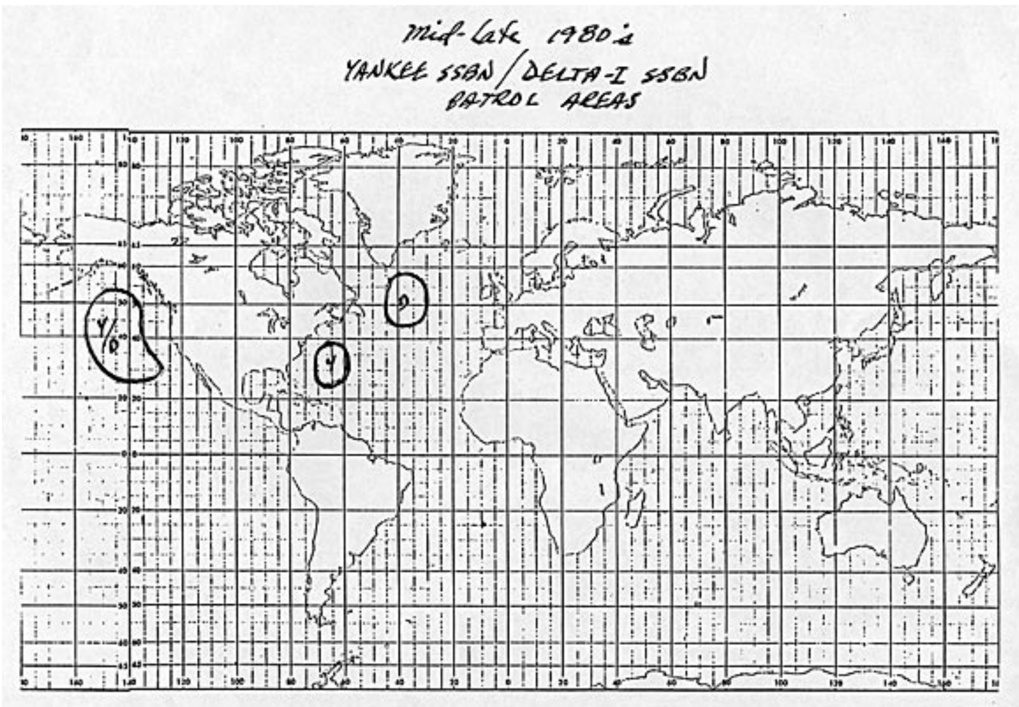

Figure 5-3. Mid-late 1980s. Yankee SSBN/Delta I SSBN patrol areas.

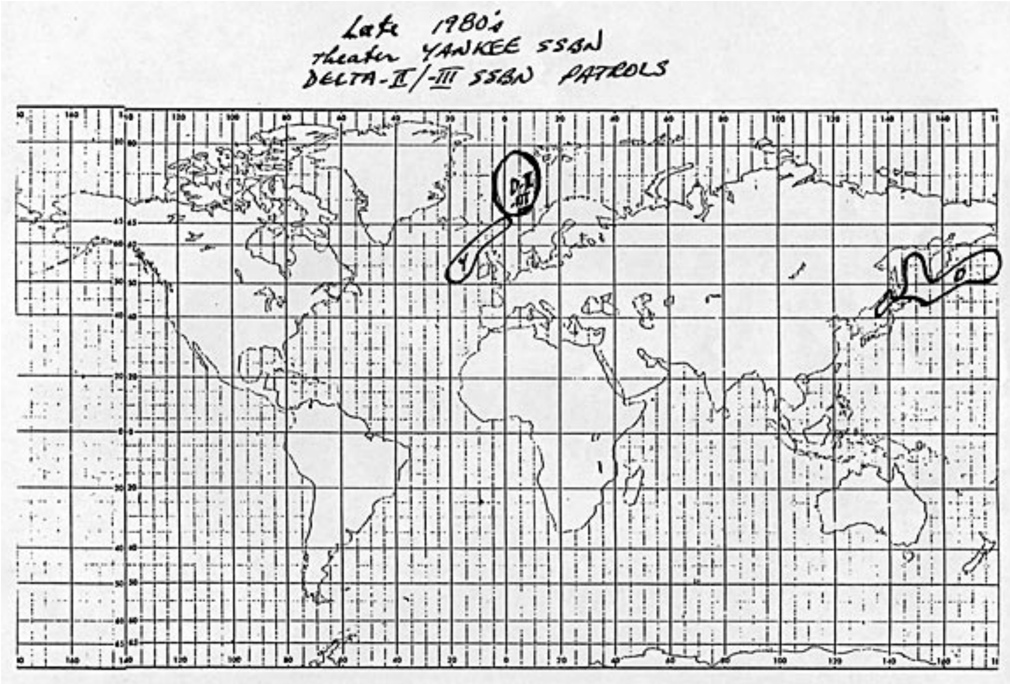

Figure 5-4. Late 1980s. Yankee SSBN/Delta II/III SSBN patrol areas.

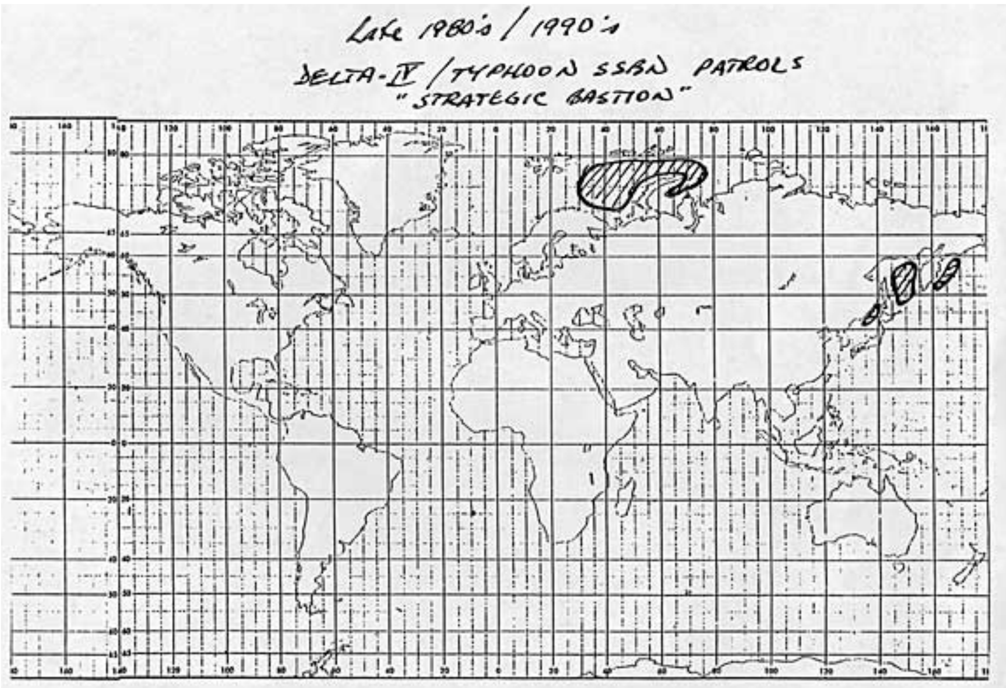

Figure 5-5. Late 1980s/1990s. Delta IV/Typhoon SSBN patrol areas. Strategic Bastion.

By the early 1980s, most analysts had concluded that Soviet naval strategy was indeed focussed on withholding strategic submarines in local waters under the protection of attack submarines, the surface fleet, and maritime air units, in a *bastion*. This shift in Soviet naval posture was to become the strategic foundation for the emerging *Maritime Strategy* of the USA.[309] The *Delta* class submarines both facilitated and solidified the bastion concept of the Soviet Union's approach to naval strategy. From having to leave home-waters and traverse ASW infested waters all the way to the US coastline, and patrol whilst constantly being held at risk by adversary forces, the assured second-strike assets of the Russians could now operate within the defensive perimeters of national forces. The improved ranges of the missiles even facilitated the SSBNs firing their weapons whilst in their home ports. The strategic submarines were in the 1970s and 1980s gradually retracted from patrolling off the coast of the USA, and to an increasing extent sent out on patrol in what is now consistently termed the bastion.

In the early 1970s, new submarines focussed on bastion-related tasks were developed. The *Tango* class brought with it a return to diesel-electric propulsion, which was deemed ideal for defensive operations in the bastions. From 1973 the *Charlie II* carried the SS-N-15 as well as the SS-N-9 *Siren*, an anti-ship missile with a 60 nm range. But NATO ASW development, particularly the S-3 *Viking* carrier-based ASW aircraft and the *Los Angeles* attack submarine, quickly made the *Charlie II* obsolete. The *Oscar* class, did not take over until 1982, and will be discussed further below. However, there were developments for Soviet attack submarines as well. In the early 1970s the *Alfa* and the *Papa* classes were set to sea. Very fast and deep-diving, they surprised the West with their capabilities. Production was shut down after only a few units, however, due to high cost.[310] In 1972 the *Victor II* entered service, a more capable version of its predecessor. The *Victor II* accommodated the SS-N-15 *Starfish*, which could carry a nuclear charged depth bomb a little more than 20 nm. Analysts believe that the SS-N-15 armament was indicative of an anti-SSBN mission.[311]

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[309] John B. Hattendorf and Peter M. Swartz, eds., "U.S. Naval Strategy in the 1980s - Selected Documents," *Naval War College Newport Papers*, no. 33 (2008): 212–16.
[310] Cote, "The Third Battle - Innovation in the U.S.Navy's Silent War Struggle with Soviet Submarines," 57–60; Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 394; Jordan, *Soviet Submarines - 1945 to the Present*, 126.
[311] Jordan, *Soviet Submarines - 1945 to the Present*, 138.

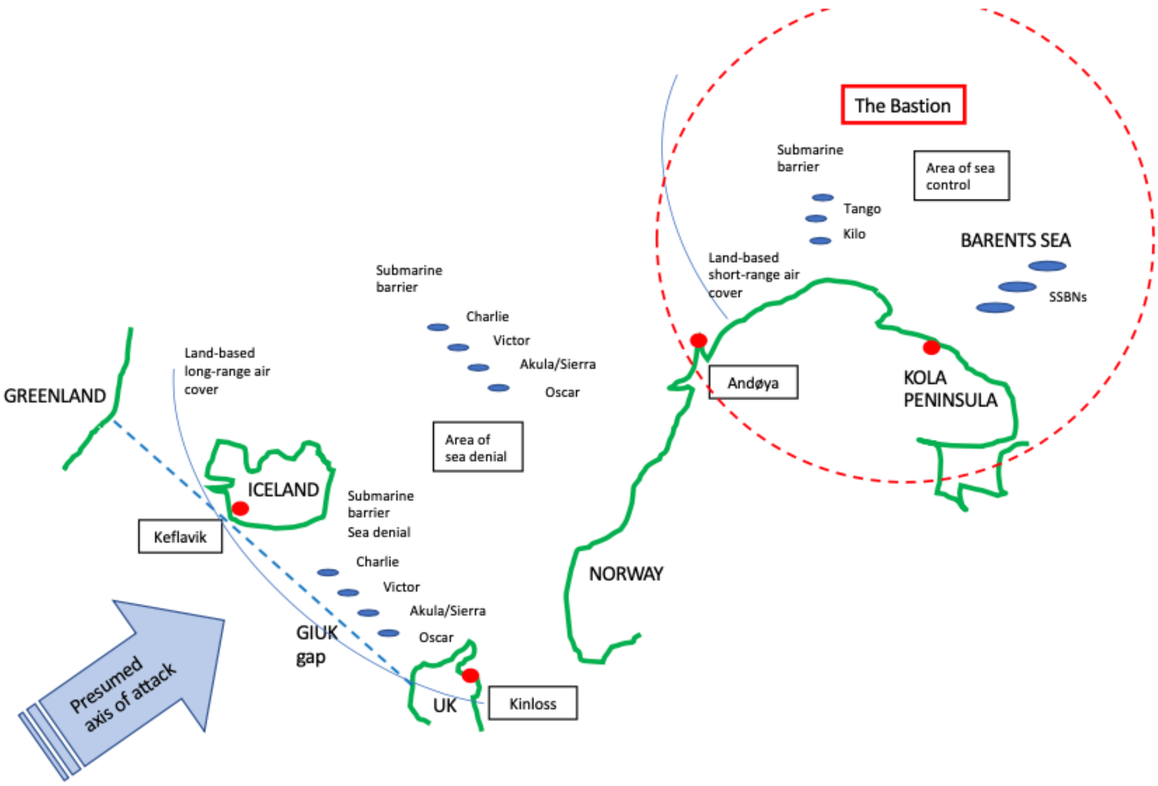

Figure 5-6. The Bastion, with principled placement of Soviet submarine forces

The Soviet Union also finally initiated programs to silence their submarines, and by the end of the decade their efforts bore fruit. The *Victor III* became operational in the late 1970s with capabilities directed towards forward deployed adversary attack submarines. She was thus an important feature of the bastion defence in the North. The Russian silencing efforts continued with a helping hand from the Walker spy ring. The stolen information showed the Soviet Union just how vulnerable their submarines were to Western ASW systems, and likely gave impetus to silencing efforts into the early 1980s.[312] The *Victor III* class was to surprise NATO navies with her quietness – she proved very hard to find. The *Victor III* class was armed with 65 wake-homing torpedoes, and the conventional successor to the SS-N-15, the SS-N-16 *Stallion* ASW missile.[313]

The nuclear-powered vessels were too large and too few in numbers to take over patrols close to shore, and a new conventionally powered submarine was required. The first unit of the *Kilo* class was completed in 1982. Only carrying torpedoes, the class was relatively simplistic

[312] Bamford, "The Walker Espionage Case"; Cote, "The Third Battle - Innovation in the U.S.Navy's Silent War Struggle with Soviet Submarines," 73.
[313] Jordan, *Soviet Submarines - 1945 to the Present*, 146–48.

and carried basic technology, and was soon marked for export. The *Kilo* class would become one of the most common diesel-electric submarines in the world.

As the last *Charlie II* was completed in 1982, the first *Oscar* class submarine was set to sea. The *Oscar* was much larger than any of the previous anti-carrier submarines, and her displacement surpassed that of the *Delta* class SSBNs. The *Charlie's* missiles had a relatively short range, necessitating the submarine to get close to her targets, which had a significant effect on American carrier battle group tactics and defences. This in turn led to the Soviets increasing the range of their anti-ship missiles in order to defeat the improved ASW defences of their adversary. The new main armament of the *Oscar* was the SS-N-19 *Shipwreck,* with a 300 nm range and a submerged launch capability. The range of the missiles of the *Oscar* integrated her into the surface and air forces in a way that her predecessors were not, and thus re-established the Soviet combined arms approach to anti-carrier operations.[314] Through the *Oscar,* it is clear that the Soviet Navy maintained capable anti-carrier elements as a part of its overall naval strategy.

The *Typhoon* class became operational in 1983, and is the largest submarine ever constructed. The *Typhoon* carried the record large SS-N-20 *Sturgeon* which was the first SLBM to be driven by solid-fuel propulsion (range 4,400 nm/8,300 km). The SS-N-20 carried six to nine MIRVs, with a significant increase in accuracy compared to its predecessors. The *Typhoon* was designed for calmly patrolling her Arctic home waters whilst being protected by other assets, thereby constituting an assured second strike capability.[315] The Soviets also continued the production of the *Delta* series. The *Delta IV* was much less costly to produce than the *Typhoon*, and carried the SS-N-23 *Skiff* with a range of 4,400 nm/8,300 km with four MIRV warheads.[316] She became operational in 1988.[317] The *Strategic Arms Limitation Treaty* (SALT I) agreement of 1972 limited the number of missiles in the inventory allowed and thus indirectly the number of firing platforms permitted. This made further large-scale production of SSBNs unnecessary. It was thus a matter of replacing old SSBNs with newer and more capable ones. The 1970s trend of operationalizing cruise missiles was also a result of arms agreements, which gave incentives to turn long-range, land-based weapons into shorter range sea-based ones. This was also the reason for several *Yankee* class SSBNs being converted

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[314] Jordan, 167–68.
[315] Jordan, 157–60.
[316] Podvig, *Russian Strategic Nuclear Forces*, 336; Jordan, *Soviet Submarines - 1945 to the Present*, 154–65.
[317] Breemer, *Soviet Submarines - Design, Development and Tactics*, 144.

into SSGNs carrying SS-N-21 and SS-NX-24 cruise missiles, in order not to go past the SLBM ceiling of the *SALT I* agreement.[318]

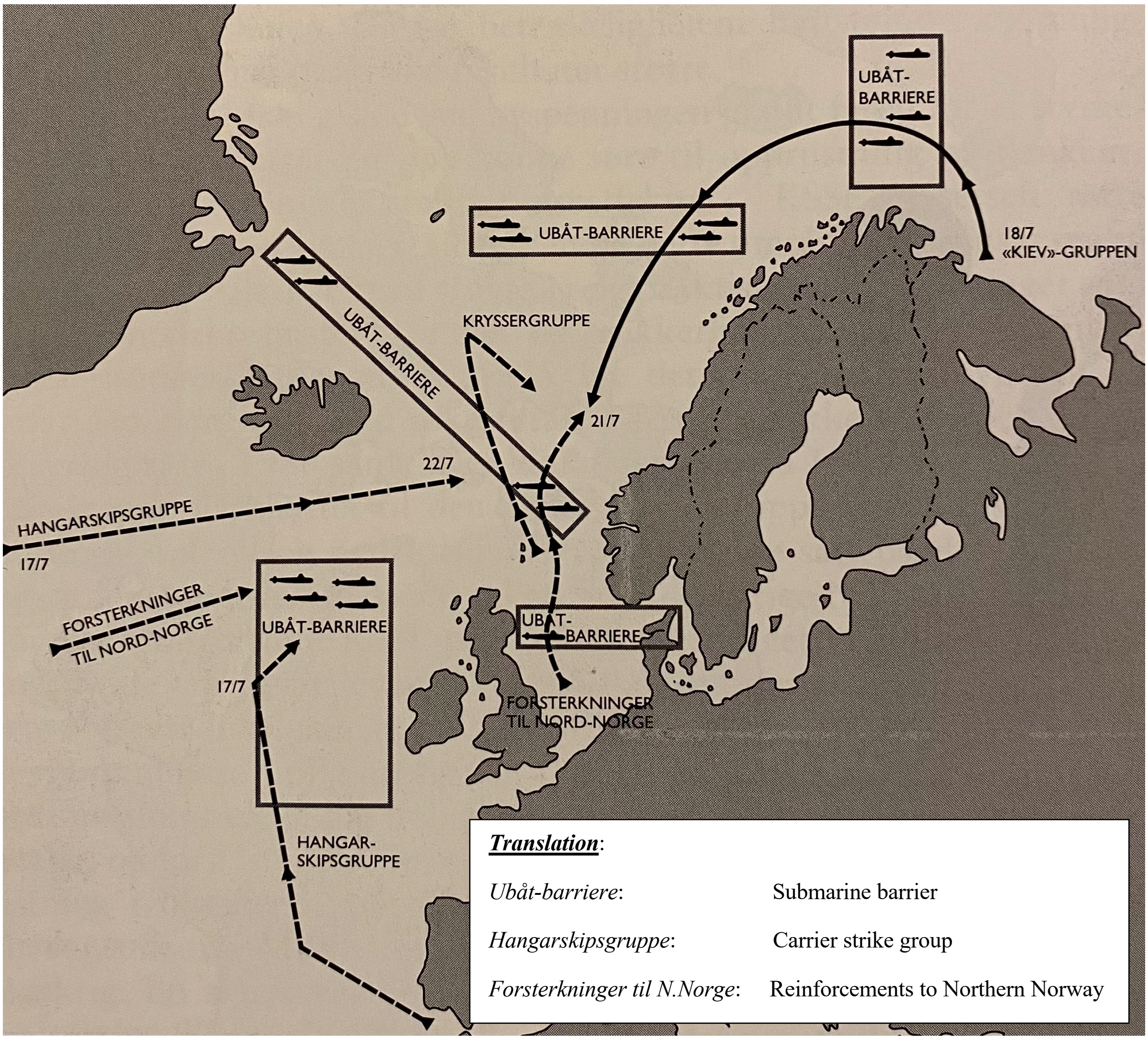

Figure 5-7. Soviet Navy force deployments during the exercise SUMMEREX 1985. The naval exercise SUMMEREX in 1985 was the largest and most complex execersise conducted by the Soviet Navy during the Cold War. The Russians established five submarine barriers in order to meet the simulated NATO threat from the south-west. The objective of the exercise was to establish control of the Norwegian Sea earløy in the conflict in order to defend the strategic assets in the Barents Sea and the Kola peninsula.[319]

The bastion operating concepts demanded a large number of capable attack boats for forward deployment for attacking lines of communication, in addition to providing a robust defence of the bastions. The mid-1980s saw the emergence of two such attack submarines, namely the

[318] Tamnes, *The United States and the Cold War in the High North*, 274–78.
[319] Overview by the Norwegian High Command. Depicted in Tamnes, *Oljealder, 1965-1995*, 6:34.

Sierra and the *Akula* classes in 1984 and 1985, respectively. The *Akula* was markedly quieter than its predecessors, and the new submarine classes were a manifestation of the Soviet quieting efforts that had started to materialize in the early 1980s.[320] Internal improvements to submarine construction had taken the Soviets a long way by the late 70s, but the silencing efforts were almost definitely taken even further by the acquisition of advanced milling machinery and software for very silent, multi-bladed propeller production in 1983/84.[321] Owen Cote has described the entry of the *Victor III*, the *Sierra* and the *Akula* onto the operational scene as the end of the Western "ASW Happy Time."[322] The *Sierra* and the *Akula* were armed with the SS-N-21 *Sampson* submarine launched cruise missile (SLCM), among other weapons. The *Sampson* land-attack cruise missile, the Soviet equivalent to the US Navy's *Tomahawk* Land Attack Missile (T-LAM), has a range of between 900 and 1,100 nm. When NATO in 1983 deployed various land-based cruise missiles and intermediate-range nuclear ballistic missiles at various European bases, the Soviet Union gave an "Analogous Response" deploying submarines to the US coastline, including *Akula* class attack submarines carrying the nuclear capable SS-N-21.[323] Patrolling off the coast of the United States, a missile engagement would provide little to no warning of attack. The new submarines posed an entirely new threat to Western ASW forces that had been spoilt with noisy *Yankee* class SSBNs patrolling in somewhat predictable patterns in the Atlantic. Said one member of the ASW force about the *Akula* deployment; "*the entire Navy had to deploy in order to find and maintain contact on one submarine*."[324] As shall be seen, this combination of quiet submarines with capable land-attack missiles marks the starting point of today's Russian submarine threat.

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[320] Cote, "The Third Battle - Innovation in the U.S.Navy's Silent War Struggle with Soviet Submarines," 69–71.
[321] For an outstanding analysis of the Toshiba/Kongsberg scandal that erupted in 1987 based on the sale of Western high-tech machinery to the Soviet Union in 1983/1984, see Olav Wicken, "Stille Propell i Storpolitisk Storm - KV/Toshiba-Saken Og Dens Bakgrunn" (Institutt for Forsvarsstudier, 1988); Tamnes, *The United States and the Cold War in the High North*, 293.
[322] Cote, "The Third Battle - Innovation in the U.S.Navy's Silent War Struggle with Soviet Submarines," 66–67; Jordan, *Soviet Submarines - 1945 to the Present*, 184–86.
[323] John Rear Admiral Butts, "Department of Defense Authorization for Appropriations for Fiscal Year 1986," Pub. L. No. Part 8, § Committee on Armed Services, U.S. Senate, 4364 (1985); Cote, "The Third Battle - Innovation in the U.S.Navy's Silent War Struggle with Soviet Submarines," 70; John Lehman, *Oceans Ventured: Winning the Cold War at Sea* (New York: W.W. Norton & Company, Inc, 2018), 140–41.
[324] Cote, "The Third Battle - Innovation in the U.S.Navy's Silent War Struggle with Soviet Submarines," 70.

5.3 Evolution of Western naval strategy

Increased Soviet naval activity took place in the Norwegian Sea, and the Northern Fleet showed its prowess during large blue water exercises in 1968 and 1970 in the North Atlantic. The Northern Flank of NATO was increasingly being viewed as a crucial element of any overarching campaign by the Alliance. However, budgetary restrictions amongst all Allies resulted in specific warfare areas being downplayed in strategic plans, such as strengthening the flanks, maritime surveillance, and anti-submarine warfare.[325] An increasing awareness was thus not necessarily followed through by commitment in strategic plans. The 1970s did, however, see an increase in Allied exercises in the North Atlantic. Exercises included ASW and forced landings in Norway, marking a more forward leaning approach to the North Atlantic at least during exercises, if not in explicit strategy. Although downplayed in strategic plans, new ASW systems and technology gave a certain optimism in the Alliance ability to defeat the Soviet submarine threat. But in spite of this technology optimism, the 1970s, together with the previous decade, marked a low-point in Allied presence in the North Atlantic. In the realm of anti-submarine warfare, the decade saw a number of changes. American ASW aircraft carriers were phased out during the Vietnam war, and focus was given to submarines, SOSUS and MPA.[326] US strategic nuclear forces that for the past decade had been represented by aircraft carriers were now represented by submerged submarines, and the overall presence in the north eroded.

The emerging bastion approach of the Soviets occurred in the context of détente and negotiations between the United States and Soviet Union on reducing their respective nuclear stockpiles in 1969. In 1972, SALT I was signed, in which a ceiling was set on a maximum allowed number of launch platforms for strategic ballistic missiles, to include strategic submarines.[327] Phasing out the *Yankees* gave way for more of the modern *Delta* submarines, thus staying below the maximum level of submarine missile launchers in accordance with SALT I.[328]

Entering the 1970s, the maritime surveillance of Soviet submarine movements and surface exercises carried on, but few initiatives were taken on a strategic level to ensure the defence of the Atlantic sea lines of communication. The traditional approach of taking the initiative

[325] Tamnes, *The United States and the Cold War in the High North*, 234–38.
[326] Cote, "The Third Battle - Innovation in the U.S.Navy's Silent War Struggle with Soviet Submarines," 52–55; Tamnes, *The United States and the Cold War in the High North*, 256.
[327] Podvig, *Russian Strategic Nuclear Forces*, 8–9.
[328] Jordan, *Soviet Submarines - 1945 to the Present*, 103.

had to make way for a more defensive way of thinking.[329] With regards to technology, cruise missiles saw a renaissance in the 1970s on both sides of the Iron Curtain, and the American submarine-launched *Tomahawk* missiles is a prime example of this. Cruise missiles have shorter ranges than their ballistic brethren, and the submarines therefore had to get closer to their targets in order to fire their load. Thus, the seeds of a more forward leaning maritime strategy could be seen in the West through cruise missile development.[330] And as Soviet capabilities and posture changed in the late 1970s, a change in NATO strategic reasoning occurred. Soviet submarines operated to an increasing degree in the North Atlantic and the Barents Sea, which lead to an increased focus on forward operations in NATO. NATO commenced a reconsideration of the Alliance's maritime concept, work that culminated in the NATO Concept of Maritime Operations (CONMAROPS) in 1982.[331] Similar work was initiated in the USA, where forward operations and force projection were key elements. The Soviet bastion strategy in many ways invited a more forward leaning West, and the revised Soviet posture of the mid-70s was a key ingredient to the emerging strategic concepts of the West in the 80s. With the emergence of the Soviet bastion approach came a renaissance in NATO interest in the High North, and the bastion concept became the basis for strategic naval thinking in the West. The US Navy conducted a comprehensive review of maritime strategy, eventually leading to the signing of the Maritime Strategy in 1984. The most important elements of this strategy were maritime superiority and forward power projection.[332] Part of the Soviet forward defence in the High North was their use of maritime bomber aircraft such as the Tu-16 *Badger* and the Tu-22 *Backfire*. Combined with new and quiet submarines commissioned in the 1980s, and a relative decline in the effectiveness of Western fixed undersea listening installations, the Russians had a significantly increased ability for sea denial in the North Atlantic. In addition, the barrier defence was no longer deemed adequate by SACLANT, who pointed out shortfalls in forces to tackle threats to the Northern Flank and simultaneously assure the safe passage of Western reinforcements across the Atlantic. The answer to the shortfalls would be, according to SACLANT, *forward* operations.[333] The concept of forwarding aircraft carriers into Norwegian fjords was revitalized from the 1950s.[334] Naval forward operations were first tested during exercise

[329] Tamnes, *The United States and the Cold War in the High North*, 225–26.
[330] Tamnes, 228.
[331] Tamnes, 261.
[332] John B. Hattendorf, "The Evolution of the U.S. Navy's Maritime Strategy, 1977-1986," *Naval War College Newport Papers*, no. 19 (2004): 54–55.
[333] Hattendorf and Swartz, "U.S. Naval Strategy in the 1980s - Selected Documents," 147.
[334] Grove and Thomson, *Battle for the Fjords*, 9.

Mainbrace in 1952 and were again practiced during *Ocean Safari* in 1985 and *Team Work* in 1988. The American had in the early 1980s initiated forward operations with submarines, which where higly classified.[335] Such operations were and integrated and important part of the Maritime Strategy, and led to strategic, principalled discussions on forward neutralization of the Soviet submarine force, so-called “strategic ASW”. When the Norwegian Labour Party came back into power in 1986, minister of defense Holst stated that such strategic forward operations constituted a destabilizing element of the challenging balancing act to maintain low ensions in the north. He said that the operationalization of the US Maritime Strategy might escalate tensions, and further lead to permanent presence of allied maritime offensive units.[336] At the same time it was important to the Norwegian government to have regular presence in Norway and surrounding areas, in order to demonstrate a credible reinforcement mechanism for times of war. The Maritime Strategy thus put further pressure on the demanding security policy balancing act in the High North.

The most formative agreement for surveillance in the North Atlantic for the remainder of the Cold War was the *GIN Clear* agreement of 1969, the successor of the *Box Car* agreement.[337] In essence, the focus of the arrangement was to maintain overview of Soviet naval movements in the Greenland, Iceland, Norway (GIN) gap. *GIN Clear* was based on bilateral agreements, and was aimed at limiting foreign surveillance aircraft taking off from Norwegian soil in monitoring of Soviet naval deployments. From mid-1970, the agreement expanded to include Denmark, the USA, the UK, Canada, West Germany, and the Netherlands. However, the Norwegian government showed a restrictive attitude towards increasing the number of countries involved in surveillance in the High North and kept a restrictive line in foreign use of airfields. West Germany and the Netherlands, for example, were not approved to fly in the High North.[338] The reason for this was a politically conservative attitude towards operating German aircraft, in particular, in what was envisaged as a low-tension area by the Norwegians. It was also an ambition of Norway not to involve more parties than necessary in intelligence sharing and coordination. British squadrons, however, flew many missions under the *GIN Clear* cooperation agreement in 1970. A notably large number of *GIN Clear* missions were executed during the first six months of 1970,

[335] Lehman, *Oceans Ventured: Winning the Cold War at Sea*, 100.
[336] Børresen, Gjeseth, and Tamnes, *Norsk Forsvarshistorie - Allianseforsvar i Endring, 1970-2000*, 114.
[337] Rolf Tamnes, “The Significance of the North Atlantic and the Norwegian Contribution,” in *NATO and the North Atlantic - Revitalizing Collective Defense*, ed. John A. Olsen, Whitehall Paper 87 (London: Royal United Services Institute (RUSI), 2017), 17.
[338] Klevberg, “Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics,” 346–50.

followed by more evenly spaced missions on the planning schedule. Having used Bodø in the 1960s as host base, *Nimrod* crews in the 1970s almost exclusively utilized Andøya as the Norwegian hosting base. The change likely took place because of the improvement in operational support at Andøya following the conversion from the Norwegian *Albatross* to the *Orion*. After the establishment of the *GIN Clear* agreement, Allied interest in flying from Norwegian airfields went into a decline. After the geographical delineation of areas in the North Atlantic through the NORCANUSUK agreement, both the British based in Scotland and the Americans based on Iceland were able to reach their dedicated patrol areas to the South and West. which were further West and South of the Norwegian areas. Also, the intelligence gathered in the Norwegian areas to the north and east of Norway were of such quality that additional surveillance operations were considered to be superfluous.[339] The *GIN Clear* arrangement remained in effect throughout the Cold War.

Norwegian procurement of the *Orion* included a formal agreement to share intelligence with the Americans. Further building on the general intelligence sharing agreement between Norway and the USA from 1954, the specific sharing of ELINT data took form through the NORUSA II agreement of 1970.[340] Intelligence sharing was based on the increasingly close relationship between the two countries and explicitly stated in the *Orion* procurement agreement. It was important for Norway to contribute to Western defence cooperation in general and NATO specifically. Also, Norwegian intelligence contributed to low tensions as the West would relate to facts as opposed to speculation. Norwegian surveillance precluded potentially provocative Allied operations in the same area. Also, intelligence from the North showed the exposed nature of the Northern Flank of NATO. And finally, technical information provided an improved basis for decision making by Western authorities.[341] Intelligence products that came out of *Orion* operations in the High North were initially of a *technical* character, but subsequently took on an increasingly important role in Norwegian security politics.[342]

The increased capabilities of the Norwegian *Orions* shifted the focus of Western surveillance in the North Atlantic from technological matters (areas apportioned based on sensor suite) to

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[339] Klevberg, 346.
[340] Riste and Moland, *Strengt Hemmelig - Norsk Etterretningstjeneste 1945-1975*, 214; Tamnes, *Oljealder, 1965-1995*, 6:69–74; Skogrand, *Alliert i Krig Og Fred*, 216–18.
[341] Børresen, Gjeseth, and Tamnes, *Norsk Forsvarshistorie - Allianseforsvar i Endring, 1970-2000*, 90.
[342] Tamnes, *Oljealder, 1965-1995*, 6:69; Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 342–43.

geographical questions (areas apportioned based on geographical proximity).[343] Even with lacking ASW capabilities, the Norwegian authorities had been restrictive with regards to the 24-degree East limitation, with the exception of specific periods when a new type of aircraft was introduced. The strict geographical delineation of responsibility after the introduction of the *Orion* for the Norwegians was facilitated by the fact that all three main nations conducting surveillance in the High North were equally ASW capable. The aforementioned NORCANUSUK agreement is a clear sign of a common understanding of common capabilities, particularly with respect to ASW.[344] In 1979, the Royal Norwegian Air Force formalized the requirements for maritime surveillance and reconnaissance. Norwegian MPAs had for decades been operating based on intelligence requirements and not on a cognizant framework for operations. This led to requirements for improved capabilities on board the *Orions*, materializing in the *Chief of Defence Directive for Maritime Patrol Aircraft Operations* in 1982. The directive formalized surface and subsurface surveillance and reconnaissance as the primary task of Norwegian MPA, followed by support to civilian national entities, ensuring national jurisdiction, and support to Search and Rescue as follow-on tasks.[345]

Although the 24-degree East restriction had been declared in early 1959, it had not been formalized in publicly available documentation. From having been a restriction enforced by the operational headquarters and written only in operational directives, the Ministry of Defense finally stated the 24-degree East restriction in writing in 1980 through a review of the plans for Allied reinforcement.[346]

5.4 The evolution of NATO ASW and MPA capabilities

The 1970s saw a prevailing optimism as to the American ability to maintain and even increase the technological lead over the Russians.[347] Crucially for the MPA force, the improved computer processing enabled improved ability to distinguish between ambient

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[343] Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 345.
[344] In addition to the operational agreements, a logistics agreement was signed in 1960 between the US Navy and the Royal Norwegian Air Force. The agreement facilitated the operational agreements through logistical arrangements such as the storage of mines, ammunition, fuel, lubricants and spare parts. This was the forerunner of the 1971 *Invictus* agreement, which had a particular focus on MPA equipment. In 1980 this was broadened to include aircraft carrier equipment. See Tamnes, *The United States and the Cold War in the High North*, 118, 251, 260.
[345] Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 462–68.
[346] Klevberg, 376.
[347] Luis Simon, "The 'Third' US Offset Strategy and Europe's 'Antiaccess' Challenge," *Journal of Strategic Studies* 39, no. 3 (2016): 425; Tamnes, *The United States and the Cold War in the High North*, 254.

noise and sounds emitted from a submarine in real-time. The P-3B *Orion* was introduced into Norwegian service in 1969, and the internal ASW system now included the Delayed Time Compression (DELTIC) system that together with the new JEZEBEL acoustic processor allowed the operator to monitor 16 channels of acoustic data simultaneously. Overall, the new aircraft was able to fuse information from the radar and acoustic sensors into a single tactical picture. The new processors improved the accuracy of the information collected, and thus facilitated more time for *tactical* problems as opposed to *mathematical* issues.[348]

The SOSUS continued to provide essential cueing to the MPA community in the 1970s. Initial contact on approaching Soviet submarines was usually gained by fixed systems on the ocean seabed. For cases in which contact was lost on a submarine by "*other sources*", an extensive search and localization effort had to be initiated by the respective MPA fleets.[349] The Norwegians P-3 *Orion* procurement included state-of-the-art analysis and processing tools for acoustic intelligence.[350] These systems were co-located with the analysis centre for the sea bed systems at Andøya, similar to the American arrangement at Keflavik, Iceland. Such co-location of processing systems facilitated a close relationship between the fixed array and MPA communities. Moreover, the previously mentioned *BRIDGE* system was expanded, to include cables in the Barents Sea. The cables were laid in 1974 and were aimed at detecting Russian submarines at as early a stage into their deployment as possible; they functioned as an integrated part of the SOSUS.[351]

After the British conversion from *Shackleton* to the MR1 *Nimrod* in 1970-71, the aircrews also enjoyed a significant leap forward in technology and capabilities. Combined with knowledge and experience, the new aircraft performed very well. The noise from the *Nimrod* jets was also harder to distinguish by a submerged submarine close to the surface than the noise from the turboprop *Orion* aircraft.[352]

In mid-1970, the Americans deployed their new P-3C *Orion* model to Keflavik. The P-3C brought with it the latest ASW technology available, including new computers, and improved

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348 Reade, *The Age of Orion - The Lockheed P-3 Story*, 20–24.
349 "Command History Report (CHR) for VP-10 (1970)" (US Navy, 1970), FOIA case number: DON-NAVY-2018-001782, Naval History and Heritage Command.
350 Riste and Moland, *Strengt Hemmelig - Norsk Etterretningstjeneste 1945-1975*, 231–32.
351 Skogrand, Njølstad, and Tamnes, "Hot Spot - Cold War, the High North, and Grand Strategy," 24. Initial cables were laid in 1972, but these were severed and had to be replaced.
352 Air Commodore (r) Garfield "Garry" Porter, British Maritime Patrol Aircraft Operations during and after the Cold War, Royal Air Force Club, London, May 31, 2017; AIR 27/3161, "Operational Records - 201 Squadron - 1966-1968."

navigation equipment and sensor functionalities. The capacity of the acoustic system's active elements was four times that of the previous aircraft.[353] The US Navy further transitioned to the P-3C *Orion* Update II in early 1979, which among other things for the first time enabled it to carry the AGM-84A *Harpoon* missile aimed at Soviet surveillance trawlers in case of war.[354] US *Orions* also operated as airborne *Harpoon* missile platforms in support of the Iranian hostage crisis.[355] The British *Nimrods* initially had the AIM-9X *Sidewinder* air-to-air missile installed in the early 80s, and were carrying these missiles during the Falklands war. The *Nimrods* were thus prepared for an increased threat environment as they entered the 90s. In parallel with the P-3 *Orion* upgrades, the *Harpoon* ASuW missile was installed on the *Nimrods* as well.[356] The Norwegians did not have missiles installed on their aircraft.

The US Navy upgrade to the P-3C *Orion* Update II in 1979 came with further improved avionics and weapons systems. A new sensor was an infrared detection system, which could identify targets regardless of weather and daylight, albeit only on the surface.[357] The new ASW designated radar AN/APS-137 became operational and was first utilized in the North Atlantic in 1986.[358] The early 1980s saw an increase in utilization and coordination of data link for ASW operations, enabling the passing of basic target information back and forth on a tactical network.[359] Further, the P-3C *Orion* Update III deployed for the first time to Keflavik in May 1990. The new onboard processor doubled once again the number of passive buoys an operator could monitor simultaneously to 32. The processor provided a four-fold gain in isolating sounds from submarines compared to ocean ambient noise.[360] Towards the end of the 1980s, there was a further increase in the exercising of *Harpoon* missile strike missions and the use of the APS-137 imaging radar.[361] The new radars also facilitated the use of P-3 *Orions* in providing targeting information for *Tomahawk* cruise missile strikes by

[353] "Command History Report (CHR) for VP-49 (1970)" (US Navy, 1970), FOIA case number: DON-NAVY-2018-001782, Naval History and Heritage Command.
[354] Roberts, *Dictionary of American Naval Aviation Squadrons - Volume 2*, 2:173.
[355] "Command History Report (CHR) for VP-23 (1979)" (US Navy, 1979), FOIA case number: DON-NAVY-2018-001782, Naval History and Heritage Command; "Command History Report (CHR) for VP-23 (1980)" (US Navy, 1980), FOIA case number: DON-NAVY-2018-001782', Naval History and Heritage Command.
[356] Kenneth B. Sherman, "Feet Dry: Maritime Patrol Goes Ashore - New Roles and Missions Mean No Safe Harbor for Land Forces," *The Journal of Electronic Defense (JED)*, no. March 2001 (2001): 40–41.
[357] Roberts, *Dictionary of American Naval Aviation Squadrons - Volume 2*, 2:310.
[358] Roberts, 2:249.
[359] "Command History Report (CHR) for VP-56 (1984)" (US Navy, 1984), FOIA case number: DON-NAVY-2018-00574, Naval History and Heritage Command.
[360] Roberts, *Dictionary of American Naval Aviation Squadrons - Volume 2*, 2:293–94.
[361] "Command History Report (CHR) for VP-44 (1986)" (US Navy, 1986), FOIA case number: DON-NAVY-2018-001782, Naval History and Heritage Command.

submarines.[362] However, towards the end of the 1980s there was a clear tendency of utilizing MPA to an increasing degree in joint operations, combining the MPA sensor and targeting suite with other assets' weapons capabilities.

Entering the 1980s, analyses by the Norwegian Air Force indicated that the aircraft would have to be replaced not long after 1986. Norwegian authorities were increasingly worried about the naval situation that was developing in the High North. Soviet exercises conducted just off the Norwegian coast in the early and mid-1980s demonstrated a capacity to project power in a manner reminiscent of a blue water navy, and this was being noticed at the highest political levels on both sides of the Atlantic. Thus, in 1986 the Norwegian government signed the *Maritime Surveillance Agreement* with the USA.[363] This was a similar arrangement to that of the procurement of the P-3B *Orion*, and this time the procurement consisted of four P-3C *Orion* Update III. What was new about this agreement was that the Norwegian government had to bear more of the cost than before. The degree of formalization of the intelligence sharing between the two nations was also new. The agreement from 1969 was founded more on a tacit understanding between the nations, but this time the requirement for sharing was explicit.[364] It is reasonable to believe that this was due to the increased value of naval intelligence from the Barents Sea due to the fact that an increasing amount of strategic patrols by missile submarines by the 1980s were conducted east of the 24-degree delineation. The four P-3C *Orion* UIII were delivered to Norway between December 1989 and June 1990. This was the same type of aircraft that the US Navy deployed to Keflavik in 1990.

In the 1970s, there was a notable increase in the use of surface towed array sonar systems (SURTASS). The SURTASS consisted of surface ships that towed a long line array (approximately 8,000 feet long) that functioned in a similar way as the SOSUS arrays. Through satellite communication and links the SURTASS ships connected with the SOSUS system, and together with the shore processing systems comprised the *Integrated Undersea Surveillance System* (IUSS).[365] By the mid-1980s the Western fixed arrays' ability to detect and track Soviet submarines had declined significantly as the Soviet submarines became quieter. This led the deployment of the *Fixed Distributed System* (FDS) in 1985. The FDS is

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[362] "Command History Report (CHR) for VP-44 (1987)" (US Navy, 1987), FOIA case number: DON-NAVY-2018-001782, Naval History and Heritage Command.
[363] Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 473–75.
[364] Klevberg, 474.
[365] Tamnes, *The United States and the Cold War in the High North*, 256; Edward Whitman, "SOSUS - The 'Secret Weapon' of Underseea Surveillance," *Undersea Warfare* 7, no. 2 (Winter 2015).

a large-area, distributed field of acoustic arrays. They are upwards looking and only capable of detecting submarines in their immediate vicinity, but this new method and system was necessitated by the low emission of sound from the new submarines.[366]

The use of satellites for surveillance and reconnaissance has by some been termed a "revolution in intelligence."[367] The first imaging and ELINT satellites of the 1960s were operationally proven by the 1970s. A satellite that could detect navigational radars and other emissions from ships was thought to complement the operational picture. The *White Cloud* passive ELINT satellite was launched in 1971.[368] *White Cloud* became the satellite workhorse for maritime surveillance for the US Navy during the Cold War, and constituted the initial constellation of the *Naval Ocean Surveillance System* (NOSS). The system was upgraded continuously during the Cold War, and up until the present. In addition, a series of IR satellites were put in geostationary orbit in order to detect the firing of Soviet Union ballistic missiles, called the *Defence Support Program* (DSP). In the early 80s, the DSP was tested to support general detection of missile and aircraft flight trajectories for early warning and self-protection for naval vessels as well.[369]

Efforts further started in the mid-1970s in the USA to develop a Synthetic Aperture Radar (SAR) satellite for maritime surveillance, however, fully functional radar satellites for maritime surveillance did not become operational until after the Cold War.[370] The new *Charlie II* submarines were deployed along with the first Soviet ocean surveillance satellites, where the latter were meant to provide targeting to the former. However, the Russian surveillance satellites never achieved their promise, and the submarines had to rely on Soviet MPAs for targeting.[371] Due to increasingly quiet Soviet submarines, the mid-70s also saw significant interest in finding non-acoustic means of finding submarines, and attempts were undertaken to detect thermal wakes, internal waves, electric currents, bioluminescence, and surface activity from a passing submerged submarine.[372] None of the capabilities were integrated into operational satellites, however. Approaching the end of the 1970s, imaging satellites were having a significant impact on naval operations, particularly in performing

[366] Whitman, "SOSUS - The 'Secret Weapon' of Underseea Surveillance"; Jonathan White and Sean Filipowski, "Know the Environment, Know the Enemy, Know the Target," *United States Naval Institute Proceedings* 140, no. 7 (July 2014).
[367] Tamnes, *The United States and the Cold War in the High North*, 211.
[368] Friedman, *Seapower and Space*, 177.
[369] Friedman, 242–45.
[370] Friedman, 205–8.
[371] Cote, "The Third Battle - Innovation in the U.S.Navy's Silent War Struggle with Soviet Submarines," 61.
[372] Friedman, *Seapower and Space*, 201–5.

surveillance of adversary ports, naval bases and shipyards. Satellites could fly with impunity directly over areas of vital naval interest, including inland targets, supporting strategic intelligence.[373] However, photographic satellites are incapable of looking through weather and clouds, and this led to efforts to develop high-resolution radar satellites such as the *Lacrosse* launched in 1988. *Lacrosse* reportedly provided a resolution of approximately 1 foot, and worked in tandem with optical imaging satellites during the Gulf War in 1991.[374] However, satellites were still only able to perform surveillance on the surface.

Towards the end of the 1980s American MPAs had satellite communication (SATCOM) equipment installed. SATCOM enabled aircraft to perform immediate, reliable, over-the-horizon, two-way secure tactical communications. Among other tasks, SATCOM was utilized for *Harpoon* missile strikes and more detailed coordination of submarine prosecution with shore and surface facilities.[375] Through the SATCOM capability, tactical operations and on-station flexibility were greatly enhanced.

Satellite technology was starting to play an important role in maritime surveillance operations. These satellites, however, were geostationary, leading to poor and at times no coverage in the Arctic. This will be elaborated upon in the final chapter.

5.5 The deployment of NATO MPA capabilities

When the *Yankee* class SSBNs initiated their regular patrols off the coast of the USA, the NATO airborne ASW community was ready for them. As the Soviet strategic submarines left port on the Kola peninsula they were followed first by the Norwegian *Orions* from Andøya, entering the North Atlantic. Further south the Soviet submarine contact was handed over to American *Orions* from Keflavik and British *Nimrods* from Kinloss. Then the *Yankees* continued their course further south and passed through the GIUK gap. Here the submarines in transit were tracked by the Americans, the British, the Dutch flying out of Iceland, and the Canadians who did the same. As the Soviet submarines entered their patrol boxes south of Bermuda, they were tracked continuously by aircraft from Naval Air Station Bermuda and Naval Air Field Lajes, Azores.[376] Although not formalized, the handovers were facilitated by

[373] Friedman, 99–100.
[374] Friedman, 98.
[375] “Command History Report (CHR) for VP-44 (1987).”
[376] Robideau, “Third Battle for the North Atlantic 1962-1991,” 14–19; Perkins, “Alliance Airborne Anti-Submarine Warfare - A Forecast for Maritime Air ASW in the Future Operational Environment,” 12–14.

experience, NATO procedures, and close and daily interaction between the tasking agencies of the respective nations.

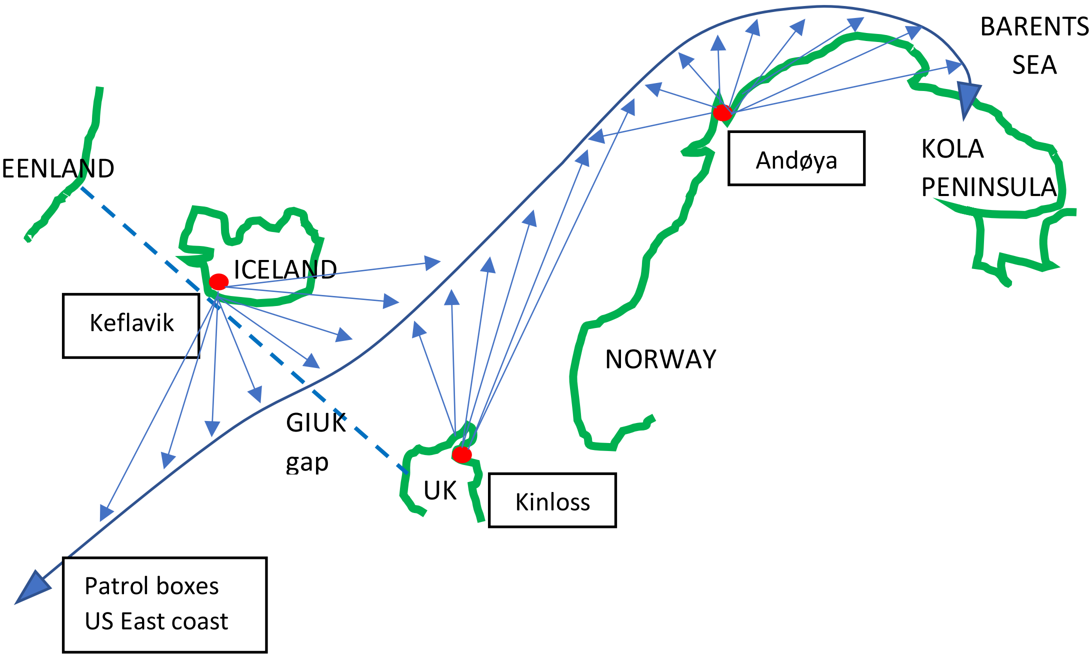

Figure 5-8. International cooperation to follow Soviet SSBNs on strategic patrol.

The Northern Fleet operations and exercises shaped the days of MPA crews during the Cold War.[377] British operational records show regular entries of "*contact gained immediately*", "*Russian Type 2 Nuclear Possub*", and "*contact held for the remainder of the sortie and was handed to the relieving aircraft at Off-Task.*"[378] The aircrews launched in carefully planned succession with a combined aim of tracking the target and gathering as much updated acoustic intelligence as possible. This intelligence was then processed at home base.[379] The squadron would send out aircrews to try to hold the target for as long as she was within reasonable reach of home base, and then hand it off to the next squadron or nation to pick up the tracking.[380] Close cooperation with Allied MPA crews continued into the 70s, and were usually well coordinated and problem free. At times, however, miscommunication could lead to two nations quarrelling over who should track the Russian submarine.[381] Operational

[377] Porter, British Maritime Patrol Aircraft Operations during and after the Cold War.
[378] AIR 27/3357, "Operational Records - 201 Squadron - 1972-1975" (Royal Air Force, 75 1972), 13 October 1972, UK National Archives, Kew.
[379] "Command History Report (CHR) for VP-56 (1971)" (US Navy, 1971), FOIA case number: DON-NAVY-2018-001782, Naval History and Heritage Command; "Command History Report (CHR) for VP-24 (1974)" (US Navy, 1974), FOIA case number: DON-NAVY-2018-001782, Naval History and Heritage Command.
[380] "Command History Report (CHR) for VP-24 (1974)," 22 January 1974.
[381] AIR 27/3162, "Operational Records - 201 Squadron - 1969-1970."

missions included both tracking of transiting strategic submarines, but also monitoring of general Soviet naval activities in order to chart tactics and manoeuvres. The largest Soviet Naval exercises and routine activity took place in the North Norwegian sea, and in the ocean areas north of Norway. Although also given other areas to cover, when it comes to documenting Soviet naval activity the Allied aircrews benefitted by far the most by flying in the High North. At the turn of the decade the high operational tempo of the Soviets and the corresponding surveillance efforts by NATO MPAs had become routine. It was commonplace for American squadrons to report more than 40 different submarines during a deployment of four to six months to Keflavik.[382] MPA operations also included surface surveillance, which entailed following Soviet intelligence ships, monitoring the Soviet fishing fleet, and keeping track of Soviet Navy surface groups. Soviet surface forces were usually escorted by several submarines, at times more than eight submarines in the same formation.[383]

The *modus operandi* of the deployed American MPA squadrons stood out in comparison to other, allied nations way of operating. The aircrews were away from their families for approximately six months at a time, standing available for flying missions more or less throughout the day, throughout the deployment. Their ability to surge squadron assets and fly non-stop over extended periods of time to track Soviet submarines meant that single *Yankee* class submarines could be followed by the Keflavik squadrons for up to a week or more at a time.[384] The squadrons that regularly deployed to Keflavik amassed a significant amount of flight hours during the Cold War. They regularly amassed more than 700 hours a month throughout a deployment, which at times was quadruple the flight hours they put in whilst at home in the USA.[385] One squadron reported approximately 80,000 hours over ten and a half years.[386] This averages out to around 630 hours a month for more than a decade consecutively, which is telling of the demands the Cold War put on the aircrews that worked on the front line. Numbers would routinely pass 900 to 1,000 hours a month during particularly busy periods.[387] Operational records from the deployments in the late 1970s show

[382] "Command History Report (CHR) for VP-56 (1973)" (US Navy, 1973), FOIA case number: DON-NAVY-2018-001782, Naval History and Heritage Command.
[383] "Command History Report (CHR) for VP-56 (1971)"; "Command History Report (CHR) for VP-56 (1973)"; "Command History Report (CHR) for VP-56 (1978)" (US Navy, 1978), FOIA case number: DON-NAVY-2018-001782, Naval History and Heritage Command.
[384] "Command History Report (CHR) for VP-10 (1970)."
[385] "Command History Report (CHR) for VP-56 (1970)" (US Navy, 1970), FOIA case number: DON-NAVY-2018-001782, Naval History and Heritage Command.
[386] "Command History Report (CHR) for VP-49 (1972)" (US Navy, 1972), FOIA case number: DON-NAVY-2018-00574, Naval History and Heritage Command.
[387] "Command History Report (CHR) for VP-56 (1973)."

that the squadrons would encounter almost every type of Russian submarine, with aircrews prosecuting two and sometimes three submarines simultaneously.[388] This underlines the fact that the North Atlantic not only was a necessary transit area for their SSBNs, but also a crucial exercise area for the remainder of the fleet, not only in the 1960s-70s, but also into the 1980s.

There was no decline in intensity of ASW operations towards the end of the Cold War.[389] This indicates that the bastion defence had not fully settled by the end of the 1980s, and that several patrols south of the bastion were still taking place. During an exercise in 1987, five *Victor III* class submarines were prosecuted simultaneously.[390] By the Americans alone, 82 sorties and 800 flight hours were flown over thirteen days of continuous prosecution against the five Soviet submarines, generating a total of 230 hours of submarine acoustic contact. The Keflavik deployment between November 1988 and May 1989 flew 744 sorties locating 17 Soviet submarines in six months.[391] This equals almost four sorties every day, which in practical terms means that there were aircraft belonging to the detachment airborne almost continuously throughout the deployment.

The Americans conducted reconnaissance in the High North with other aircraft types than MPA as well. Between 1977 and 1989, American SR-71 *Blackbirds* flew regular missions into the Barents Sea, usually supported by KC-135Q air-to-air refuelling aircraft based in the UK.[392] These aircraft flew close to both Russia and Norway, at one point violating Norwegian airspace.[393] However, the *Blackbirds* provided invaluable radar intelligence on military activity and bases on the Kola peninsula, intelligence collection that would eventually be taken over by satellites.[394] In operationalizing the Maritime Strategy the US Navy initiated regular clandestine submarine operations in the Barents Sea.[395] From the mid-1980s, the Royal Navy supported the Americans with submarine operations of their own in the High North. The British were integrated in the forward strategy, aiming at destroying the Soviet

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388 "Command History Report (CHR) for VP-44 (1979)" (US Navy, 1979), FOIA case number: DON-NAVY-2018-001782, Naval History and Heritage Command; "Command History Report (CHR) for VP-56 (1978)"; "Command History Report (CHR) for VP-56 (1984)."
389 "Command History Report (CHR) for VP-44 (1986)," 3.
390 "Command History Report (CHR) for VP-44 (1987)." This has among ASW veterans colloquially been termed "the Victor surge".
391 Roberts, *Dictionary of American Naval Aviation Squadrons - Volume 2*, 2:87–90.
392 Paul F. Crickmore, *Lockheed Blackbird - Beyond the Secret Missions*, Revised edition (Oxford: Osprey Publishing, 2016), 305–27.
393 Børresen, Gjeseth, and Tamnes, *Norsk Forsvarshistorie - Allianseforsvar i Endring, 1970-2000*, 116.
394 Crickmore, *Lockheed Blackbird - Beyond the Secret Missions*, 349, 398.
395 Lehman, *Oceans Ventured: Winning the Cold War at Sea*, 100.

fleet early in a conflict.[396] As these were clandestine operations they were not openly debated or confronted by the Soviet Union. The operations were opposed in policy terms by the Norwegian government, as discussed, but there was no mechanism for denying such operations neither by the Norwegians nor by the Russians. They became an integraeted part of the silent cold war in the abyss.

British *Nimrod* crews were sent to both Norway and Iceland to conduct surveillance and tracking of Russian submarines. Regardless of originating base and nationality of the MPA, the aircrews received orders from the nation they took off from, and updates on targets and areas to cover by the headquarters with the most current information. The coordination for such a multi-national effort was executed by the lead nation at any given time, which was the nation in whichever sector the target was located. That nation carried the weight of the operation and offered openings or gaps in coverage in terms of flying time to other nations.[397] For example, the Canadians deployed at times forward to Iceland to get an early feel for the target, before they picked up the submarine as it approached the Western Atlantic.[398]

The British MPA community also spent a significant amount of time working in the High North.[399] When Argentina invaded the Falkland Islands in April 1982, an urgent operational requirement for an air-to-air refuelling (AAR) capability for the *Nimrod* arose.[400] The new AAR capability facilitated missions into areas without having to secure foreign landing approval for refuelling mid-operation.[401] A range of missions were thereafter conducted north of Norway. Their reports reveal that British crews were also exposed to a significantly higher level of Soviet activity in the High North as compared to further south in the Atlantic.[402] The AAR capability thus paid off in the North Atlantic as well as in support of the Falklands campaign. The *Orions* never had an AAR capability. The Norwegians were geographically close enough to Soviet operations for AAR requirement not to be a factor. US Navy squadrons on their side deployed to one location, such as Keflavik or Bermuda, and then sent detachments to other locations, such as the Azores, in order to fill gaps in coverage.[403] The

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[396] Peter Hennessy and James Jinks, *The Silent Deep - The Royal Navy Submarine Service since 1945* (UK: Penguin Random House, 2015), 546, 556.
[397] AIR 27/3357, “Operational Records - 201 Squadron - 1972-1975.”
[398] Porter, British Maritime Patrol Aircraft Operations during and after the Cold War.
[399] Porter, British Maritime Patrol Aircraft Operations during and after the Cold War.
[400] AIR 27/3697, “Operational Records - 201 Squadron - 1981-1982” (Royal Air Force, 1982 1981), UK National Archives, Kew.
[401] Porter, British Maritime Patrol Aircraft Operations during and after the Cold War.
[402] AIR 27/3694, “Operational Records - 201 Squadron - 1983-1984” (Royal Air Force, 1984 1983), UK National Archives, Kew.
[403] Roberts, *Dictionary of American Naval Aviation Squadrons - Volume 2*, 2:46.

Americans thus met lack of range through deploying assets further out, or by operating collaborating assets in the areas of interest.

At least one Norwegian *Orion* surveillance mission was executed every single day for the remainder of the Cold War. The area covered was fairly constant throughout the time period, going as far as 40 degrees East, and along the Soviet border on the Kola peninsula.

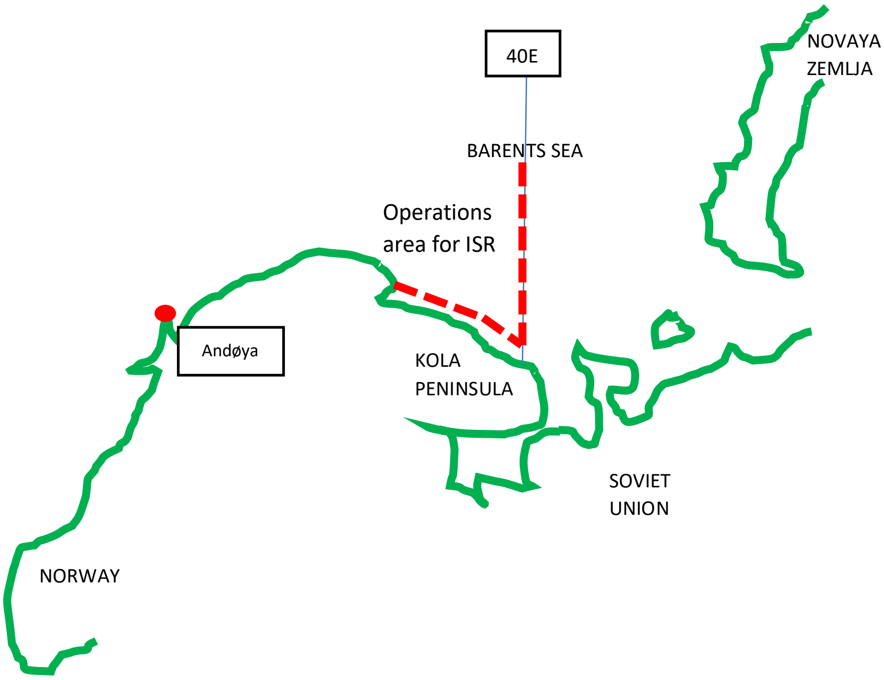

Figure 5-9. Eastern and southern limitation for airborne surveillance in the Barents Sea

From the mid-70s until the end of the Cold War the Norwegians ventured further east than 40 degrees once a week. When the navigational equipment onboard the P-3B *Orion* was upgraded in 1980, headquarters authorized to move the southern limitation of the operations areas further south than before, down to 15 nautical miles from land (three miles outside the international 12 nautical mile sovereign border).[404]

The *Orion*-era for Norwegian MPA was characterized by the mere localization of their operations area. The localization of the primary surveillance area for the Norwegians meant that the amount of Russian activity that the Norwegian operators witnessed during their daily operations was second to none in the Alliance. It was commonplace during the 1980s for a Norwegian MPA to track and follow several different submarines during a single sortie.[405]

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[404] Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 378–80.
[405] Reade, *The Age of Orion - The Lockheed P-3 Story*, 68.

One Norwegian tactical coordinator operating at the Norwegian MPA squadron in the 1980s reports that he once recorded fourteen different submarines in a single mission.[406] The combination of the level of equipment of the *Orion* aircraft, together with the proficiency that came with operating in such a "target rich environment", led to an unsurpassed overview of Soviet submarine activity in the High North. The NIS assessed in 1970 that it had awareness of the whereabouts and activities of 90% of the nuclear propelled submarines at any given time, and 100% of the *Yankee* class in particular.[407] This number presumably declined as the new and silent submarines such as the *Akula* and the *Delta IV* came online. The intelligence collected was used by the NIS in support of providing a decision-making baseline for military and political leadership, and as a continuation of this, it was used for trading information, materiel, and access to partners' systems.[408]

Operational records show a different *modus operandi* by the MPA fleets when tracking attack submarines compared to tracking strategic missile submarines. For example, prosecution of *Charlie* and *Victor* class submarines were "*short, 'go for the throat' prosecutions*", in which the MPA would spend as little time as possible attaining attack criteria and performing a simulated attack.[409] In following the nuclear strategic submarines, the MPA would take a more defensive, hold-at-risk approach in which the target would be tracked without revealing the aircraft's presence.

Widespread international cooperation took place within the MPA community. Interaction happened daily in operational flying, regularly during NATO exercises, and many times in the form of visits to each other's homebases. There were at times cases where coverage was not deemed adequate by other nations or there was some particular interest in a given target. In such cases the Keflavik squadron would send a detachment to fly for a specified period of time from an allied country.[410] The US Navy at Keflavik regularly hosted aircrews from Canada, Norway, the Netherlands and the UK in return.[411] In tracking a *Hotel* class SSBN in 1973, for example, cooperation between US, Dutch and Canadian aircrews all flying out of

[406] Harald Håvoll, Norwegian Maritime Patrol Aircraft operations during and after the Cold War, Nesodden, Norway, October 22, 2018.
[407] Riste and Moland, *Strengt Hemmelig - Norsk Etterretningstjeneste 1945-1975*, 232.
[408] Klevberg, "Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics," 496–97.
[409] "Command History Report (CHR) for VP-44 (1987)."
[410] "Command History Report (CHR) for VP-56 (1973)"; "Command History Report (CHR) for VP-56 (1975)" (US Navy, 1975), FOIA case number: DON-NAVY-2018-001782, Naval History and Heritage Command; "Command History Report (CHR) for VP-56 (1978)"; Roberts, *Dictionary of American Naval Aviation Squadrons - Volume 2*, 2:87, 293.
[411] "Command History Report (CHR) for VP-56 (1971)"; "Command History Report (CHR) for VP-56 (1978)."

Keflavik produced 90% contact time over 23 sorties that stretched five days and 1,300 nm of submarine transit.[412] Sorties were coordinated with those air operations centres that could have a mutual interest in a target or area.[413] As one former MPA air wing commander put it: "*It was just friendly cooperation*."[414] This multi-national coordination, conducted by national command & control elements under national command, in essence functioned as the basis for NATO MPA command & control in crisis or times of war. These arrangements continued throughout the 1980s.

5.6 Chapter conclusion

Going into the 1970s, the Russians continued their strategic patrols with the *Yankee* class that were initiated towards the end of the 60s. The posture of the Soviet Navy was forward leaning and assertive, but the *Yankee* class was somewhat of an interim solution to the challenge posed by Western ASW forces. When the *Delta*/SS-N-8 combination came online for the Northern Fleet in the mid-1970s, it facilitated a retreat to the bastion in the High North. Fewer and fewer strategic patrols took place south in the Atlantic, and the Russian fleet entered a period of a retracted posture that was to last for several decades.

Through all this, even as satellite technology facilitated increasing levels of intelligence gathering from space, MPAs were the weapon of choice for sustaining knowledge on and pressure over Russian submarines as they exercised and patrolled. The Northern Fleet conducted several large-scale exercises in the North Atlantic, and continued several patrols with both surface vessels and submarines even after the bastion approach was introduced. The cooperation between American, British and Norwegian MPAs in the North Atlantic continued until the end of the Cold War. As we have seen, Russian engineers were able to quieten their submarines through research and Western technology. This put NATO ASW sensors, including those of MPA, significantly under pressure in the 80s. The improvement to computer processing power kept modern MPAs somewhat able to follow the emerging submarines. However, the significant quieting progress of Russian submarine technology gave a sense of NATO ASW force being "saved by the bell" with the collapse for the Soviet Union.

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[412] "Command History Report (CHR) for VP-56 (1973)."
[413] Angus, "Command and Control of MPA Assets on the Northern Flank."
[414] Porter, British Maritime Patrol Aircraft Operations during and after the Cold War.

The initial decade covered in this chapter entailed a significant degree of predictability by the Russian submarines. Although far out to sea, the transit routes of the *Yankee* class were known to Western MPA. This meant that the range of the aircraft was used efficiently. It was with the silencing of the new attack submarines in the 80s and their non-predictable movements that really put the Western MPA force to the test.

6. Post-Cold War and Change in ISR Focus – 1991-2015

6.1 Introduction

The collapse of the Soviet Union halted much of the submarine production and threw Russia into political and economic turmoil. The US ONI has estimated that fully three quarters to five sixths of the Soviet-era naval inventory was scrapped, including vessels that were fully operational but deemed too costly to maintain.[415] The steady decline of the Russian fleet in the 1990s fuelled predictions that the Russian navy of the future would be capable of no more than basic coastal defence.[416] The Presidential Nuclear Initiatives (PNI) of the early 1990s between Russia and the United States further resulted in a series of reciprocal pledges to substantially reduce both the American and the Russian nuclear arsenals.[417]

The collapse of the Soviet Union effectively removed the one, obvious security threat to NATO. The 1990s was thus characterized by a fledging understanding of threats, which led to several warfare specialties losing their explicit mission. A prime example of this was NATO's MPA fleet. With Russian submarine patrols in the 1990s at times ebbing to just a handful per year, many nations started using submarine hunting aircraft in support of the land battle. MPAs carry several sensors that can be put to extensive use outside the realm of hunting submarines. This, however, further devolved ASW competency in the Alliance.

In political terms for Norway, the 1990s in the High North were characterized by significant efforts to mold the political dynamics in the Barents region into formal, practical arenas for international cooperation. Early on, this manifested itself into bilateral science programs, arrangements for maritime search-and-rescue, and cooperation on safely dismantling the many nuclear reactors on the Kola peninsula. Bilateral fishery surveillance and resource management were further developed. The political drive to establish formal arrangements for political cooperation was sought to put the strengthen the framework within which both low

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[415] Office of Naval Intelligence, "The Russian Navy - A Historic Transition" (Office of Naval Intelligence (ONI), December 2015), vi, http://www.oni.navy.mil/Portals/12/Intel%20agencies/russia/Russia%202015print.pdf?ver=2015-12-14-082038-923; Robert S. Norris and William N. Arkin, "Russian (C.I.S.) Strategic Nuclear Forces End of 1995," *Bulletin of the Atomic Scientists* 52, no. 2 (April 1996): 63.

[416] Richard Staar, "Russia's Navy Remains in Decline," *United States Naval Institute Proceedings* 124, no. 8 (August 1998); Kristian Atland, "The Introduction, Adaptation and Implementation of Russia's 'Northern Strategic Bastion' Concept, 1992-1999," *Journal of Slavic Military Studies* 20, no. 4 (2007): 501.

[417] Daryl Kimball, "The Presidential Nuclear Initiatives (PNIs) on Tactical Nuclear Weapons at a Glance" (Arms Control Association, July 2017), 1, https://www.armscontrol.org/printpdf/111.

tensions could be maintanined, and natural resources could be explored and managed.[418] In many ways, these soft power moves coindided neatly with the decreasing military strategic focus on the High North due to the diminishing activity levels. Within NATO, however, Norway remained one of the most active advocates for a continued focus on collective defense as the overarching strategic concept increasingly turned towards a reduced command structure and the ability to condict expeditionary warfare.[419]

Entering the new century, Norway finally restructured its armed forces from a counter-invasion force to a structure tuned for expeditionary warfare, like most other allies. The terrorist attack on the United States in 2001 further drove organisational changes within the Alliance. Norway took active part in these changes for two main reasons: first, because the threat from Russia had decreased and therefore took up less space in Norwegian strategic thinking, and second, because there was an imminent requirement to secure a continued American engagement in the defense of Europe.[420]

Strategic thinking in the first decade of the new millennium was by shaped by the conflicts in the Middle East. Towards 2006 and 2007, however, there had been a resurgence in Russian activities in the North Atlantic, and very harsh rhetoric from the Russian political leadership, exemplified by Vladimir Putin's speech at the Munich Security Conference in 2007. Norway then sought to refocus the Alliance's attention towards challenges closer to home. There was a growing concern regarding NATO's actual capability to defend its own territory, after years of focussing on expeditionary warfare. This led to the Norwegian initiative in 2008 to "raise NATO's profile". This initiative would be the starting point for the Alliance's return to its roots with regards to defending its members. In the strategic concept released two yers later, several elements from the initiative were incorporated, as we shall see.

By the 2010s, however, the Russians had begun to acquire new submarine capabilities, resulting in increased levels of naval activity and a resumption of inter-state rivalry. This forced the strategic focus back towards prospects of peer-to-peer conflicts, leading to a renewed focus on MPA and ASW as a whole.

This chapter portrays the final historical element of the intersection between the development of Russian submarines and the utilization of the Western MPA fleet in meeting that threat.

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[418] Tamnes, *Oljealder, 1965-1995*, 6:332–35.
[419] Børresen, Gjeseth, and Tamnes, *Norsk Forsvarshistorie - Allianseforsvar i Endring, 1970-2000*, 119.
[420] Børresen, Gjeseth, and Tamnes, 126–27.

We shall see that in the mid-2010s, the USA, the UK and Norway had all decided once more to move ahead with a capable MPA force.

6.2 The 1990s – Russian Decline and Western Strategic Ambivalence

In general, the economic situation simply demanded evolving the Russian Navy into a leaner force. At the same time, the military and political leadership did not disregard the possibility of war, even after the collapse of the Soviet Union. These overarching strategic trends seem to have provided the foundation for renewed work on the bastion concept in the mid-1990s.[421] The Northern Fleet had throughout the Cold War established itself as the main strategic hub for Russian naval operations. The Russian leadership also explicitly stated that there was a requirement to "*concentrate Russia's sparse forces and means in a limited number of directions*", thus providing safer grounds for President Yeltsin to announce the establishment of the Northern Strategic Bastion in August 1998.[422] The main function of the bastion would be firstly, to provide a credible nuclear deterrent in the North, and secondly, to constitute an "*independent naval force able to secure Russia's naval interests on the world oceans*."[423] This was likely meant as much for an internal Russian audience as for an external international one. The Northern Strategic Bastion was a political instrument: the mission of the Northern Fleet was to secure Russian military and economic interests in the Arctic and on the world oceans.[424] The concept only really gained traction and credibility in the 2000s, however, after the initiation of an expensive Russian weapons programs under President Putin.

In the cut-backs and triage that took place, an implicit policy of emphasizing quality over quantity and multi-role over single mission vessels permeated the Russian Navy. It was in this context that the keel of a new, nuclear multi-role nuclear submarine was laid in 1993, that of the *Severodvinsk* class.[425] The new multi-role submarine was meant to take over for the *Sierra* and *Akula* attack submarines and the *Oscar* cruise missile submarines. Three years later, in 1996, the keel was laid for a new SSBN to replace the *Deltas* and *Typhoon*, namely the *Dolgorukiy* class. But successive failures in the development of the associated SS-N-32

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[421] Atland, "The Introduction, Adaptation and Implementation of Russia's 'Northern Strategic Bastion' Concept, 1992-1999," 505–7.
[422] Atland, 508.
[423] First Deputy Minister Andrei A. Kokoshin, as quoted in Atland, 509.
[424] Atland, 513.
[425] Office of Naval Intelligence, "The Russian Navy - A Historic Transition," 18.

Bulava SLBM caused the development of the submarine to take more than a decade and a half.[426] The *Typhoons* were decommissioned in the late 1990s due to cost of production, maintenance, and the absence of a mid-life update regime.[427]

The operational tempo of the Russian SSBN fleet declined significantly in the 1990s. There were 37 patrols in 1991, and there were only seven in 1999.[428] The plight of the Russian economy, as well as the complete breakdown of established logistics, led to fuel shortages, forcing the cancellation of high-profile foreign deployments for the Russian Navy mid-decade, with only few exceptions.[429] The 1990s would thus be characterized by a significant drop in operational activity, vast fleet decommissioning, and a stumbling and agonizingly slow construction of only two, distinct, new submarines.

Within NATO, the years following the downfall of the Soviet Union were characterized by a desire to realize the peace dividend. Significant cut-backs in force numbers were enacted by most nations. As early as 1991, NATO issued a new strategic concept. The concept emphasized that the "*threat of a simultaneous, full-scale attack*" had effectively been removed, and that in contrast to the predominant threat of the past the Alliance now had to prepare to meet threats that were "*multi-faceted in nature and multi-directional.*"[430] In naval terms, the focus on Russian submarine deployments more or less evaporated in parallel with the decline in Russian submarine activity.[431] NATO's new naval mission was "*to ensure sea control in order to safeguard the Allies' sea lines of communication, to support land and amphibious operations, and to protect the deployment of the Alliance's sea-based deterrent*."[432] Still maintaining a foot in deterrence operations and the mission to protect

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[426] Nuclear Threat Initiative (NTI), "Russia Submarine Capabilities" (NTI, June 10, 2014), https://www.nti.org/analysis/articles/russia-submarine-capabilities/.

[427] Victor Mizin and Michael Jasinski, "The Future of the Russian Sea-Based Deterrent," *The Journal of Slavic Military Studies* 16, no. 1 (2003): 69–83; Nuclear Threat Initiative (NTI), "Russia Submarine Capabilities"; Norman Friedman, "World Naval Developments: The Typhoon Saga Ends," *United States Naval Institute Proceedings* 125, no. 2 (February 1999); Robert S. Norris and Hans M. Kristensen, "Russian Nuclear Forces, 2006," *Bulletin of the Atomic Scientists* 62, no. 2 (April 2006): 64–67. The Russian Navy kept one *Typhoon* class submarine as a test platform for new strategic missiles. The first such test was performed through the firing of an SS-N-32 *Bulava* SLBM in September 2005 from the modified *Typhoon*

[428] Robert S. Norris et al., "Russian Nuclear Forces, 2001," *Bulletin of the Atomic Scientists* 57, no. 3 (June 2001): 78.

[429] Norris and Arkin, "Russian (C.I.S.) Strategic Nuclear Forces End of 1995," 63; Staar, "Russia's Navy Remains in Decline."

[430] NATO, "The Alliance's New Strategic Concept" (NATO, November 8, 1991), NATO, online archive.

[431] Birkeland, "The Potential of LIDAR as an Anti-Submarine Warfare Sensor," 54–56; Perkins, "Alliance Airborne Anti-Submarine Warfare - A Forecast for Maritime Air ASW in the Future Operational Environment," 45.

[432] NATO, "The Alliance's New Strategic Concept."

SLOCs, we see an early turn towards support to Joint operations, with collaboration with air and land forces.

Conceptual developments in the 1990s emphasised naval support to land operations and joint operations in the littorals, and downgraded anti-submarine warfare and anti-air warfare at sea.[433] The stress was further placed on power projection, strategic nuclear deterrence, and a credible forward presence. With an increasing requirement for close joint coordination, ideas for interconnectedness provided the foundation for "*network centric warfare.*"[434] In NATO the focus turned to understanding the new threat environment and manoeuvring towards Alliance expansion without increasing tensions with Russia. Russia had joined the North Atlantic Cooperation Council in 1991, and NATO's Partnership for Peace (PfP) program three years later. Developments in the maritime domain were thus not a high priority within the Alliance, as such.[435]

NATO's large command & control structure of the Cold War was slowly but surely downsized to a fraction of its former size.[436] As the Russian Navy's operational activity in the Atlantic diminished, more focus was given to the Mediterranean, where Russian activity continued into the 1990s. A common interest in following Russian vessels in the Mediterranean led in 1994 to the establishment of a Memorandum of Understanding (MoU) organization based in Naples, called *Commander Maritime Air Naples* (CMAN). CMAN performed the overall coordination of national MPA missions in the Mediterranean. The national Maritime Air Control Authorities (MACA) would coordinate their missions through CMAN, but were ultimately in charge of their own assets during the respective missions. When NATO commenced its lone Article 5 operation, *Operation Active Endeavour* (OAE) in 2001 in the Mediterranean following the 9/11 attacks on the USA, the CMAN construct constituted the backbone for coordination of MPA missions in that operation. Nations that deployed their MPA to Sicily, for example, and nations that flew in so-called *direct support* of the operation, were under command & control of CMAN for the (OAE) mission. The MACA construct did not apply outside the Mediterranean, however. In the North Atlantic, command & control coordination between the Americans at Keflavik, the British at Kinloss,

[433] John B. Hattendorf, ed., "U.S. Naval Strategy in the 1990s - Selected Documents," *Naval War College Newport Papers*, no. 27 (2006): 9.
[434] Hattendorf, 17–20.
[435] NATO, "Declaration of the Heads of State and Government - Brussels Summit" (NATO, January 11, 1994), NATO, online archive; NATO, "Final Communique - Berlin" (NATO, June 3, 1996), NATO, online archive.
[436] See for example NATO, *NATO Handbook 1995* (Brussels: NATO Office of Information and Press, 1995), 164.

and the Norwegians at Andøya continued to be characterized by "friendly cooperation", and based on the *modus operandi* for surveillance coordination established during the Cold War.[437]

In the mid-90s, concerns were raised in Norwegian political circles regarding the validity of the self-imposed restrictions in Norwegian security policy. Among other activities in 1988, the substantial NATO Exercise, *Teamwork 88* had raised concerns surrounding the possibility of Allied vessels capable of carrying nuclear weapons making port calls in Norway without explicitly confirming the absence of such weapons to the Norwegian government.[438] The long-standing Norwegian basing policy forbade any storage of nuclear weapons in Norway during peacetime, and large exercises created uncertainties in this regard. There was a recognized requirement to review the restrictions in the context of the new security environment.[439] The Norwegian government conducted an internal review of the self-imposed restrictions and national basing policy in 1995. This led to a few changes, such as the term "*self-imposed restrictions*" in several instances being replaced by the more flexible term "*political guidelines.*"[440] The new description was more in line with both the dialogue between Norwegian and Russian authorities in the North that had been initiated after the Cold War, as well as the overarching thaw in the relationship between NATO and Russia. Instead of mentioning only "*allied units*", the guidelines would henceforth cite "*foreign units*", in order also to take into account countries operating under the new PfP construct.[441] It was also important for Norwegian authorities not to *restrict* Allied activities, but rather stimulate allied activity within the framework of low tensions in the North. Before 1995, very few dispensations were given from the 24-degree restriction. After 1995, the Norwegian Ministry of Defence (MoD) could authorize Allied flights east of 24 degrees East. The objective of the guidelines was always to facilitate Allied activity and presence *in combination with* maintaining low tensions in the North.[442] Norway had always been dependent on allied

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[437] Porter, British Maritime Patrol Aircraft Operations during and after the Cold War; Håvoll, Norwegian Maritime Patrol Aircraft operations during and after the Cold War.

[438] Innst. S nr.151 (1995-1996), "Recommendation to Parliament by the Defense Committee - Confirmation of Norway's Self-Imposed Restrictions in Security Policy" (Stortinget, March 13, 1996), Stortinget, online archive.

[439] Norwegian Minister of Defence Jørgen Kosmo, "Long Term Challenges for the Armed Forces" (Speech, Oslo Militære Samfund, Oslo, January 8, 1996), Stortinget, online archive.

[440] Norwegian Minister of Defence Jørgen Kosmo, "Letter from the Minister of Defence to the Defense Committee," Official correspondance, February 26, 1996, Stortinget, online archive.

[441] The PfP program was initiated in 1994, and is a framework for cooperation, coordination and for creating trust between NATO and former members of the Soviet Union.

[442] Svein Efjestad, Norwegian self-imposed restrictions in the High North, Interview, September 2, 2019, Norwegian Ministry of Defense.

activity as a part of her deterrence posture, but it was essential to put restrictions on this activity.[443] In the new security environment, emphasis was even given to conducting joint Search and Rescue exercises with Russian units, to facilitate coordination and low tension in the High North.

With the collapse of the Soviet Union, high-end Russian technology became available to whatever nation could afford it. Western strategists raised concerns over nations such as Libya, China, Iran and Algeria acquiring relatively capable, small, conventional diesel-electric submarines, which would pose a credible threat in the littorals.[444] The regular Keflavik Tactical Exercise (KEFTACEX) in the 1990s became an important event to practice this scenario. NATO MPAs were challenged against NATO conventional submarines. One important lesson that came out of the exercises of the 1990s was that upon detection of a small, conventional submarine the air crew had to prepare for attack *immediately*. The open-ocean approach established during the Cold War of detection, localization, and tracking before settling into attack mode was no longer applicable when prosecuting a submarine in the littorals.[445] The demanding acoustic environment with much ambient noise against the very quiet electric propulsion of the submarines required a quick attack while the chance was there – it might not come back.

With the diminishing operational tempo of Russian submarines, there was a fear in the MPA community that lower priority would be given to ASW training and maintaining ASW capabilities and knowledge within the Alliance.[446] This concern was justified. Missions increasingly entailed surveillance of smuggling, exercising joint and combined operations, littoral surface surveillance, and research and development. NATO *tactics* and *procedures* for ASW were still adjusted for Cold War strategic patrols of Russian SSBNs, as opposed to smaller submarines posing a threat closer to shore.[447] Regular NATO exercises compensated for some of the reduction in adversary activities, although the exercises to an increasing degree focused on anti-surface engagements as opposed to anti-subsurface operations.[448] A

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[443] Norwegian Minister of Defence Jørgen Kosmo, "Letter from the Minister of Defence to the Defense Committee," February 26, 1996.
[444] Perkins, "Alliance Airborne Anti-Submarine Warfare - A Forecast for Maritime Air ASW in the Future Operational Environment," 31.
[445] David Reade, "NAS Keflavik, Iceland - The ASW Training Capital of the World," *Maritime Patrol Aviation* 3, no. 2 (March 1995): 36.
[446] Reade, 41.
[447] "Command History Report (CHR) for VP-16 (1995)" (US Navy, 1995), Encl. (3), FOIA case number: DON-NAVY-2018-001782, Naval History and Heritage Command.
[448] Roberts, *Dictionary of American Naval Aviation Squadrons - Volume 2*, 2:48, 256–57.

lack of training opportunities was less prominent for the Norwegian aircrews that continued to cover the Barents Sea on a regular basis. After all, even with a severely reduced operational and exercise tempo, the Russians continued to execute missions, albeit of a local geographical nature. The downturn in operational activity on the part of the Russians had somewhat less of an impact on submarine exposure for the average Norwegian operator.[449]

Over the years, the improvements made to the capabilities of MPA mostly involved existing sensors, such as improved capacity and memory of the central computers, more processing capacity for acoustic processors, and better navigational systems. Some improvement programs initiated in the late 1980s met with fiscal constraints in the 1990s, and together with schedule delays and cost overruns, several upgrade programs were cancelled.[450] It seemed difficult to justify spending money on airborne ASW when the perception was that the threat had evaporated. In line with the new security environment and strategic development, the US Navy instead initiated the Anti-Surface Warfare Improvement Program (AIP) in 1994. The AIP upgrade included radar upgrades to both Inverse Synthetic Aperture Radar (ISAR) and Synthetic Aperture Radar (SAR) capabilities, improved Electronic Support Measures (ESM), and the Advanced Imaging Multi-Spectral Sensor (AIMS) with a capable Electro-Optical/Infra-Red (EO/IR) camera. The AIP aircraft were also equipped with the AGM-85E *Stand-off Land Attack Missile* (SLAM) and the AGM-65D/F *Maverick* missile. The upgraded aircraft were given a SATCOM capability and a communications suite that facilitated closer integration with the joint force. A limited number of AIP aircraft also had the Tactical Common Data Link (TCDL), which enabled real-time streaming of sensors from the aircraft to other units.[451] In the mid-1990s, a few selected US Navy P-3 *Orions* were also updated through the new Command, Control, Computers and Communications for ASW (C4 for ASW) programme. This included tactical data link through the Link-16, and satellite connectivity through an encrypted INMARSAT connection.[452] These innovations reflect efforts to achieve greater integration of MPA with other warfare assets and domains. The US Navy initiated studies in the 1990s to find a replacement for the aging P-3C *Orion*, and the decision was made in 2004 to replace the latter with the P-8 *Poseidon*, a modified and

[449] Håvoll, Norwegian Maritime Patrol Aircraft operations during and after the Cold War.
[450] Gary Ambrose, "Transforming Maritime Patrol Aviation" (Master's Thesis, Quantico, VA, USA, USMC Command & Staff College, 2003), 6.
[451] Ambrose, 7–8.
[452] Geoff Fein and Grace Jean, "Changing the Game: U Navy Applies New Approaches to Submainres Threats," *IHS Jane's Navy Internatioinal*, 2014, https://www.janes.com/images/assets/836/46836/US_Navy_applies_new_approaches_to_submarine_threats.pdf

militarized Boeing 737 jet aircraft.[453] A UK MoD study in the early 1990s similarly evaluated options to replace the *Nimrod* MR2 that in essence mirrored the alternatives of the Americans, including a P-3 option.[454] The decision was made in 1996 to build the *Nimrod* MR4 as a continuation of the MR2, with significant upgrades to the entire aircraft, including the airframe and the sensor suite.[455]

The Norwegian P-3C *Orion* fleet was also upgraded at the end of the 1990s through the Upgrade Improvement Program (UIP), largely mirroring the American AIP suite. The mission for the Norwegian *Orions* was thus still to monitor the Russian Northern Fleet and its submarines in the High North. The Norwegian *Orions* were therefore not upgraded with the aforementioned TCDL system. Nor were the Norwegian aircraft upgraded to carry missiles. The Norwegian P-3 *Orion* UIP included several Norwegian specific solutions and sensors, such as a dedicated ESM/ELINT station.[456] The US Navy has flown the P-3 *Orion* for ASW and acoustic intelligence (ACINT) missions, and the EP-3 *Aries* for SIGINT collection. The Norwegians only had one type of operational MPA, and the Norwegian UIPs could thus be seen as a hybrid between the American P-3 *Orion* and the EP-3 *Aries*. The UIP model included a significant upgrade to the radar, the ESM suite, the computer processing capability, GPS installation, improved self-protection systems and SATCOM.[457] The tailored Norwegian stations and the consequent low volume of spare parts for the sensors led to costly and time-consuming upgrades of a very customized aircraft in the 2000s. Throughout the entire period since the UIP upgrade, the Norwegian MPA community has struggled to get a hold of spare parts. The discussion of replacing the *Orions* began in earnest in the late 2000s, but would take six years to come to a conclusion.[458]

It was not until the 1990s that unmanned aircraft technology matured to the point that capable systems could be controlled from the other side of the world, and be integrated with conventional land or maritime forces. And *Operation Desert Storm* in 1991 raised new requirements for ISR. Several targets were attacked simultaneously in a systematic fashion,

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[453] GE Aviation, "Boeing Team Wins $3 Billion Multi-Mission Maritime Aircraft Program," *GE Aviation Online*, June 14, 2004, https://www.geaviation.com/press-release/jv-archive/boeing-team-wins-3-billion-multi-mission-maritime-aircraft-program.
[454] Flight International, "RMPA Contenders Step up Campaign," *Flight International*, no. 1 (May 7, 1996): 16.
[455] Ministry of Defence, "Major Projects Report 2005 - Project Summary Sheets" (London: National Audit Office, November 25, 2005), 67.
[456] Marco Borst, "Under Arctic Conditions in Europe: Norwegian Orions," *AIR International*, January 1998, 58.
[457] Borst, 58.
[458] This author worked as the primary staff officer for maritime patrol aircraft at the Air Operations Inspectorate of the Royal Norwegian Air Force between 2009 and 2011, and took part in those initial discussions.

with targets "linked" through their relative importance to the Iraqi regime and infrastructure.[459] This demanded almost instant information on target updates and attack results, so-called *Battle Damage Assessment* (BDA). Satellite imagery was neither responsive nor flexible enough. This opened the door for what is termed "organic assets" to conduct intelligence gathering, such as the *Pioneer* unmanned aircraft.[460] Based on these operations, combined with historical strategic airborne intelligence gathering, the concept for a long-endurance unmanned aircraft was born in the early 1990s. This idea would eventually lead to the *Global Hawk* drone flying with the US Air Force today, and the *Alliance Ground Surveillance* (AGS) system about to become operational for NATO.[461]

Satellite operations had been prohibitive for most nations in a least two aspects: cost and the level of technology required. The 1990s were characterized by the proliferation and further miniaturization of satellite technology, and an abrupt decrease in cost associated with developmental breakthroughs. Globalization created a global market for satellite services, which in turn facilitated a market for launch services. A combination of these factors have led to what is today termed "New Space."[462] "Old Space" was the realm of the few nations that could afford the immense investments required to send big, heavy satellites into orbit. "New Space" is for all nations, commercial companies, universities and anyone that sees benefit or profit in satellite services. New Space has facilitated new possibilities in the realm of maritime surveillance, as we shall see.

Fewer Russian submarine deployments led to fewer intelligence collection opportunities for NATO surveillance aircraft. It did not take long until MPA squadrons were explicitly tasked

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[459] For an introduction to the thinking and core ideas behind the air campaign in *Operation Desert Storm* in 1991, in particular the concept of "parallel attack", see John A. III Warden, "The Enemy as a System," *Airpower Journal* 9, no. 1 (1995): 40–55.

[460] In brief, *organic assets* are those belonging to the commander that tasks them. For *Pioneer* operations, see Rick Thomas, *Global Hawk - The Story and Shadow of America's Controversial Drone* (Great Britain: Amazon, 2015), 51–52.

[461] NATO, "First NATO AGS Remotely Piloted Aircraft Ferries to Main Operating Base in Italy" (NATO, November 21, 2019), https://www.nato.int/cps/en/natohq/news_171171.htm. The momentum for unmanned aircraft led to the development of other capable aircraft as well, such as the *Predator*, *Reaper, Heron, Hermes 900,* to name a few. These will not be discussed in this thesis.

[462] For articles on "New Space", see for example Jeff Foust, "Current Issues in NewSpace," *The Space Review*, March 5, 2007, http://www.thespacereview.com/article/823/1; Stephen Cass, "We May Be Heading for a Space Bubble," *MIT Technology Review* Online (September 14, 2010), https://www.technologyreview.com/s/420776/we-may-be-heading-for-a-space-bubble; Jeff Foust, "The Evolving Ecosystem of NewSpace," *The Space Review*, August 15, 2011, http://www.thespacereview.com/article/1906/1; Sheraz Sadiq, "Silicon Valley Goes to Space," *Kqed.Org*, November 18, 2013, https://www.kqed.org/science/11135/silicon-valley-goes-to-space-2; Eric Berger, "Blue Origin Just Validated the New Space Movement," *Arstechnica.Com*, June 10, 2016, https://arstechnica.com/science/2016/10/blue-origin-just-validated-the-new-space-movement/.

to perform duties that diverged from wartime MPA roles, such as postal drops in remote locations and ice edge reconnaissance.[463] Mission areas into the mid-1990s turned more towards NATO ASW exercises with an emphasis on quiet diesel-electric submarines and surface surveillance, training with national forces such as transiting aircraft carrier battle groups, long-range navigation training and ice reconnaissance.[464]

US squadrons that had deployed to Iceland increasingly sent detachments to the Mediterranean.[465] The British had always paid attention to the Baltic with regards to maritime surveillance, and this effort continued into the 1990s with operational missions flown out of Nordholz, Germany.[466] MPAs that flew daily to maintain awareness of the whereabouts of the Soviet Navy during the Cold War were, utilized in operations that did not entail ASW at all.[467] American *Orions* and British *Nimrods* took part in operations *Desert Shield* and *Desert Storm* during the first Gulf War in 1991, as well as in the NATO embargo operation in the Adriatic *Operation Sharp Guard* during the war on Serbia in 1992.[468] Balkan engagements culminated in the controversial *Operation Allied Force* in the spring of 1999, which saw an MPA fire land-attack missiles in a live operation for the first time.[469] The Balkan and Adriatic operations served as catalysts for increased utilization of MPA in an over-land role.[470] Norwegian MPAs did not take part in these operations, but remained focussed on the High North.

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463 "Command History Report (CHR) for VP-5 (1992)" (US Navy, 1992), September 1992, FOIA case number: DON-NAVY-2018-00574, Naval History and Heritage Command.
464 Håvoll, Norwegian Maritime Patrol Aircraft operations during and after the Cold War; "Command History Report (CHR) for VP-49 (1993)" (US Navy, 1993), FOIA case number: DON-NAVY-2018-00574, Naval History and Heritage Command; "Command History Report (CHR) for VP-5 (1993)" (US Navy, 1993), FOIA case number: DON-NAVY-2018-00574, Naval History and Heritage Command.
465 "Command History Report (CHR) for VP-5 (1992)," Encl. (4).
466 Porter, British Maritime Patrol Aircraft Operations during and after the Cold War.
467 Borgeld, "Keflavik - from the Past to the Present," 41.
468 "Command History Report (CHR) for VP-5 (1992)," Encl. (4); Charles Haddon-Cave, "The Nimrod Review - An Independent Review into the Broader Issues Surrounding the Loss of the RAF Nimrod MR2 Aircraft XV230 in Afghanistan in 2006," Report to the House of Commons (London: House of Commons, October 2009), 18; "Command History Report (CHR) for VP-5 (1993)," Encl. (1).
469 Sherman, "Feet Dry: Maritime Patrol Goes Ashore - New Roles and Missions Mean No Safe Harbor for Land Forces," 39; Naval Air Museum Barbers Point, "Lockheed P-3C Orion - BuNo 160770," accessed September 6, 2018, http://nambp.org/lockheed-p-3c-orion; Perkins, "Alliance Airborne Anti-Submarine Warfare - A Forecast for Maritime Air ASW in the Future Operational Environment," 45.
470 Roberts, *Dictionary of American Naval Aviation Squadrons - Volume 2*, 2:88, 146, 355, 357, 360.

6.3 The 2000s – Russian ambitions and Western expeditionary warfare

When Vladimir Putin came to power in 2000 he halted the decline of the Navy, and later reversed it.[471] He continued cooperation with NATO at the same time as he channelled more funds towards restructuring of and investments in the military. The new president saw the need for an explicit naval strategy. That same year he promulgated a new National Security Concept and a new naval doctrine. The naval doctrine emphasized the "*qualitative renewal*" of the forces, and old systems would be replaced by new ones in the coming decades.[472] With the Russian economy taking a slight upturn at the time of issue, the naval doctrine demanded the renewal of outdated submarines and surface vessels, development of multi-role, ship-based as well as land-based aircraft, increased readiness, improved command & control systems, the reduction of diversity in systems and improved standardization of weapons systems production.[473] The doctrine also emphasized the requirement for information systems and smart weapons. Critics underlined, however, that the doctrine attempted to "*preserve at least the appearance of a navy worthy of a superpower, even at the cost of sacrificing quality and safety*."[474] The doctrine was seemingly aimed at pleasing hawks in the Kremlin, without having any obvious impact on NATO strategy.

In 2007-2008 there was a pivot towards what can be termed a Cold War mentality in the military and political leadership in Russia. This became evident both through rhetoric and military posture. One example is Vladimir Putin's speech at the Munich Security Conference in 2007, where he attacked the "*architecture of global security*", the United States' "*disdain for basic principles of international law*", and accused NATO of moving in on Russian borders from the West.[475] The new military posture was manifested not only through possessing the largest stockpile of nuclear weapons in the world and showing an increased interest in them, but also through an increase in exercises and test missile launches.[476] In late 2007/early 2008, the *Admiral Kuznetsov* aircraft carier led a two-month task force deployment from the Baretns Sea to the Mediterranean. The goal of the deployment was "*to*

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[471] Rolf-Inge V. Andresen and Tor Bukkvoll, "Russian Weapons Development towards 2020," *Forsvarets Forskningsinstitutt (FFI)* FFI-rapport 2008/01957 (January 12, 2009): 4, 9–10.
[472] International Institute for Strategic Studies, "Reviving Russia's Navy," *Strategic Comments* 6, no. 6 (July 2000).
[473] International Institute for Strategic Studies.
[474] Mizin and Jasinski, "The Future of the Russian Sea-Based Deterrent," 78–79.
[475] Vladimir Putin, "Speech and the Following Discussion at the Munich Conference on Security Policy" (Kremlin, February 19, 2007), http://en.kremlin.ru/events/president/transcripts/24034.
[476] Robert S. Norris and Hans M. Kristensen, "Russian Nuclear Forces, 2008," *Bulletin of the Atomic Scientists* 64, no. 2 (June 2008): 54.

ensure naval presence in tactically important regions of the world oceans."[477] And to underline the renewed importance of strategic assets. Oil revenues had facilitated a 150% increase in spending for the strategic nuclear forces since the early 2000s.[478] But with the immense backlog in maintenance of aging vessels, what can be termed overambitious political goals at the beginning of the century were still not met by matching levels of funding.[479] This negatively impacted modernization efforts.

The Georgian war in 2008 would show Russian leadership the state-of-affairs in the Russian military: poor ability to mobilize, inflexible leadership, poorly trained conscripts and lack of synchronization of units.[480] The deficiencies led to expedited modernization programs for new equipment, readiness and command & control.[481] Russian land forces began executing snap exercises regularly, in order to improve readiness.[482] Russia had also initiated work to modernize existing strategic nuclear weapons, the finalization of which would become permissible only after the *START Treaty* expired in 2009. As a consequence, the aging *Delta IV* class was fitted with the new SS-N-23 *Sineva* strategic missile. In September 2008, the Russian Navy finally conducted a successful test-firing of a SS-N-32 *Bulava* missile, indicating that the operationalization of the new *Dolgorukiy* class SSBN was approaching. This test-firing was, however, followed by several failed firings, further delaying the program. In mid-2009, a *Delta IV* class SSBN test-launched two SS-N-23 *Sineva* missiles from a position close to the North Pole. According to Russian sources, the *Delta IV* was escorted and protected by a task force of several nuclear-powered attack submarines.[483]

In 2009, Russia also published her new national Arctic strategy. The most important aspects of the strategy were exploitation of natural resources, securing Russia's borders, and strengthening international cooperation in the region. Russia has maintained significant

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[477] Guy Faulconbridge, "Russian Navy to Start Sorties in Mediterranean," *Reuters*, December 5, 2007, https://www.reuters.com/article/us-russia-navy/russian-navy-to-start-sorties-in-atlantic-tass-idUSL0518563620071205.
[478] Nuclear Threat Initiative (NTI), "Russia Submarine Capabilities."
[479] Nuclear Threat Initiative (NTI).
[480] Gustav Gressel, "Russia's Quiet Military Revolution, and What It Means for Europe," Policy Brief (European Council on Foreign Relations, October 2015), 2; Robert S. Norris and Hans M. Kristensen, "Russian Nuclear Forces, 2009," *Bulletin of the Atomic Scientists* 65, no. 3 (June 2009): 55. A reaction to Western posturing materialized a little more than 20 years earlier as well, through the "Analogous Response" that we saw earlier in the mid-1980s with the deployment of the *Akulas* carrying nuclear capable SS-N-21 SLCMs.
[481] Svein Efjestad, "Norway and the North Atlantic: Defence of the Northern Flank," in *NATO and the North Atlantic - Revitalizing Collective Defence*, by John A. Olsen, Whitehall Paper 87 (London: Royal United Services Institute (RUSI), 2017), 62–64.
[482] Olsen, *NATO and the North Atlantic - Revitalizing Collective Defence*, 68.
[483] Robert S. Norris and Hans M. Kristensen, "Russian Nuclear Forces, 2010," *Bulletin of the Atomic Scientists* 66, no. 1 (February 2010): 77.

cooperation with Norway with regards to common regulations of fish stocks in the Norwegian and the Barents Sea, which extends back to the height of the Cold War. The financial setback of 2008 did not affect the implementation of the strategy to any mentionable degree.[484] There seemed, however, to be a lack of a distinguishable mission for the Russian Navy.[485]

The financial crisis of 2008 put a brake on the force modernization program.[486] However, facilitated by an improved fiscal foundation by 2010, the Russians published a new military strategy that year. Significant weapons programs were initiated aiming for an overhaul of 70% of the prioritized units of the armed forces by 2020. The new National Security Strategy aimed to clarify Russia's nuclear weapons employment policy, and how Russian forces would be utilized in a modern, complex, and nuanced threat environment.[487]

The *Dolgorukiy* class SSBN was finally accepted by the navy in January of 2013 after more than a decade and a half in development, production and testing.[488] The issues delaying particularly the SS-N-32 *Bulava* (range 4,600 nm/8,500 km) missiles' acceptance onto the vessel was said to be associated with technical malfunctions and quality control issues in final assembly.[489] The first *Dolgorukiy* class commenced its first operational patrol in the fall of 2014.[490]

The modernization of the non-strategic nuclear capability seems, however, to be centred around the introduction of the *Severodvinsk* class SSGN. The *Severodvinsk* class multi-purpose submarine also took 17 years to complete.[491] The mission of the *Severodvinsk* is

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[484] Norwegian Intelligence Service, "FOKUS 2011 - The Assessment of the Intelligence Service," Annual Unclassified Assessment (Oslo, 2011), 7, https://forsvaret.no/fakta_/ForsvaretDocuments/FOKUS-2011.pdf.
[485] Andrei Martyanov, "Russia's Navy in Search of a Mission," *United States Naval Institute Proceedings* 140, no. 12 (December 2014).
[486] Zysk, "Mot et Moderne Russisk Forsvar? Utviklingstrender i Militær Modernisering Og Strategisk Tenkning," 10.
[487] Hans M. Kristensen and Robert S. Norris, "Russian Nuclear Forces, 2011," *Bulletin of the Atomic Scientists* 67, no. 3 (2011): 69; Zysk, "Mot et Moderne Russisk Forsvar? Utviklingstrender i Militær Modernisering Og Strategisk Tenkning," 10–12.
[488] RT, "Finaly Flying Colors: Yury Dolgoruky Nuclear Sub Joins Russian Navy," *RT.Com*, January 10, 2013, https://www.rt.com/news/yury-dolgoruky-submarine-ceremony-678/; Steve Gutterman, "New Russian Nuclear Submarine Goes into Service," *Reuters*, January 10, 2013, https://www.reuters.com/article/us-russia-submarine/new-russian-nuclear-submarine-goes-into-service-idUSBRE9090YR20130110; Hans M. Kristensen and Robert S. Norris, "Russian Nuclear Forces, 2013," *Bulletin of the Atomic Scientists* 69, no. 3 (2013): 75.
[489] Office of Naval Intelligence, "The Russian Navy - A Historic Transition," 17.
[490] Hans M. Kristensen and Robert S. Norris, "Russian Nuclear Forces, 2015," *Bulletin of the Atomic Scientists* 71, no. 3 (2015): 91.
[491] Norman Polmar, "The Russian Navy - Beneath the Waves," *United States Naval Institute Proceedings* 138, no. 6 (June 2012); Alexander Korolkov, "Russia's Top-Secret Nuclear Submarine Comes into Service," *Russia Beyond*, June 17, 2014, https://www.rbth.com/defence/2014/06/17/russias_top-secret_nuclear_submarine_comes_into_service_37483.html.

ASW, ASuW, and land-attack missions. The first *Severodvinsk* class submarine was finally declared combat-ready in early 2016. Although not quite at quiet as her American counterparts, the new Russian SSGN is considered to be the least detectable of the vessels in the Russian Navy order of battle.[492] An important feature with non-strategic nuclear forces, however, is that they are able to carry both nuclear and conventional missiles. Important aspects of this are both intentional and unintentional signalling and posture.[493] This ambiguity can lead to strategic uncertainty on the part of the adversary. A significant area of emphasis for Russia is to make herself less unilaterally dependent on nuclear weapons for regional and global deterrence. Focus is therefore given to developing conventional precision-guided, long-range weapons, in addition to the ability to utilize and exploit all the state's elements of power in a crisis situation.[494] The development of the nuclear capable *Kalibr* family of missiles that can be placed on nuclear as well as conventional attack submarines, stand out as a centre-point for Russian doctrinal development.

By the year 2000 nearly two thirds of the Russian SSBN fleet had been withdrawn from service. The Russian Navy was able to maintain one SSBN on strategic patrol in the Arctic and one in the Pacific, although there were periods lasting up to three months at a time where there were no patrols at all due to safety concerns.[495] These were well justified. In August 2000 the *Oscar* class SSGN *Kursk* sank in the Barents Sea, prompting a further decrease in operational tempo on Russian submarines.[496] In 2001, the Russian Navy conducted one strategic submarine patrol; and in 2002 it conducted none.[497] Russian submarine activity would eventually start to recover, and in 2005 the Russian Navy conducted five strategic patrols. Several of those were concurrent, meaning that Russia in the 2000s did not have a continuous operational sea-based strategic deterrent. However, by 2009 the patrol tempo of Russian strategic submarines had risen to nine patrols per year. But the amount of patrols

[492] Tamnes, "The Significance of the North Atlantic and the Norwegian Contribution," 24–25.
[493] Kristensen and Norris, "Russian Nuclear Forces, 2015," 95.
[494] Norwegian Intelligence Service, "FOKUS 2013 - The Assessment of the Intelligence Service," Annual Unclassified Assessment (Oslo, 2013), 18.
[495] In comparison, the US Navy SSBN patrol rate in the 2000s were steadily numbering more than 60 patrols a year. See Robert S. Norris and William N. Arkin, "Russian Nuclear Forces, 2000," *Bulletin of the Atomic Scientists* 56, no. 4 (August 2000): 70–71; Robert S. Norris and Hans M. Kristensen, "Russian Nuclear Forces, 2004," *Bulletin of the Atomic Scientists* 60, no. 4 (August 2004): 74.
[496] Robert S. Norris et al., "Russian Nuclear Forces, 2002," *Bulletin of the Atomic Scientists* 58, no. 4 (August 2002): 73.
[497] Norris et al., 73; Robert S. Norris and Hans M. Kristensen, "Russian Nuclear Forces, 2007," *Bulletin of the Atomic Scientists* 63, no. 2 (April 2007): 64.

would once again drop in the following years.[498] In 2007, Russia's attack and cruise missile submarines increased their patrols to seven patrols, an increase from four patrols the previous year. These submarines had averaged roughly 12 patrols a year during the 1990s.[499]

NATO issued a revised strategic concept concurrent with the war against Serbia in 1999.[500] This revision emphasised mobile and flexible forces with endurance to operate in expeditionary operations. Specific tasks for the different services were downplayed, and emphasis was given to joint operations.[501] Cooperation between NATO and Russia continued through the NATO-Russian Founding Act of 1997, and deepened further in 2002 with the establishment of the NATO-Russia Council. By then, Russian submarine patrols in the Atlantic had been more or less discontinued.[502] NATO's relationship to Russia had morphed into an explicit political framework for security cooperation. It seems evident that changes to threats and threat perceptions induce changes to strategic thinking. The revised Russian strategy of the early 2000s was not backed by new equipment or expanded operations. The 9/11 attacks in 2001 on the USA were therefore the primary factor shaping the focus of the strategic discussions of NATO.[503] The Alliance continued to focus on expeditionary warfare while making changes to its command structure, which among other things led to the disestablishment in 2003 of SACLANT in Norfolk, VA, USA.[504] This removed the sole headquarters that maintained a primary focus and responsibility on the Atlantic, with an emphasis on the Russian Northern Fleet. SACLANT had the peacetime responsibility for contingency plans, force requirements, exercises, and strategic and doctrinal development in the Atlantic area. The removal of SACLANT from the NATO Command Structure seems to have played a part in the atrophy of ASW skills within the Alliance in the decade that followed. In what was likely a combination of faith in emerging technology, a focus on the Middle East, and the lack of Russian operational submarine deployments, the Americans closed down Keflavik as a naval air base in 2006. American ASW command & control was

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[498] Jeffrey Lewis, "Led Zeppelin Comes to Washington," *Foreign Policy*, January 5, 2015, https://foreignpolicy.com/2015/01/05/led-zeppelin-comes-to-washington-russia-nukes-putin-arms-control/; Hans M. Kristensen and Robert S. Norris, "Russian Nuclear Forces, 2014," *Bulletin of the Atomic Scientists* 70, no. 2 (2014): 80; Norris and Kristensen, "Russian Nuclear Forces, 2007," 64.
[499] Norris and Kristensen, "Russian Nuclear Forces, 2008," 57.
[500] Øyvind Bergstrøm, "NATOs Maritime Strategi Etter 1990 - Fra Sjømakt Til Ordensmakt?" (Master's Thesis, Oslo, Norwegian Armed Forces Staff College, 2009), 24.
[501] Bergstrøm, "NATOs Maritime Strategi Etter 1990 - Fra Sjømakt Til Ordensmakt?," 30.
[502] Reference previous section of this chapter, and also Olsen, *NATO and the North Atlantic - Revitalizing Collective Defence*, z4.
[503] NATO, "Prague Summit Declaration" (NATO, November 21, 2002), NATO, online archive.
[504] NATO, para 4.b.

pulled back to the East coast for the Atlantic. The British continued to fly out of Kinloss in Scotland, with command & control situated in Northwood, London.

The 9/11 attacks on the USA in 2001 for the first time led to a member nation calling for Alliance members' support through NATO's Article 5.[505] The ensuing operation, *Operation Active Endeavour (OAE),* was launched in late 2001, and was a maritime anti-terror operation, with the tasks of tracking and controlling ships in the Mediterranean.[506] MPAs were used extensively in OAE. In addition to US squadrons from Keflavik, the Mediterranean NATO nations routinely supported the operation. So did, for the first time, the Norwegian P-3 *Orion* squadron, as it deployed to Sicily to support as well.

An overwhelming focus on the Middle East in the mid-2000s had led to a sentiment in Norwegian security policy circles of reduced focus on the maritime domain, particularly in the High North. Norway did not deploy *Orions* to the Middle East, but sent them to the Mediterranean in support of OAE in 2005 and 2006. In September 2008, the Norwegian Minister of Defence presented at an informal ministerial meeting in London a paper on raising NATO's profile in the member states. The initiative sought a better balance between out-of-area operations with in-area activities, and emphasized the importance of revitalizing collective defence and deterrence. In Norwegian terms, this meant an increased NATO focus on the North Atlantic.[507] After the paper had been presented, NATO initiated work to strengthen the links between the NATO Command Structure and the military establishments in the member nations. Progress, however, was slow, as was the implementation of changes in NATO activities. A key difference from the Cold War was the wide array of threat perceptions within the Alliance, as opposed to the one, common threat in the past that provided a focus for all Alliance members.

However, even with a more forward-leaning Russia (the Munich speech, the Georgia war), there were other pressing challenges elsewhere. By 2009, NATO had initiated *Operation Allied Protector* off the Horn of Africa at the request of the UN, in order to counter piracy and armed robbery at sea.[508] MPAs, including Norwegian units, were extensively utilized in

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[505] In summary, Article 5 of the North Atlantic Treaty states that an attack on an Alliance member shall be considered an attack on the Alliance as a whole.
[506] NATO, "Operation Active Endeavour" (NATO, October 27, 2016), NATO, online archive, https://www.nato.int/cps/en/natolive/topics_7932.htm.
[507] The Norwegian Ministry of Foreign Affairs, "St.Meld.Nr.38 (2008-2009) - Om Samarbeidet i NATO i 2008" (The Norwegian Government, 2008), 7.
[508] NATO, "Counter-Piracy Operations" (NATO, December 19, 2016), NATO, online archive, https://www.nato.int/cps/en/natolive/topics_48815.htm#Protector.

order to build a pattern-of-life both ashore and at sea.[509] Later in 2009, however, NATO declared that "*developments in the High North have generated increased international attention.*"[510] Concurrently, sporadic reports emerged of Russian submarines patrolling the East coast of the United States.[511] A recognition of a requirement for a renewed focus on anti-submarine warfare thus started to gain traction within the Alliance starting in 2010.[512] This, however, was never reflected through changes in long-term investment among the Alliance members.[513]

In 2010, NATO also revised its strategic concept.[514] The concept built further on force flexibility and international stabilization efforts, but incorporated more aspects of defending Alliance territory than the previous one.[515] Important to Norwegian security politics, the strategic concepts incorporated several elements from the Norwegian initiative from 2008. Among these were an increased focus on situational awareness and early warning, a closer linkage between national headquarters and the NATO Command Structure, improved readiness times for NATO forces, and the execution of more regular and relevant exercises.[516] All of these elements were emphasised to an increasing degree in the Alliance in the coming decade. The Norwegian initiative and active engagement with other Alliance members on such issues were not the only factors that played into the restructuring of NATO in the 2010s, but they certainly seem to have played a significant role. In 2011 the *Alliance Maritime Strategy* was issued, with a combined emphasis on expeditionary warfare at distance, and security operations closer to home. [517] Further changes to the NATO Command Structure were initiated in 2010-2012.[518] The two maritime commands in Naples, Italy, and Northwood, UK, were consolidated into one, single maritime command at Northwood, namely the Allied Maritime Command (MARCOM). Up until then, Naples had been in

[509] The operation later turned into *Operation Ocean Shield* in 2009 and ran until the end of 2016.
[510] NATO, "Strasbourg/Kehl Summit Declaration" (NATO, April 4, 2009), NATO, online archive.
[511] Mark Mazzetti and Thom Shanker, "Russian Subs Patrolling Off East Coast of U.S.," *New York Times*, August 4, 2009.
[512] Perkins, "Alliance Airborne Anti-Submarine Warfare - A Forecast for Maritime Air ASW in the Future Operational Environment," 31.
[513] Peter Hudson and Peter Roberts, "The UK and the North Atlantic: A British Military Perspective," in *NATO and the North Atlantic - Revitalizing Collective Defence*, by John A. Olsen, Whitehall Paper 87 (London: Royal United Services Institute (RUSI), n.d.), 80–83.
[514] NATO, "Active Engagement, Modern Defense - Strategic Concept for the Defense and Security for the Members of NATO" (NATO, November 20, 2010), NATO, online archive.
[515] NATO, "Lisbon Summit Declaration" (NATO, November 20, 2010), NATO, online archive.
[516] Svein Efjestad, Raising NATO's profile - the Norwegian NATO initiative, December 9, 2020.
[517] Brooke A. Smith-Windsor, "NATO's Maritime Strategy and the Libya Crisis as Seen from the Sea," Research Paper (Rome: NATO Defense College, March 2013), 2–3.
[518] NATO, "Lisbon Summit Declaration."

charge of the Mediterranean and surrounding areas to the south and east, such as the Indian Ocean and counter-piracy operations. Northwood were in charge of the English Channel, the Baltic, and the Atlantic, to a larger extent focussing on exercises. Now, Northwood was in charge of all things maritime, with only one office in charge of coordinating maritime air affairs, that of *Commander Maritime Air NATO* (COMMARAIRNATO). Building on the MACA construct from the Mediterranean, COMMARAIRNATO had to adjust to a smaller command structure in addition to an increased geographical area of responsibility. COMMARAIRNATO's focus areas stretched from north of Norway, to the Baltic, the Mediterranean, and all the way down to the Indian Ocean. Described in detail in MARCOM's classified document *Alliance Maritime Governance* from 2016, COMMARAIRNATO sought to exercise his command & control through a distributed network of national MACAs and other national command and control constructs, named the *"Maritime Air Network."*[519] The NATO command structure did not have any dedicated ASW forces nor a mandate to coordinate them in peacetime outside of exercises. ASW in peacetime had always been coordinated by the respective *national* headquarters, although interaction and coordination between these headquarters certainly continued.

The PNI from 1991 together with the *START I Treaty* had prevented Russia and the United States from placing tactical nuclear submarine-launched cruise missiles (SLCM) on attack submarines.[520] *START I* expired in December 2009, and in early 2011, the two nations ratified the *New START Treaty*, in which both countries committed to further reduction in deployed strategic nuclear weapons, as well as an improved inspection regime.[521] The latter was also specifically emphasized in NATO's Strategic Concept the previous year.[522] NATO also pointed to the disparity between the Russian and Western non-strategic nuclear weapon stockpile and their deployment close to NATO countries' borders. More importantly for this thesis, however, the *New START Treaty* of 2010 did not put any limitations on placing SLCMs on attack submarines. The treaty solely focusses on capping the deployed *strategic*

[519] Rear Admiral Thomas Ernst, "Agile Command and Control in a Degraded Environment," in *Preparing NATO for Joint Air Operations in a Degraded Environment.*, Joint Air & Space Power Conference 2016 (Kalkar, Germany: Joint Air Power Competence Centre, 2016).
[520] Nuclear Threat Initiative (NTI), "Russia Submarine Capabilities."
[521] BBC, "US Senate Votes to Begin Debate on New Start Treaty," *BBC.Com*, accessed October 4, 2018, https://www.bbc.com/news/world-us-canada-12004945; nti.org, "U.S. Senate Ratifies New START in 71-26 Vote, Despite Top GOP Opposition," *NTI Online*, December 22, 2010, https://www.nti.org/gsn/article/us-senate-ratifies-new-start-in-71-26-vote-despite-top-gop-opposition/; Kristensen and Norris, "Russian Nuclear Forces, 2011," 67.
[522] NATO, "Active Engagement, Modern Defense - Strategic Concept for the Defense and Security for the Members of NATO," 24.

warheads allowed on long-range delivery vehicles.[523] As a result, the Russian SLCM capability has now risen to be one of the main naval threats towards US and European targets.

After 9/11, NATO's engagement in Afghanistan drove force requirements, budgets, and consumed the general attention of the Alliance.[524] A wide array of troops and weapons systems were deployed to the Middle East, and MPAs were no exception. The counter-insurgency operations were intelligence demanding and intelligence driven, and the requirement for airborne intelligence assets were more or less insatiable throughout. This high demand for ISR services were a root cause of the explosion in utilization of unmanned ISR platforms in the 2000s.[525] And as MPAs were increasingly being deployed for over-land missions, they were tasked to operate in a fundamentally different surface-to-air threat environment. This demanded a new approach to missile defence and self-protection. The new threat environment led to the installation of improved self-protection systems.[526] The migration to over-land missions in the 1990s and the 2000s seems to have been facilitated by a symbiosis between operational demands and the MPA community adapting to a new threat environment. The aircraft was increasingly being tasked to fly over-land missions because they already carried the sensors that could support those missions. The dangerous element of such flexibility towards the mission portfolio is that knowledge and competence for niche missions and capabilities are perishable and will atrophy. This, critics claim, is what has happened to the NATO ASW capability in general, and to the NATO airborne long-range ASW capability, specifically.[527]

In spite of a decreasing strategic focus on adversary submarines at the turn of the century, the United States Office of Naval Research (ONR) initiated work on developing *Multistatic Active Coherent* (MAC) technology for airborne assets in the early 2000s.[528] In order to meet the challenge of increasingly quiet adversary submarines, so-called *multistatic* systems have

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[523] Kristensen and Norris, "Russian Nuclear Forces, 2011," 67.
[524] NATO, "Istanbul Summit Communique" (NATO, June 28, 2004), NATO, online archive.
[525] John O. Birkeland and Gjert Lage Dyndal, "Fremtidig Autonom Droneteknologi Og -Konsepter," in *Når Dronene Våkner*, ed. Tor Arne Berntsen, Gjert Lage Dyndal, and Sigrid Redse Johansen (Oslo: Cappelen Damm Akademiske, 2016).
[526] Sherman, "Feet Dry: Maritime Patrol Goes Ashore - New Roles and Missions Mean No Safe Harbor for Land Forces," 39.
[527] Håvoll, Norwegian Maritime Patrol Aircraft operations during and after the Cold War; Perkins, "Alliance Airborne Anti-Submarine Warfare - A Forecast for Maritime Air ASW in the Future Operational Environment"; Birkeland, "The Potential of LIDAR as an Anti-Submarine Warfare Sensor."
[528] Chapter 1 "Introduction" of this thesis gave a short introduction to this technology, and the final chapter of this thesis points to the inherent potential in this technology.

been developed that enable a search for a submerged target under difficult acoustic conditions. Monostatic acoustic systems consist of one active buoy that sends out a sound and searches for a return. Bistatic systems consist of two platforms, for example two ships or two separate buoys, where one platform is the active one and the other is the passive.[529]

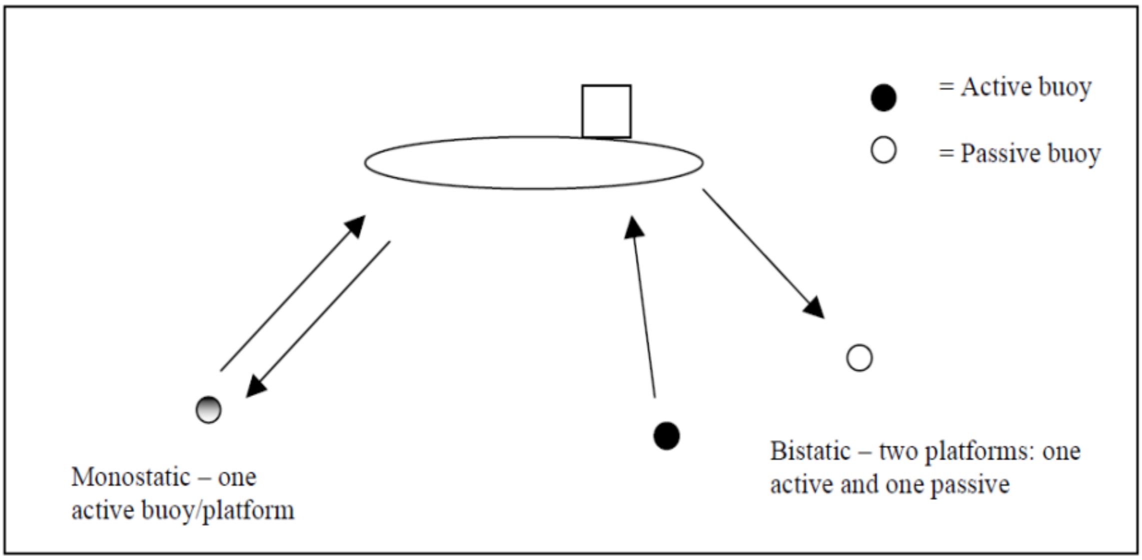

Figure 6-1. Monostatic and bistatic systems. [530]

Multistatic systems have several passive platforms or buoys, and often more than one active or explosive buoy. The system will note the timing of the transmitted sounds, and then record the returns on all the passive sensors. This will give the computer the opportunity to triangulate the position of the enemy submarine. These are capable systems, but they have their limitations. The multistatic systems are active and reveal the presence of the ASW force. Multistatic systems are also not as efficient in littoral waters, due to false and confusing returns from other elements than submarines. Also, fresh water, differences in temperature, turbulence and currents in the littorals will create layers in the water, which complicate all types of acoustic searches, no matter how efficient they are.[531] But with further development of both buoys and processing systems, MAC systems are expected to have a significant impact on modern ASW in the near future.

[529] Birkeland, "The Potential of LIDAR as an Anti-Submarine Warfare Sensor," 24.
[530] Birkeland, 24.
[531] Birkeland, 25.

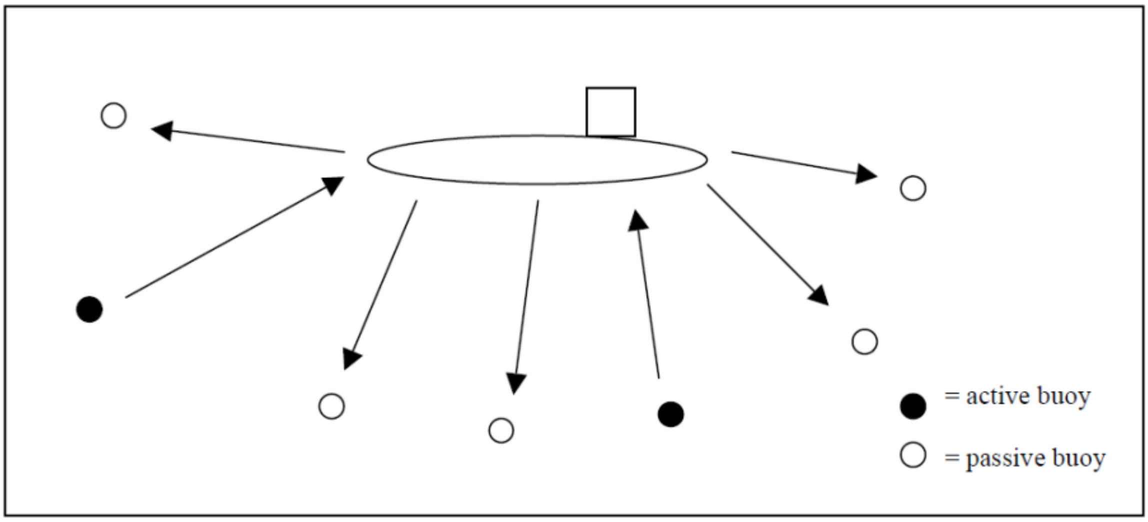

Figure 6-2. Multistatic systems.[532]

The technology will be a welcome addition to any ASW asset whenever the use of active buoys is required. MAC technology has been further refined and developed, and will be installed on the P-8 *Poseidon*.[533] The US Navy decision to procure the P-8 *Poseidon* MPA is a significant leap forward in terms of sensors capacities, such as the radar, the EO/IR and the ESM system.[534] The acoustic suite brings a significant improvement to the processing capacity, and the tactical computer provides a full tactical picture of the battlespace the aircraft is operating in for every crew station. This is crucial for, among other things, the MAC concept just discussed. With regards to communications, the P-8 is set up with SATCOM, UHF, VHF, HF and Link-16.[535] The Link-16 provides a near instantaneous sharing of data with other elements for the forces that are connected to the network.

In the mid-2000s, the US Navy underlined the requirement for airborne wide-area, ocean surveillance, in order to monitor ship traffic and military naval movements worldwide. The concept was termed *Broad Area Maritime Surveillance* (BAMS), and set the requirement for a capability that could provide persistent coverage in any weather, and be able to investigate targets in a manner that other strategic assets, such as satellites, could not. As a supplement to MPAs, unmanned technology was pursued. In 2008, the US Navy moved ahead with a derivative of the *Global Hawk* drone. The aircraft was modified to carry a maritime radar with 360-degree coverage, electro-optic camera providing full-motion video and an

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[532] Birkeland, 24.
[533] The Office of the Director, Operational Test and Evaluation, "FY2014 DOT&E Annual Report," Annual Report, 2014, 227–28.
[534] Fein and Jean, "Changing the Game: U Navy Applies New Approaches to Submainres Threats."
[535] Fein and Jean.

Automatic Identification System (AIS) receiver. It was constructed for long-range surface surveillance, but was not capable of conducting underwater search. Additionally, the drone had its wings and fuselage strengthened in order to enable descent to lower altitudes, which would entail both more turbulence and icing conditions compared to the high-altitude operations of the *Global Hawk*.[536] The drone was given the interim name *BAMS-Demonstrator*, BAMS-D. One BAMS-D aircraft deployed to the Arabian Gulf in support of naval operations there, and proved its relevance to naval commanders through updating emerging threats and targets over the horizon.[537] Satellites and organic assets to the naval force were unable to provide similar services with corresponding speeds and update intervals.

As a continuation of the New Space movement of the 1990s, space-based maritime surveillance also continued to grow in the 2000s. Although not able to penetrate below water, space-based sensors provide a crucial element of the total picture when compiling maritime situational awareness. The NOSS constitutes the US Navy's main space-based ELINT capability and provides an emission based, global maritime surface picture.[538] The DSP from the 1970s was replaced with the *Space-Based IR System* (SBIRS), which is still operating in support of air and missile defence.[539] Other systems for SIGINT have been derived from the satellites launched in the 1970s, and as naval vessels for the most part are underway, the most prominent surveillance tool from space is based on SIGINT.[540] The most obvious downgrading factor of electro-optical systems is that of cloud coverage disturbing the line-of-sight between the satellite and the target. Radar imaging systems penetrate clouds, and do not have this problem. A prominent radar imaging satellite system launched by the United States in 2010 is the *TOPAZ*, which will likely be replaced by a new generation of surveillance satellites in the near future.[541] The targets of surveillance, however, have for the most part been static infrastructure and sites of activity on land and close to the shore. Ports, shipyards and docks are obviously important elements of maritime surveillance, but they are not the

[536] Thomas, *Global Hawk - The Story and Shadow of America's Controversial Drone*, 241–42.
[537] Thomas, 232–38.
[538] Geoffrey Forden, "Viewpoint: China and Space War," *Astropolitics* 6, no. 2 (2008): 148; Friedman, *Seapower and Space*, 177–79; Dwayne A. Day, "Above the Clouds: The White Cloud Ocean Surveillance Satellites," *The Space Review*, April 13, 2009, Online edition, http://www.thespacereview.com/article/1351/1; Jeffrey T. Richelson, *The US Intelligence Community*, Seventh edition (Boulder, CO: Westview Press, 2016), 230–31.
[539] Kevin McLaughlin, "Would Space-Based Systems Defenses Improve Security?," *Washington Quarterly* 25, no. 3 (2002): 179–81.
[540] Richelson, *The US Intelligence Community*, 232–33.
[541] Bruce Berkowitz, *The National Reconnaissance Office at 50 Years: A Brief History* (Chantilly, Virginia: Center for the study of national reconnaissance, 2011), 26; Richelson, *The US Intelligence Community*, 189–94.

primary subject of surveillance when fleets or submarines are at sea. The more adaptive and flexible asset for surveillance and reconnaissance of submarines is still, however, the MPA in its primary role.

6.4 The 2010s – Annexation of Crimea and renewed tensions

In March 2014 Russia illegally annexed the Crimean peninsula of Ukraine, which changed NATO-Russia relations for the foreseeable future."[542] The Russians revised their national strategy in December 2014. It is defensive in nature; NATO is still portrayed as the most pressing threat to Russia's existence, and calculated ambiguity is a prominent feature of the document.[543] The strategy did, however, take into account new fiscal constraints that arose both from external sanctions due to the situation in Ukraine and from internal economic turmoil and slow growth.[544] Even before the sanctions imposed in response to the Crimean annexation, the decline in oil prices had complicated the Russian military's ambitious modernisation plans.[545] And even in times of economic growth under Putin, the significant funds allocated to the Navy were simply not enough to recover from the massive naval decline of the 1990s. There remained significant backlogs of maintenance, training, and dismantlement tasks.[546] In 2015, a new Russian maritime doctrine was released, to be in effect through 2020. The document focussed on a variety of issues, of which naval activities were but one fraction of the national portfolio of tasks and interests, such as exploitation of natural resources, climatological issues, and fisheries science. The national maritime doctrine in fact tells us little about the role of the Navy.[547] In order to gain an understanding of that role, particularly in relation to the Northern Fleet, one instead needs to keep track of Russian exercises and weapons testing in the High North. And this is where the requirement for a renewed MPA fleet comes into play.

After the Russian Crimean annexation, the Alliance initiated the *NATO Readiness Action Plan*, which included increased readiness of the NATO Response Force, and the initiation of

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[542] NATO, "Wales Summit Declaration" (NATO, September 5, 2014), para 1, para 18, NATO, online archive.
[543] Kristensen and Norris, "Russian Nuclear Forces, 2015," 86–87.
[544] Olga Oliker, "Unpacking Russia's New National Security Strategy," *Csis.Org*, January 7, 2016, https://www.csis.org/analysis/unpacking-russias-new-national-security-strategy.
[545] Norwegian Intelligence Service, "FOKUS 2015 - The Assessment of the Intelligence Service," Annual Unclassified Assessment (Oslo, 2015), 14, https://forsvaret.no/ForsvaretDocuments/FOKUS2015-endelig.pdf; Kristensen and Norris, "Russian Nuclear Forces, 2015," 86.
[546] Nuclear Threat Initiative (NTI), "Russia Submarine Capabilities."
[547] Kremlin, "Maritime Doctrine of the Russian Federation," trans. Anna Davis (U.S. Naval War College, 2015), 18.

a range of *Immediate Assurance Measures*. These consisted of an increased presence and forward posture, including "*maritime patrol aircraft flights along our eastern borders.*"[548] Through the Alliance Maritime Strategy, the importance of the maritime domain was referenced as growing in relevance both geopolitically and economically.[549]

In 2016 the NATO Alliance reiterated its dismay with Russian aggression and posture, with particular emphasis on Ukraine and Crimea.[550] NATO enhanced its posture and presence along the Eastern periphery and cancelled all civilian and military cooperation with Russia, whilst remaining open for dialogue. The maritime domain was given enhanced attention, and NATO recognized both the Baltic and the Black Sea as challenging regions requiring close cooperation and support, and increased situational awareness. The North Atlantic was described in terms recognizable from the Cold War years:

> *"…the Alliance will be ready to deter and defend against any potential threats, including against sea lines of communication and maritime approaches of NATO territory. In this context, we will further strengthen our maritime posture and comprehensive situational awareness."*[551]

But in introducing the term "*strategic anticipation*" (as opposed to "indications and warnings"), the importance of overall enhanced situational awareness is underlined, "*particularly in the east, the south, and in the North Atlantic. Our ability to understand, track, and ultimately, anticipate, the actions of potential adversaries through Intelligence, Surveillance and Reconnaissance (ISR) capabilities and comprehensive intelligence arrangements is increasingly important*."[552]

A set of questions from the Foreign Affairs and Defence Committee forwarded to the Norwegian MoD in 2016 included two on the military guidelines on foreign military activity in Norway. The MoD emphasised in its response that the restrictions have played a fundamental part in Norwegian security policy since the 1950s, manifesting a key tool in the balancing act between deterrence and assurance towards Russia. The explicit response was that

548 NATO, "NATO's Readiness Action Plan (RAP) - Fact Sheet" (NATO, July 2016), NATO, online archive.
549 NATO, "Wales Summit Declaration," para 71.
550 NATO, "Warsaw Summit Communique" (NATO, July 9, 2016), para 5, NATO, online archive.
551 NATO, para 23.
552 NATO, para 47.

> *"All Allied flying missions over Finnmark with foreign military aircraft further East than 24 degrees East, with the exception of transport and passenger aircraft, shall be approved by the Ministry of Defence. There is an absolute limitation in place for foreign military aircraft, with the exception of transport and passenger aircraft, to fly east of 28 degrees East."*[553]

This was a reaffirmation of past restrictions. In its effort to stimulate Allied activities in the North Atlantic, it will be interesting to follow the Norwegian Government's approach to the 24-degree restriction in the future. Possibly a more important question is, however, how the Norwegian government will handle foreign assets operating in the Barents Sea that has launched from bases outside of Norwegian territory. Unmanned, long-endurance aircraft, for example, can easily launch from abroad and operate in the Barents Sea for extended periods of time.[554]

The Commander of MARCOM pointed in 2017 to increased Russian activities, he emphasized that NATO was attempting to reverse the general atrophy in ASW competency, among other things by prioritizing ASW exercises.[555] By the following year, it was recognized at the strategic level of NATO that there was a requirement for an increased focus on ASW, a notion gaining traction with many nations, not least the USA, the UK and Norway.[556] The "*collective maritime warfighting skills in key areas*" were to be reinvigorated, with emphasis on "*anti-submarine warfare, amphibious operations, and protection of sea lines of communications*."[557] In the summer of 2018, NATO announced several changes to its command structure. The most noteworthy of which in the context of the North Atlantic was the establishment of a Joint Force Command in Norfolk, USA, to "*focus on protecting the transatlantic lines of communication*."[558] The requirement for a refocussing on ASW included an acknowledgement that ASW is a "combined arms" endeavour, requiring multiple forces

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553 Norwegian Ministry of Defense, "Response from the Ministry of Defense to the Foreign Affairs and Defense Committee on Questions Related to the Long Term Plan - Prop. 151 S (2015-2016)" (Stortinget, August 17, 2016), Stortinget, online archive.

554 Keflavik is not permanently operational, but is sporadically used by the US Navy for P-8 operations, as well as for NATO flights such as Icelandic Air Policing (IAP)..

555 Clive Johnstone, "NATO's Maritime Moment: A Watershed Year in Alliance Sea Power" (Speech, Allied Ambassador's Lunch, Residence of Belgian Ambassador to the United Kingdom, London, January 17, 2017), https://mc.nato.int/media-centre/news/2017/nato-maritime-moment-a-watershed-year-in-alliance-sea-power.aspx.

556 John T. jr Hanley, "Creating the 1980s Maritime Strategy and Implications for Today," *Naval War College Review* 67, no. 2 (Spring 2014): 5–6.

557 NATO, "Brussels Summit Declaration" (NATO, July 11, 2018), para 19, NATO, online archive.

558 NATO, para 29.

working closely in an integrated manner. The MPA cannot go it alone, neither can the ASW frigate, nor the lone submarine. It will thus not be sufficient to procure one or two new ASW assets – a systemic approach is required to handle modern ASW challenges.[559]

In the UK, the MR4 development program was costly and fell significantly behind schedule. In addition, a *Nimrod* MR2 deployed to Afghanistan crashed in 2009, claiming the lives of 11 crewmembers. The ensuing accident investigation pointed to significant systemic faults in many areas from procurement to aircraft maintenance. Combined with the significant cost-overruns of the MR4 program, the review seems to have played a prominent role in the cancelling of the *Nimrod* program in the *Strategic Defense and Security Review* (SDSR) of 2010. The primary reason for the MR4 cancellation was economic. However, the MoD officially regretted the decision. The hastened decision to scrap the *Nimrod* on economic grounds was quickly undermined by the clear strategic requirement for maritime surveillance a long-range ASW capability. The MoD therefore established the "Seedcorn Initiative" in 2011, which consisted of Royal Air Force personnel being sent to allied air forces to operate maritime surveillance aircraft in order to maintain and develop surveillance and anti-submarine warfare skills. It would also shorten the time required to regenerate an airborne ASW organization in spite of several years of lacking this capability.[560] In what is likely the most humiliating occurrence in the history of British maritime air operations, the UK had to call on France and Canada for support in 2015 in the search for a Russian submarine operating off the Scottish coast, close to Faslane, the home port of the British strategic nuclear submarines.[561] The new SDSR in 2015 assessed that Great Britain could no longer live without an airborne maritime ISR capability. The decision was presented to procure nine P-8 *Poseidon*, with the goal of flying them operationally by 2019.[562]

559 Cote, "The Third Battle - Innovation in the U.S.Navy's Silent War Struggle with Soviet Submarines," 83–84; Hanley, "Creating the 1980s Maritime Strategy and Implications for Today," 5–6.
560 UK Defense Committee, "Future Maritime Surveillance," Vol I (London: House of Commons, September 5, 2012), 41; George Allison, "First British P-8A Poseidon Will Be 'Ready to Fly with a UK Crew' on Day One of Arriving in the UK," *UK Defence Journal*, July 25, 2018, https://ukdefencejournal.org.uk/first-british-p-8-poseidon-will-be-ready-to-fly-with-a-uk-crew-on-day-one-of-arriving-in-the-uk/.
561 Thomas Gibbons-Neff, "With No Sub-Chasing Aircraft of Its Own, UK Calls on Allies to Help Find Russian Submarine," *Washington Post*, November 23, 2015, https://www.washingtonpost.com/news/checkpoint/wp/2015/11/23/with-no-sub-chasing-aircraft-of-its-own-uk-calls-on-allies-to-help-find-russian-submarine/?noredirect=on&utm_term=.fd82147b45bf; Avionews, "The United Kingdom Has No Maritime Patrol Aircraft, Asks NATO for Help," *Avionews*, October 12, 2014, https://www.avionews.com/item/1164814-the-united-kingdom-has-no-maritime-patrol-aircraft-asks-for-nato-help.html.
562 UK MoD, "National Security Strategy and Strategic Defense and Security Review (SDSR) 2015" (HM Government, November 2015), 37; Defense Contracts Online, "P-8A Programme Progresses" (Defense Contracts Online, (date unknown)), https://www.contracts.mod.uk/do-features-and-articles/p-8a-programme-

In the 2010s, uncertainties arose in Norway as to whether the *Orions* should continue to go through costly upgrades, or be replaced by a new aircraft such as the P-8 *Poseidon*. The comprehensive review of the force structure in 2014 and 2015 led to the Chief of Defence (CHOD) White Paper in 2015, which recommended the discontinuation of the P-3 *Orion* fleet after its operational lifetime, and proposed its replacement by medium altitude/long endurance (MALE) unmanned aircraft.[563] By design, the CHOD white paper was a recommendation to the Norwegian MoD. However, because of the processes of the long-term plan development at the strategic level in the Norwegian Defence Staff, political considerations concerning security policy were not adequately incorporated in the CHOD's formal advice to the Minister of Defence. The main emphasis was rather put on long-term economic sustainability. Thus, when the proposal to phase out the P-3 *Orions* was made in 2015, it was made without adequate security policy considerations.[564]

One of the Norwegian Armed Forces' primary tasks is to conduct intelligence operations, conduct resource and traffic management in areas under Norwegian jurisdiction, and claim sovereignty by showing presence in areas of national interest.[565] The fact that it might take some time before Allied support can arrive in Norway only emphasizes the importance of early warning, or strategic anticipation.[566] When the Norwegian government discusses national contributions to the Alliance, the surveillance effort in the High North is regularly brought forward as one of the most important NATO contributions.[567] In addition, the notion that intelligence represents political capital has increasingly gained traction also in the civilian community in Norway.[568] With the Government's explicit ambition to prioritize the High North and the nation's maritime areas and resources, political traction was gained to maintain the P-3s and to consider a replacement, as opposed to the military advice from the CHOD to replace them with drones. Airborne drones are not capable of conducting underwater search for submarines, although they are expected to achieve this in the near

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progresses/; Allison, "First British P-8A Poseidon Will Be 'Ready to Fly with a UK Crew' on Day One of Arriving in the UK."

563 Norwegian Chief of Defense (CHOD), "A Defense Undergoing Change - Fagmilitært Råd (FMR) - Defense White Paper" (Norwegian Defense Staff (FST), n.d.), 85.

564 Efjestad, Norwegian self-imposed restrictions in the High North.

565 Espen Barth Eide, "Forsvarets Oppdrag i Nordområdene ('The Mission of the Armed Forces in the High North')" (Speech, Nordområdekonferansen, Bodø, March 30, 2006).

566 NTB, "Det Vil Ta Én Til to Måneder for NATO å Hjelpe Norge," *NRK*, April 5, 2016.

567 Forsvarsdepartementet, "NATO-Toppmøtet: Viktige Avklaringer Om Fremtidens NATO" (The Norwegian Government, September 3, 2014), https://www.regjeringen.no/no/aktuelt/NATO-toppmotet-Viktige-avklaringer-om-fremtidens-NATO/id766528/.

568 Anders Madsen, "Etterretning Er Politisk Kapital," *Aftenposten*, February 24, 2016, https://www.aftenposten.no/meninger/kommentar/i/vAkl/etterretning-er-politisk-kapital-per-anders-madsen.

future. This means that replacing the Norwegian MPAs with drones would remove the national long-range airborne ASW capability, a capability recognized as being of strategic importance to Norway. The ensuing Long-Term Planning (LTP) process at the Norwegian MoD in the spring of 2016 thus overturned the P-3 proposal: Norway would instead replace the P-3 *Orions* with a new fleet of P-8 *Poseidons*.[569] The official explanation underlined that the maritime domain and the High North have always been fundamental to Norwegian security politics.[570] Norwegian and adjacent maritime areas are seven times the size of the Norwegian land mass, and the distances are vast. "*These areas have regained their military-strategic importance, and there are no indications on this changing in the near future. The new security policy situation requires improved situational awareness in our areas of interest*."[571] The Norwegian Government also pointed to the international dimension in their justification for procuring the P-8. As NATO is increasingly focussing on the maritime domain, maritime patrol aircraft have become a sought-after resource. As a nation with significant maritime interests, it is of fundamental importance that Norway contributes to "*ensuring freedom of navigation on the high seas, particularly for the transatlantic sea lines of communication, which are fundamental to allied safety and security*."[572] Finally, it is emphasized that the "*combination of a new security policy realm and new generations of submarines entail that modern sensors and systems for surveillance are paramount*."[573] The Norwegian MoD deemed the deliveries from the MPA fleet too important to cut. It was thus a political decision to override the advice of the CHOD.[574] The LTP for the Norwegian Armed Forces was published in the spring of 2016, and additionally included the decision to shut down Andøya airbase and move the MPA fleet to Evenes airbase.[575]

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[569] St.prop. 151 S (2015-2016), "Long-Term Plan for the Norwegian Armed Forces" (Norwegian Ministry of Defense, June 16, 2016), 76.

[570] The Norwegian Government, "Prop. 27 S (2016-2017) - Endringer i Statsbudsjettet 2016 under Forsvarsdepartementet" (The Norwegian Government, November 25, 2016), https://www.regjeringen.no/contentassets/a38d11296b8f4d2a8df432ac430335c4/nn-no/pdfs/prp201620170027000dddpdfs.pdf.

[571] Forsvarsdepartementet, "Norge Har Inngått Kontrakt Om Kjøp Av Fem Nye P-8A Poseidon" (The Norwegian Government, March 29, 2017), https://www.regjeringen.no/no/aktuelt/norge-har-inngatt-kontrakt-om-kjop-av-fem-nye-p-8a-poseidon-maritime-patruljefly/id2546045/.

[572] Forsvarsdepartementet.

[573] Forsvarsdepartementet.

[574] Håvard Klevberg, Discussion - Norwegian MPA capability, Norwegian Ministry of Defense, Oslo, May 24, 2018; Alf Bjarne Johnsen, "Solberg: Vil Overvåke Mer Med Fly Som Forsvarssjefen Vil Skrote," *VG*, October 12, 2015, https://www.vg.no/nyheter/innenriks/i/22RKr/solberg-vil-overvaake-mer-med-fly-som-forsvarssjefen-vil-skrote.

[575] Among other things, the closure of Andøya Air Base and establishment of Evenes as the sole air base in the north, the closure of the coastal national guard and the eventual phasing out of the Navy's corvettes of the Skjold class.

In monitoring Russian testing and development activities from the air, Norway depends on her MPAs. However, according to reports in the media, the Norwegian MPA capability is somewhat limping into the future as of 2020. Sensors upgrades and airframe improvements have been discontinued due to the incoming new aircraft, causing challenges to maintain experienced personnel.[576] The latter seems to be partly due to the decision in the current LTP to close down Andøya airbase and establish the new P-8 capability at Evenes airbase.[577] These challenges have been acknowledged by the MoD, and the focus is to get the P-8 operational as soon as possible after 2023.[578]

After a few years of operational experimentation, testing and evaluation in the US Navy, the large unmanned aircraft *BAMS-D* was given the name *Triton*, and the technical designation MQ-4. The US Navy decided that the *Triton* would complement the *Poseidon* as a part of the overarching BAMS approach mentioned earlier. From focussing on expeditionary warfare on land in the 2000s, the US Navy were in the 2010s returning to a holistic approach to maritime airborne surveillance. In addition to manned and unmanned systems, space-based surveillance has increasingly become an integrated part of maritime surveillance. Through New Space there are now several capable commercial surveillance services available, such as *Airbus*, *Planet*, or *Digital Globe*. These provide imagery with resolution down to a few centimetres, with obvious intelligence value.[579] They are for the most, however, focussed over land and near shore, and have limited value in the search for submarines. The New Space environment facilitated Norway launching her own satellite for maritime surveillance in 2012; a micro-satellite that carries an AIS receiver.[580] New Space, as we shall see, has also facilitated the planned broadband communications satellite that Norway will launch in 2023.

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576 See for example Kjetil Stormark, "Bare ETT Operativt Overvåkningsfly," *Aldrimer.No*, October 29, 2016, https://www.aldrimer.no/norge-har-bare-ett-operativt-overvakingsfly/.

577 Andreas Budalen and Beth Pettersen, "Orion-Flyene Er På Vingene Igjen," *NRK (Online)*, November 8, 2016, https://www.nrk.no/nordland/orion-flyene-er-pa-vingene-igjen-1.13216832. Although also located in the High North, Evenes is too far from Andøya for anyone to engage in a daily commute. The move therefore means that the personnel has to move, or lose their workplace

578 Stortinget, "Skriftlig Spørsmål Fra Willfred Nordlund (Sp) Til Forsvarsministeren," Pub. L. No. 15:607 (2018-2019) (2019); Tony Sivertsen, "Må Forvente Noe Lavere Flyaktivitet," *Vestrålen Online (VOL)*, January 5, 2019, https://www.vol.no/pluss/2019/01/05/%E2%80%93-M%C3%A5-forvente-noe-lavere-fly-aktivitet-18189636.ece.

579 Richelson, *The US Intelligence Community*, 195. See digitalglobe.com, planet.com and intelligence-airbusds.com for examples.

580 In accordance with International Maritime Organization (IMO) regulations, it is mandatory for all civilian ships with a tonnage surpassing 300 tons (and all passenger ships irrespective of size) to emit AIS signals that states the ship's name, course, speed, destination, and other details. A satellite is able to pick up these signals, and create an overview of maritime traffic.

6.5 Chapter conclusion

The post-Cold War era was characterized by a Russia initially attempting to establish herself in a new geopolitical setting, then pursuing renewed ambitions both militarily and geopolitically, massing the economic means to support those ambitions, and then initiating several military campaigns to underscore the Russian comeback on the geopolitical scene. NATO, meanwhile, struggled to find a common area of focus, and the fluctuating strategic focus in the 1990s did not settle until the campaigns in the Middle East began after 9/11 in 2001. Those land-centric campaigns were executed to the detriment of the maritime theatre of operations.

MPAs were increasingly used to support the over-land battle in the late 90s, and even more so in the 2000s. In the cases where MPAs were utilized in the maritime domain, it was to conduct surface surveillance, mostly of civilian movements. This led to a general atrophy in the perishable ASW competency within NATO, and marginalized ASW in the MPA mission portfolio. The significant increase in the use of unmanned aircraft and satellite services have fed into the insatiable requirement for ISR services in counter-insurgency warfare.

This seems to have masked some of the new requirements for modern airborne ASW. New technology has been operationalized that might challenge the assumption of MPAs being the sole answer to handling the new submarines in the north. Satellites and unmanned aircraft seem to have an important role to play in the future. For the time being, however, these new services remain inadequate in the search for submerged submarines.

However, the modern Russian submarine threat poses challenges to the traditional MPA approach. The adversary submarines are now much quieter, they move unpredictably, and they require intra-theatre connectivity and understanding on the part of the hunter. The question remains whether the MPA is the sole answer to the modern Russian submarine threat.

7. A theoretical framework for airborne ISR

7.1 Introduction

There doesn't seem to exist a general theoretical framework for airborne ISR. Volumes of literature have been written about specific aircraft and specific operations, and many of those efforts have been mentioned. Hardly any of them, however, attempt to establish a generic theoretical framework that is specific for airborne ISR. This chapter is the start of an effort to fill that gap.

An obvious starting point for crafting such a framework is provided by military intelligence doctrine on one hand, and by relevant literature from the field of military intelligence studies on the other. On military intelligence doctrine, the most significant publication to date is Joint Publication (JP) 2-0 on "*Joint Intelligence"* issued by the US Department of Defence in 2013.[581] In 2015, the US Air Force further refined intelligence in the air domain into an annex to its core doctrine, Annex 2-0, "*Global Intelligence, Surveillance, and Reconnaissance.*"[582] Both documents describe the intelligence cycle and how it applies to operations and planning in great detail. They are comprehensive and all-encompassing, but they are descriptive in nature. Other than describing the ISR processes as a foundation for intelligence collection in the air domain, they do not provide any theoretical approach to surveillance and reconnaissance through the utilization of aerial platforms, *per se*. Air intelligence doctrine outlines principles for the intelligence process within the air force, but does not project these into a framework in which a principled discussion on the elements of airborne ISR can take place.[583]

Second, there is Group Captain Geoffrey Oxlee's "Aerospace Reconnaissance" published in 1997.[584] Oxlee gives an outstanding description of how airborne reconnaissance forces operate, with a brief historical introduction, followed by individual chapters that discuss in depth the different aspects of sensors, reconnaissance aircraft, and the analysis process. Oxlee

[581] Joint Publication (JP) 2-0, "Joint Intelligence" (United States Department of Defense, October 22, 2013).
[582] Annex 2-0, "Global Integrated Intelligence Surveillance and Reconnaissance Operations" (US Air Force, January 29, 2015).
[583] The Norwegian Armed Forces does not have an intelligence doctrine that is releasable to the public (unclassified). For British general doctrine on intelligence support to operations, see UK MoD, "Joint Doctrine Publication 2-00 - Understanding and Intelligence Support to Operations" (UK Ministry of Defense, 2011); UK MoD, "Joint Doctrine Publication 0-30: UK Air and Space Operations" (UK Ministry of Defense, July 2013), 3-6 - 3-10.
[584] Geoffrey Oxlee, *Aerospace Reconnaissance* (London: Brassey's, 1997).

does not, however, provide a generic approach for a principled discussion on aerial ISR as a system. Also, it doesn't discuss ASW or ISR related to underwater warfare at all. Oxlee's book is specific and descriptive, in that the author goes into detail on sensor parameters, different airframe configurations, and a thorough processing of sensor data that is based on post-flight analysis. Nothing is mentioned on the levels of maturity of sensor products, or how the intelligence products are disseminated to the force. Oxlee's book is a great introduction to aerial reconnaissance, particularly details of post-flight imagery analysis, in an analytical environment with all the tools required at the analyst's disposal – a setting in which the author has a long and distinguished professional background. The place of airborne ISR within the joint battle space, however, is not discussed, leaving the reader with a detailed description of important elements of airborne ISR, but not a theoretical understanding required to discuss it on a generic level.

This chapter first turns to contemporary discussions on ISR and the place of ISR in warfare. It then moves on to discuss what we might term as the basic building blocks and tiers of airborne ISR, drawing on historical studies on the development of airborne and space-based surveillance and reconnaissance. Fundamental to this discussion is the history of maritime ISR and ASW that has been illustrated in the previous chapters. In studying the historical evolution of maritime airborne ISR and ASW in the High North, a region of significant geopolitical importance to NATO and one whose environment and location pose clear challenges, it has become possible to identify the key building blocks that constitute the basic tier of the theoretical framework. The chapter then moves on to briefly discuss the different sensors that are commonly associated with airborne ISR. They constitute the second tier of the theoretical framework. Then, the processing and delivery of the sensor products are discussed, constituting the third and final tier of the theoretical framework. The discussion then turns to armed reconnaissance, and how airborne ISR fits into targeting. Finally, the theoretical framework is discussed in the context of anti-submarine warfare, which is the focal point of this thesis.

7.2 Trends in discussions on airborne ISR

After the Cold War, warfare became limited in time, scope and space, and armed forces were forced to think *joint*. Expeditionary warfare in the 1990s (Gulf War I, Somalia, Balkans) were indications of a new type of warfare, and with the shift to counterinsurgency warfare, intelligence stepped up as more of a core tenet of modern warfare as opposed to the more classic interpretation of intelligence as having an auxiliary, supporting role. This is where "ISR" grew into its own, and became an integrated part of the "network-centric warfare" movement. "ISR" as a term came into daily usage in the mid-1990s, after first being coined by the United States Vice Chairman of the Joint Chiefs of Staff Admiral Owens, pointing to ISR as a vital component of modern warfare, implemented through the concept of net-centric warfare.[585] A network-centric approach to warfare is essentially the military embodiment of information age concepts. It is the linkage of computers, communications, sensors and military units in order to improve efficiency and effectiveness of military operations.[586] Or as John Ferris puts it, it is "*the idea that armed forces will adopt flat structures, working in nets on the internet, with soldiers at the sharp end able to turn data processing systems at home into staffs through 'reachback', real time, immediate and thorough inter-communication.*"[587] In short, it is about gathering, interpreting, disseminating, and acting upon information in the battlefield – faster than your opponent. The tenets of netcentric warfare thus facilitate a networked force in order to improve information sharing, which in turn will enhance the quality of information and shared situational awareness, which will enable collaboration, self-synchronization, sustainability and speed of command, which finally will increase mission effectiveness.[588] The most prominent critique of an exaggerated emphasis on netcentric warfare is the focus on technology that usually encompasses such an emphasis. Critical voices in the early and mid-2000s pointed to important elements of command and warfare in general being eroded in favour of an emphasis on quantitative measurements (number of targets hit, numbers of areas covered through surveillance etc.), and what some commentators have termed the "*fetishisation of speed and tacticisasion of strategy*."[589] Netcentric warfare is not the topic of discussion for this thesis, however, any discussion of modern ISR should take into account developments of modern armed forces as a whole, in order to make the gathered intelligence products actionable to the rest of the joint force.

[585] See Deptula and Brown, "A House Divided - The Indivisibility of Intelligence, Surveillance and Reconnaissance."
[586] Clay Wilson, "Network Centric Warfare: Background and Oversight Issues for Congress" (Washington, D.C.: Congressional Research Service, June 2, 2004), CRS-2.
[587] John Ferris, "Netcentric Warfare, C4ISR, and Information Operations: Towards a Revolution in Military Intelligence?," *Intelligence and National Security* 19, no. 2 (2004): 199–225, 199.
[588] John Luddy, "The Challenge and Promise of Network-Centric Warfare" (Arlington, VA: Lexington Institute, February 2005), 3.
[589] See for example Ferris, "Netcentric Warfare, C4ISR, and Information Operations: Towards a Revolution in Military Intelligence?", 201.

Military developments in the new millennium have been characterized and shaped by Western military engagements in the Middle East. The focus has largely been on Counter-Insurgency (COIN) operations, with a significant decline in focus on other warfare areas, such as ASW, especially when compared to the Cold War.[590] Discussions over the past decade highlight a concern with *how ISR fits into new modes of warfare* and have been subject to many articles. It was underlined that ISR must be approached as a "synergistic whole", and how ISR provides battlespace awareness and further decision superiority when utilized and integrated properly.[591] There were warnings a few years into the Middle Eastern campaigns that the ISR community was heading in the wrong direction.[592] The focus seemed to be exclusively on real-time, tactical processing of sensor data, which, the argument went, was eroding the analysts' ability to conduct long-range predictive analysis.[593] John Ferris commented that "*'computers' have eaten qualities once assigned to 'command' while 'intelligence' has diminished, as an idea connoting 'to think' slips into one meaning 'to sense'*."[594] One important element from the discussions is that ISR is all about delivering *effect*: The decision maker, at the various levels, must be informed with actionable intelligence in order to facilitate effect in operations. The emphasis within ISR efforts must be on *qualitative effects*, and not a *quantitative focus* on the number of areas and targets surveyed.[595] The balance between focus on actions and focus on effects, an overarching, strategic, joint approach to the development of ISR, intelligence sharing between services and nations, and the role of leaders' sound direction and guidance for ISR operations are all key factors to proper integration of ISR into warfare.[596]

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590 John O. Birkeland, "The Potential of LIDAR as an Anti-Submarine Warfare Sensor" (M.Phil (R), War Studies, University of Glasgow, 2009), 54-55; William Perkins, "Alliance Airborne Anti-Submarine Warfare - A Forecast for Maritime Air ASW in the Future Operational Environment" (Joint Air Power Competence Centre (JAPCC), June 2016), 45-46.
591 Deptula and Brown, "A House Divided - The Indivisibility of Intelligence, Surveillance and Reconnaissance."
592 For discussions on the intersection between COIN and intelligence, see for example Dan Zeytoonian et al., "Intelligence Design: COIN Operations and Intelligence Collection and Analysis," *Military Review*, October 2006.
593 Daniel P. Shibilski, "Future of Air Force Intelligence," *United States Naval Institute Proceedings* 132, no. 2 (February 2006).
594 Ferris, "Netcentric Warfare, C4ISR, and Information Operations: Towards a Revolution in Military Intelligence?," 204.
595 See also Jaylan M. Haley, "An Evolution in Intelligence Doctrine - The Intelligence, Surveillance, and Reconnaissance Mission Type Order," *Air & Space Power Journal* 26, no. 5 (Fall 2012).
596 Examples of articles discussing these factors in modern ISR support to operations are A. Denis Clift, "Intelligence in the Internet Era - From Semaphore to Predator," *Studies in Intelligence* 47, no. 3 (2003); William B. Danskine, "Aggressive ISR in the War on Terrorism - Breaking the COld War Paradigm," *Air & Space Power Journal* 19, no. 2 (Summer 2005); John Kriendler, "NATO Intelligence and Early Warning" (Swindon, England: Conflict Studies Research Centre, Defense Academy of the United Kingdom, March 2006);

Another prominent factor for discussion in the 2000s with regards to ISR was the *efficient tasking and utilization* of ISR assets. The insatiable desire for more information and expectations of ISR support by any ground commander executing any mission, combined with a constant shortage of ISR assets to service all requests meant that the question of efficient tasking took centre stage in discussions within the intelligence community. A central challenge pertains to integrating ISR assets into the Air Tasking Order (ATO), a 72 hour tasking cycle revolving around attack aircraft and targeting.[597] Some claim that the ATO process is outdated, static and built around assumptions and dynamics from the Cold War; it is based on symmetry in warfare, pre-planned targeting, and peer-to-peer warfighting.[598] One must move away from the quantitative placement of assets towards targets, to a qualitative focus on the commander's intent – the underlying *purpose* of the operation must be at the forefront of the execution of any operation.[599] This is based on the relatively high level of authorization required for the use of lethal force in aerial targeting. One idea to remedy this is to embed "*ISR Tactical Controllers*" with ground units for optimal utilization to the supported entity.[600] This would provide an important "translation" of terminology between the ground unit and the air unit, and likely improve the use of specific assets in support of specific units on specific missions, much like the forward air controller vis-a-vis Close Air Support (CAS).[601]

Jeff S. Hinrichs, "Education in Intelligence, Surveillance, and Reconnaissance beyond the 'Green Door,'" *Air & Space Power Journal* 22, no. 2 (Summer 2008); Deptula and Brown, "A House Divided - The Indivisibility of Intelligence, Surveillance and Reconnaissance"; Deptula and Fransisco, "Air Force ISR Operations - Hunting versus Gathering"; Dagvin R.M. Anderson, "A Holistic Approach to Intelligence, Surveillance and Reconnaissance," *Air & Space Power Journal* 25, no. 4 (Winter 2011); Haley, "An Evolution in Intelligence Doctrine - The Intelligence, Surveillance, and Reconnaissance Mission Type Order"; Jason M. Brown, "Airpower Is Intelligence, Surveillance, and Reconnaissance," *Air & Space Power Journal* 27, no. 4 (August 2013); Matthew J. Martin, "Unifying Our Vision - Joint ISR Coordination and the NATO Joint ISR Initiative," *Joint Force Quarterly (JFQ)*, no. 72 (Quarter 2014); Nicholas P. Cowan, "Rethinking Command and Control of Intelligence, Surveillance and Reconnaissance (ISR)" (U.S. Air Force, July 2015).

[597] For an outstanding account of the evolution, shortfalls and potential of the ATO Cycle, see Robert P. Winkler, "The Evolution of the Joint ATO Cycle" (Master of Science in Joint Campaign Planning and Strategy, Norfolk, VA, Joint Advanced Warfighting School, 2006), dtic.mil/cgi-bin/GetTRDoc?AD=ADA451239.

[598] Michael L. Downs, "Rethinking the Combined Force Air Component Commander's Intelligence, Surveillance, and Reconnaissance Approach to Counterinsurgency," *Air & Space Power Journal* 22, no. 3 (Fall 2008).

[599] Cowan, "Rethinking Command and Control of Intelligence, Surveillance and Reconnaissance (ISR)"; Carl Rhodes, Jeff Hagen, and Mark Westergren, "A Strategies-to-Tasks Framework for Planning and Executing Intelligence, Surveillance, and Reconnaissance (ISR) Operations" (RAND, Project Air Force, 2007).

[600] Adam B. Young, "Employing Intelligence, Surveillance, and Reconnaissance - Organizing, Training, and Equipping to Get It Right," *Air & Space Power Journal* 28, no. 1 (Jan-Feb), 2014.

[601] See for example Steven Maceda, "Control of Theater Intelligence, Surveillance, and Reconnaissance for the Ground Commander," *Air & Space Power Journal* 22, no. 4 (Winter 2008).

Never before have intelligence products been as available as they are now to military units, whether they belong to the tactical, operational, or strategic level. This immense amount of information does pose significant challenges. The requirement to process and analyse significant caches of data ("Big Data") has prompted further discussions pertaining to the requirement for onboard computers, to autonomously process sensor information into actionable intelligence, through so-called autonomous *processing, exploitation and dissemination* (PED). Autonomous PED will eventually provide the foundation for inflight analysis and the in-flight transmission of processed intelligence. Other challenges, such as control of unmanned systems beyond-line-of-sight (BLOS), survivability in contested airspace, common command and control infrastructure, open architecture, and standardized data link systems, are all lessons from the past 20 years that are shaping discussions for the future development of airborne ISR.[602]

In order to contextualize the discussion on ISR requirements in the High North, it is beneficial to arrive at a few basic elements to frame that discussion. It is the ambition of this thesis to build a theoretical foundation for just such a discussion; one that can also facilitate a framework for similar assessments elsewhere and in a different strategic and tactical setting. A generic framework will put factors such as range, communications and sensors at the appropriate level, and structure the characteristics of airborne ISR under what really matters: The effect delivered to the force. By analysing the history of airborne ISR, manned or unmanned, aircraft or satellite, it has become possible to identify three categories or tiers that should structure the discussion of the characteristics and capabilities involved. The lowest and most basic tier includes the factors that facilitate airborne ISR in the first place. They have been narrowed down to altitude, speed, range, communications, and survivability. The second tier consists of the sensors that the airborne asset is carrying, facilitating the respective intelligence products that can be delivered. The top tier involves the processing and eventual dissemination of these products, in a given *time* and with a given *product maturity*. The actual sensor data processing is an important factor for airborne ISR, as it is for

[602] For more details, see for example Slava Frayter and Koen Willems, "Increased Efficiency or Beyond Line-of-Sight in Airborne ISR Operations" (National Geospatial Agency (NGA), 2013), proceedings.spiedigitallibrary.org/proceeding.aspx?articleid=1688649; David Bottom, "Overcoming ISR Data Challenges" (National Geospatial Agency (NGA), 2013), spie.org/Publications/Proceedings/Paper/10.1117/12.2019033; USAF Chief Scientist, *Technology Horizons - A Vision for Air Force Technology 2010-2030* (Maxwell AFB, Montgomery, Alabama: Air University Press, 2010); Mike Fowler, "The Future of Unmanned Aerial Vehicles," *Global Security and Intelligence Studies* 1, no. 1 (Fall 2015); Jenny R. Holzer and Franklin L. Moses, "Autonomous Systems in the Intelligence Community: Many Possibilities and Challenges," *Studies in Intelligence* 59, no. 1 (2015); Puong F. Yeh, "The Case for Using Robots in Intelligence Analysis," *Studies in Intelligence* 59, no. 4 (2015).

all intelligence collection and dissemination. In cases where there is no on-board processing capability, neither human nor automated, the sensor data is transmitted raw. If there is a processing capability on-board, whether it be by humans or computers, the airborne asset becomes capable of disseminating processed intelligence to some degree of maturity. Real-time dissemination of sensor data more or less exclusively consists of raw sensor data. Strategic intelligence, on the other hand, has been processed, validated and contextualized, but it takes time to reach that maturity level. Together, these three tiers of airborne ISR comprise a generic, theoretical framework.

7.3 Tier 1: Characteristics of airborne ISR

If we narrow down the history airborne ISR to the basic building blocks that comprise the act of exploiting the air domain for information gathering, we note that some enduring elements stand out. The basic characteristics of airborne ISR are therefore the building blocks that facilitate the missions that aircraft are tasked to execute. The exploitation of the air rests on the three enduring tenets of airpower: altitude, speed, and range.[603] In addition, there are two basic facilitators for battlefield integration; communications, and survivability.

Height, or *altitude*, was the original attribute required by surveillance aircraft in order to gain the proper perspective. Altitude is a matter of giving the sensor the appropriate elevation for the right angle and placement against a target. The higher the altitude, the further the sensor is able to see and detect signals. The higher the altitude the less impact elevated features such as tall buildings and mountains have on the ability to collect on the target. However, higher altitudes demand more capacity from the sensors – for optical sensors this means a requirement for a larger aperture. Higher altitudes also mean more interference for the RF antennae attempting to distinguish between many more signals in the air than is the case at lower altitudes. Very high altitudes also demand special engines for the aircraft flying in ultra-thin air. And, of course, the higher the altitude the greater the chance of weather and cloud coverage obscuring the target for optical sensors. Traditional maritime patrol aircraft have been operating at very low altitudes, and have been equipped with turbo-propeller engines, which are more efficient at low altitudes. Traditional MPA tactics, as the ones utilized during the tracking of Soviet submarines in the 1970s and 1980s, demand low

[603] The Royal Norwegian Air Force, "Forsvarets Doktrine for Luftoperasjoner" (The Norwegian Armed Forces, 2018), 17.

altitudes in order to plot sonobuoys that have been dropped into the water onto the tactical overview. Low altitude has also facilitated a higher responsiveness with regards to attacking the target as well as getting close enough for a visual confirmation of any target close to or on the surface. Jet aircraft have traditionally flown at much higher altitudes because they operate more efficiently in thinner air. But at very high altitudes, this changes again, and the thin air requires specialized jet engines. Lower altitudes give a more recognizable picture to the interpreter of the imagery, both for technical analysis and by untrained operators. The low altitude of small, tactical unmanned systems used extensively in the past two decades has lowered the threshold for "layman" interpretation of imagery, simply because the aspect of the imagery is familiar to the operator.[604]

Speed is another original tenet of airpower in general, and of airborne ISR specifically. Speed allows you to cover a larger area, respond rapidly to an incident, and increase survivability. An extreme example of speed is the SR-71 *Blackbird* ISR aircraft, flying more than three times the speed of sound. Likewise, modern jet-powered MPAs fly faster and are thus more responsive compared to older, propeller-driven models. The ability to respond to a situation or incident somewhere can be crucial for intelligence collection. The last known position of a submarine, or datum, is a good example of this. In operations where ISR aircraft have flown fast and low in order to avoid detection and enemy fire, it was at times a challenge to get images with clarity and proper resolution.[605] Lower speeds and higher altitudes have mitigated this issue. Finally, speed facilitates a larger area covered for surveillance in a mission. MPAs have evolved from relatively slow flying propeller aircraft to much faster jet-powered MPAs. This will facilitate both shorter reaction times and coverage of larger areas.

Range – the ability to fly beyond enemy lines, to observe remote locations, to monitor the vast oceans – has always played a key role for airborne intelligence collection. Range is also one of the characteristics of modern ISR aircraft to influence how ISR is integrated into over-

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[604] See for example Ferris, "Netcentric Warfare, C4ISR, and Information Operations: Towards a Revolution in Military Intelligence?," 220–21. There has also been a range of articles and books on mistakes done by drone operators in assessing a potential target for a drone attack, leading to the killing of innocent people, see for example Gregoire Chamayou, *Drone Theory* (New York: Penguin Random House, 2015); Ed Pilkington, "Life as a Drone Operator: 'Ever Step on Ants and Never Give It Another Thought?,'" *The Guardian*, November 15, 2015; Ryan Devereaux, "The Drone Papers - Manhunting in the Hindu Kush," *The Intercept*, October 15, 2015, https://theintercept.com/drone-papers/manhunting-in-the-hindu-kush/. A good article with a defence of drone operations is T. Mark McCurley, "I Was a Drone Warrior for 11 Years. I Regret Nothing.," *Politico*, October 18, 2015, https://www.politico.com/magazine/story/2015/10/drone-pilot-book-213263. Regardless of viewpoint, the lowered threshold for acting militarily on imagery is on display in the mentioned material.

[605] Oxlee, *Aerospace Reconnaissance*, 88; Doug Gordon, *Tactical Reconnaissance in the Cold War* (Barnsley: Pen & Sword Aviation, 2006), 181.

land operations. Some unmanned aircraft can stay aloft for more than 24 hours, which facilitates more or less continuous monitoring of targets, which again leads to greatly improved battle-space awareness.[606] Aircraft endurance is not necessarily connected to the level of warfare, although most short-range aircraft are utilized tactically, and most strategic aircraft have a long endurance. In the middle we find aircraft servicing the operational level, that boast immensely long endurance but can provide surveillance over one specific area for the tactical or operational level. Maritime surveillance and reconnaissance usually require long endurance due to the vast surveillance areas or the remote target location. Maritime airborne ISR also entails peripheral intelligence flights along the border of foreign countries, normally requiring long endurance as well. Range and lack of range have also been instrumental in the geographical delineation of responsibility between different MPA nations in the North Atlantic, as we have seen. Furthermore, increased range has the potential of changing international dynamics in the High North with regards to airborne surveillance, where new technology can bypass any Norwegian national guidelines for operating in the Arctic that might apply.

The most central aspect with *communications* for airborne ISR assets is the ability to transmit sensor data to a receiving unit for action. The time it takes for sensor products to be transmitted to a receiving unit on the battlefield is correlated to the level of battlefield integration. Following this, the requirement for urgent transmission of intelligence has led to ever increasing demands for "real-time intelligence." From a technological standpoint this means that the ISR aircraft has its communications suite connected to it sensor(s) or sensor processing systems, which enables the airborne asset to transmit either real-time, or parts of the gathered sensor data after processing it to a certain degree in near real-time. As the previous chapters have shown, communications for MPA in the High North have traditionally not been a major issue, due to the nature of the operations and the lack of any requirement for detailed, high bandwidth instant communication. However, new adversary technology and *modus operandi* are posing new requirements for communication solutions in the Arctic. In an increasingly complex battlespace, there is an imperative to be connected with the rest of the force through the use of data link systems. Link systems provide awareness of friendly and enemy positions, awareness of threats to own unit and the force as a whole, and updates

[606] John L Trefz, "From Persistent ISR to Precision Strike - The Expanding Role of UAVs" (Master's Thesis, Rhode Island, NY, Naval War College, 2003), 12–14.

to battlespace developments. They provide an automated ability to communicate and coordinate with the rest of the force.[607]

The reciprocal element of transmitting data from the aircraft is receiving updated information from the ground. This usually involves directions and guidance for employment of the ISR asset, and can involve updated orders in case of a manned aircraft, or electronic steering and detailed waypoints for an unmanned aircraft. This can be summarized as the ability to execute command & control (C2) of an ISR asset. In the context of airborne ISR, C2 is about the level of ability to communicate intentions and requirements, and receive orders and requirements from other units.[608] Dynamic C2 rests on the ability to communicate, and the ability to change areas for surveillance and reconnaissance and the coordination and de-confliction with other aircraft such changes entail. The way any ISR aircraft is tasked for its mission also falls under C2 and shapes the flexibility in the utilization of that aircraft. Most historical strategic reconnaissance and surveillance were executed with minimal input from any higher entity: They flew on orders given before the flight, and received few amendments *in situ*. Most modern airborne ISR aircraft are in continuous contact with their commanding authority, which either makes them flexible to strategic or operational demands during the mission, or has them answer to orders from the supported tactical ground unit at any given time. It must be stressed that in the context of this theoretical framework, the focus is the ability to *integrate* C2, rather than on C2 *per se*. It is about the ability to receive orders and changes *in situ*, not about how orders have been developed or from what level in the military hierarchy those orders were transmitted. This aspect is particularly important when we discuss autonomy in military units, manned or unmanned.

Survivability is another core characteristic of any aircraft operating close to, or within adversary or contested airspace. Of great importance during ASW missions during the Cold War, a generation of warfighters has in the new millennium operated in war-zones in the Middle East with little to no air threat, nor threats from the ground or surface. Most planners and analysts agree that future warfare will not necessarily entail such freedom of manoeuvre in the air, and threats from both enemy air, ground and maritime units will demand a much higher degree of survivability through self-protection than has been and is the case for many military ISR aircraft. However, the mission being executed shapes the necessity for self-

[607] Thor A. Simensen, "Link-11 Communication" (Master's Thesis, Monterrey, CA, Naval Postgraduate School (NPS), 1992), 8–9.
[608] Cowan, "Rethinking Command and Control of Intelligence, Surveillance and Reconnaissance (ISR)," 12–15.

protection: Tactical maritime reconnaissance aircraft far out to sea usually have fewer concerns about being shot down, but aircraft approaching the firing-range of hostile surface-to-air missiles will have to function with an increased level of risk, or be able to protect themselves against the threat.

This is an important aspect of any warfighting aircraft, but the dangers associated with even peacetime reconnaissance during times of tension is shown through all the ISR aircraft that have been shot down outside of war.[609] Survivability can be improved through a host of measures. Speed and altitude were historically the main features of survivability, but now – in response to the advances made in the field of missile technology – counter-measures within the airframe of an aircraft designed to neutralize or defend against incoming attacks have come to play a more important role. Classic examples are physical measures such as deploying chaff, which are streams of metal that disturb the radar picture of incoming missiles, and flares, which are chemical elements deployed burning at an extremely high temperature, in order to disturb heat-seeking missiles. Further, there are jamming devices that will disturb the radio-frequency spectrum for enemy aircraft and missiles, and lasers that dazzle hostile sensors attempting to track an aircraft. The discussion around the *Atlantic* procurement program showed that weapons, too, play a role in an aircraft's self-defence.

The core characteristics of airborne ISR can thus be listed as the following:

Altitude of the asset	Communication capabilities
Range of the asset	Survivability & self-protection
Speed of the asset	

Table 7-1. Core characteristics of airborne ISR (Tier 1)

With every airborne ISR mission and aircraft through history we see these characteristics to differing degrees. They do vary by airframe, which shapes aircraft capability in total. However, every core characteristic has implications for the others. Long endurance potentially denotes a significant amount of data that must be processed and analysed. The level of survivability affects areas the asset can cover and fly into, with implications for command & control, and the ability to communicate with friendly units. These are but a few examples, but they show an inter-connectedness among the basic building blocks of airborne

[609] For a detailed account of Western surveillance and reconnaissance aircraft that were shot down during the Cold War, see Larry Tart and Robert Keefe, *The Price of Vigilance - Attacks on American Surveillance Flights* (New York: Ballantine Books, 2001).

ISR, as highlighted by the negotiations to procure a common MPA for NATO during the late 1950s.

7.4 Tier 2: Sensors

Tier 2 covers the type of intelligence *products* an airborne asset is capable of developing. These products depend on the *sensors* an aircraft is able to carry. Sensors, then, are the key to any type of remote sensing, and the utilization of sensors essentially comes down to efficient exploitation of the electromagnetic spectrum. The improvement in sensor technology over the past century has been immense, from the early handheld cameras to today's hyperspectral sensors that are able to distinguish between different types of materials through frequency analysis.

In the history of airborne ISR, the first sensor utilized for elevated observation was, of course, the human eye. But as soon as technology evolved, cameras were utilized, providing the basis for IMINT.[610] The most common airborne ISR sensors are electro-optical (EO) cameras that provide still and moving imagery. By now, IMINT includes advanced mapping and imagery radars, such as SAR, and a host of other imaging sensors, such as infra-red sensors, spectral imagery, and lidars. Further, as interception and exploitation of electronic signals through the air became reality, the analysis of enemy usage of the electromagnetic spectrum led to airborne SIGINT. SIGINT is traditionally deduced to analysis of ELINT, and interception of adversary communications, facilitating COMINT. In addition, collecting signals between a missile being tested and the controlling ground station known as telemetry, is considered foreign instrumentation and signals intelligence (FISINT), which also falls under SIGINT. In the context of maritime airborne surveillance and of particular interest of this thesis, intelligence collection on submarine sound signatures have played a crucial part in the art of ASW, as will be discussed in the final chapters. ACINT is thus an important discipline for reconnaissance and surveillance in the maritime arena. It is important to note that airborne and space-based sensors are (still) not able to penetrate water, in the sense that they can conduct underwater search from up high. For this, one is still dependent on sensors in the water, such as sonars mounted on a ship, or sonobuoys dropped into the water.

[610] IMINT is part of Geospatial Intelligence (GEOINT), where the purpose is to "*describe, assess, and visually depict physical features and geographically referenced activities on Earth*." See JP 2-0 "Joint Intelligence" for details.

This list is clearly not exhaustive, but it portrays the most common intelligence *products* delivered by airborne sensors. It is important to note that the requirement for analysing and interpreting sensor data before it can be put to use varies from sensor to sensor. EO camera imagery, for example, is assumed by many to be the most intuitive data to interpret and understand. However, the notion that a "picture is a picture", as some laymen seem to think, can have serious consequences for decisions in targeting situations. This factor will be further discussed below.

7.5 Tier 3: Processing and delivery of intelligence products

Having described the two lower tiers of airborne ISR, we have now arrived at the crux of airborne ISR: the intersection between intelligence and operations.[611] Turning to history again, as well as lessons from modern warfare, there is a clear link between the level of interaction with ground and/or surface units and the level of warfare intelligence assets are serving: *tactical* intelligence collection – close interaction with ground units; *strategic* intelligence collection – no interaction with ground troops. The type of information gathered is also linked to the level of warfare intelligence assets are serving: information on enemy troop movements – tactical; targeting information for war plans – strategic. In the absence of war, the utilization of airborne intelligence assets was more or less exclusively strategic. The operational requirements that are at the forefront of planning and operational discussion drive investment to service those requirements. In between wars, this means strategic, future requirements. During wars, the ongoing fighting on the ground and at sea shaped urgent developments of intelligence and weapons systems. In order to stay true to the core and purpose of airborne intelligence collection – the support of operations based on decision-makers' intent – we must dare to point to the very intersection between airborne intelligence products and operations being supported. Two basic tenets can be derived, forming the top tier in a theoretical approach to airborne ISR.

The level of warfare being supported can be expressed in a more principled manner: *time*. If the intelligence collector is supporting the development and adjustment of war plans, it is considered to be support of a strategic nature, and the intelligence *takes time* to develop and

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[611] Michael I. Handel, "Intelligence and Military Operations," *Intelligence and National Security* 5, no. 2 (1990): 1–95; Ferris, "Netcentric Warfare, C4ISR, and Information Operations: Towards a Revolution in Military Intelligence?"; Anderson, "A Holistic Approach to Intelligence, Surveillance and Reconnaissance"; Deptula and Brown, "A House Divided - The Indivisibility of Intelligence, Surveillance and Reconnaissance"; Brown, "Airpower Is Intelligence, Surveillance, and Reconnaissance."

contextualize. Also, this type of strategic intelligence will have time to mature in the sense that it can be supported by other sensors and intelligence sources for the sake of corroboration and verification. The interaction with ground units with specific regard to strategic intelligence does not usually take place – that type of interaction becomes almost irrelevant.

On the other end of the scale we find the real-time dissemination of sensor products – for instance streaming of live video – from a collecting asset down to ground and surface units. At the lowest level, this is dissemination of a raw, unprocessed sensor product to the consumer. It is picked up by the respective sensor, and the only delay in transmission is whatever delay would be inherent in the electronic system converting data from a sensor format to transmittable information.[612] This is common practice at the tactical level.

The element of time is thus closely linked to the level of warfare that the ISR assets are serving. It is further connected to the type of targets the surveillance and reconnaissance efforts are covering. One important factor in the assessment of the level of warfare being supported is the ability and willingness to share the sensor-products, processed or unprocessed, with the joint force or other national entities.

- Combat information and tactical intelligence[613]: Sensor products which are transmitted in order to build an understanding of the target in real-time, should be considered *combat information*. Combat information is not processed and contextualized by an analyst at all, but used by the receiving unit in direct support of tactical actions. Airborne ISR here supports immediate and local action, limited in time and space. *Tactical intelligence* is information that is not utilized or acted upon immediately, but facilitates the planning and execution of tactical actions that will take place within minutes, hours, or days after receiving the information.[614]

[612] For an interesting discussion on the development of this capability in the early 1990s, see James P. Marshall, "Near-Real Time Intelligence on the Tactical Battlefield," Research Report (Maxwell AFB, Montgomery, Alabama: Air University, January 1994).
[613] NATO defines the "tactical level" of war as "*the level at which activities, battles and engagements are planned and executed to accomplish military objectives assigned to tactical formations and units*." (AAP-06)
[614] For a discussion on the challenges of near-real time distribution of sensor products and intelligence following the Gulf War in 1991, see Marshall, "Near-Real Time Intelligence on the Tactical Battlefield," 47–78.

- Operational intelligence[615]: Sensor products that are analysed and provide a basis for how the operational level distributes its forces should be considered operational. Any airborne ISR product that builds a foundation for near-term planning approximately 3-30 days out, at the joint force level, should be considered *operational* ISR.

- Strategic intelligence[616]: U-2 aircraft flying over Soviet missile sites during the Cold War, and maritime patrol aircraft monitoring enemy ballistic missile test firings from submarines were gathering information on enemy strategic capabilities. The intelligence products inform own weapons and systems development, and deliver crucial information to war planners at the strategic level. The level of warfare being supported is these cases are therefore *strategic*.[617]

Any and all sensor data are interpreted at some point, either by a soldier that sees the imagery or other raw data, or by a trained analyst that processes, interprets and possibly collates the data and places it in a tactical, operational, or strategic context. The importance of this aspect is just this: imagery is not necessarily as easily interpreted as one would think, and there are trained analysts for every type of sensor information. Some ISR aircraft transmit their data in real-time, leaving it to the recipient to understand what is being seen on the screen. Other aircraft, with sensor operators on-board, can do basic interpretation on-board and provide tactical and operational updates to the force based on onboard processing. Others yet again bring raw sensor data back to their home base where the sensor data is thoroughly analysed and contextualized. This spectrum of sensor analysis is shaping *how* intelligence products are utilized, and *at what level* they are being utilized. As we shall see, these elements are also crucial for any discussion on autonomous PED to begin.

Historians discussing airborne ISR conducted during the Cold War highlight the sporadic shift between strategic and tactical focus for the ISR community.[618] This shift back and forth

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615 NATO defines the "operational level" of war as "*the level at which campaigns and major operations are planned, conducted and sustained to accomplish strategic objectives within theatres or areas of operations*." (AAP-06)

616 NATO defines the "strategic level" of war as "*the level at which a nation of a group of nations determines national or multinational security objectives and deploys national, including military, resources in order to achieve them.*" (AAP-06)

617 For an introduction to the different levels of war and their relationship to intelligence, see Handel, "Intelligence and Military Operations," 26–27.

618 John T. Furquhar, *A Need to Know: The Role of Air Force Reconnaissance in War Planning, 1945-1953* (Maxwell AFB, Montgomery, Alabama: Air University Press, 2005); Tyler Morton, "Ears and Eyes in the Sky: The Evolution of Manned Airborne ISR" (Master's Thesis, Maxwell AFB, Montgomery, Alabama, School of Advanced Air and Space Studies, 2012), www.dtic.mil/get-tr-doc/pdf?AD=AD1019401.

is, if not problematic, challenging both for operators and analysts, and the organization as a whole. With the uncertainties that exist on the nature of future conflicts, an ISR organization must be prepared to service the *entire* spectrum of operations. There is a comparison to be made between the Cold War shifts in focus and contemporary ISR units that have been accustomed to a tactical focus for two decades, and that might face strategic challenges in the future. Commentators have also warned of too much tactical focus and what they perceive as "neglect of strategic intelligence", calling for a holistic approach to strategic intelligence as fundamentally necessary to encompass all other intelligence activities.[619] This warning is closely linked to the aforementioned "fetishization of speed and tacticisation of strategy." The historical chapters of this thesis have shown airborne ASW to be an excellent case study of the spectrum in sensor analysis, ranging from real-time processing and immediate use of sensor data for their own targeting in a tactical setting, to post-flight, deep analysis of sensor data facilitating platform, weapons and sensor development in a strategic sense. Another historical example is the effort that went into introducing the new ELINT tools to modern warfare – the actual benefits from these new operations were questionable.[620] Several factors played their part: The lack of understanding with commanding officers for intelligence as a tool; the lack of ability to change perspective on operations and plans based on new intelligence that contradicts that baseline perspective; and, of course, the organisational challenges that echo to this day – a warfighting organisation that does not necessarily know and understand how to process and effectively and efficiently disseminate the information that comes out of the intelligence processes.[621]

In any case, the sensor data being collected are either analysed onboard for own use (e.g. weapons drop); transmitted as raw data in real-time, correlated with a database, and then transmitted; they are interpreted by a sensor operator before transmission; or they are

[619] For more on this discussion, see John G. Heidenrich, "The State of Strategic Intelligence. The Intelligence Community's Neglect of Strategic Intelligence.," *Studies in Intelligence* 51, no. 2 (2007); Deptula and Brown, "A House Divided - The Indivisibility of Intelligence, Surveillance and Reconnaissance"; Harrison Donnelly, "Q&A - Lt.Gen. John C. Koziol, Deputy Under Secretary of Defense, Joint and Coalition Warfighter Support, Directore DoD ISR Task Force," *Geospatial Intelligence Forum* 8, no. 6 (September 2010); Deptula and Fransisco, "Air Force ISR Operations - Hunting versus Gathering."

[620] John Ferris and Michael I. Handel, "Clausewitz, Intelligence, Uncertainty and the Art of Command in Military Operations," *Intelligence and National Security* 10, no. 1 (1995): 17–30.

[621] For writings on general intelligence theory, see for example Michael Herman, *Intelligence Power in Peace and War* (Cambridge: Cambridge University Press, 1996); David Kahn, "An Historical Theory of Intelligence," *Intelligence and National Security* 16, no. 3 (2001); Lock Johnson, "Bricks and Mortar for a Theory of Intelligence," *Comparative Strategy* 22, no. 1 (2003): 1–28; Arthur S. Hulnick, "What's Wrong with the Intelligence Cycle?," *Intelligence and National Security* 21, no. 6 (2006): 959–79; Michael Herman, J. Kenneth McDonald, and Vojtech Mastny, "Did Intelligence Matter in the Cold War?," *Forsvarsstudier*, no. 1/2006 (2006).

analysed post-flight and then disseminated. This relates to the second axis of intelligence processing in support of effects and intent: *the maturity of the intelligence product*. It is useful to distinguish between tactical and strategic processing of raw sensor data. Data with *tactical maturity* refers to sensor data that has been analysed sufficiently to be acted upon in a tactical situation. For acoustic data, it is usually the direction or range to the submarine from the sonobuoy in the water, in other words, positional data. Even in this category there are sub-levels of maturity, for example, if the sensor operator is too uncertain about a frequency line for it to be entered into the tactical plot of the aircraft. But if further analysis brings more clarity and certainty, the information can be taken into the plot and acted upon. Once it becomes an active part of the tactical calculations and assessment, we can term the sensor data tactically mature. The other category of maturity is of a strategic nature. In terms of acoustic data, this is a level of maturity that comes after time-consuming analysis post-mission, where analysts can dwell on certain frequency lines to identify more and new characteristics of the submarine itself. When information from several sonobuoys are analysed together, analysts are able to find out details on propulsion and propeller blades, machinery internal to the submarine, equipment external to the submarine, details of the gear box technology and more. This information in turn can be used to describe the actual capabilities of the submarine, what types of missions she can be expected to perform, and other types of information of strategic nature. It provides insight into submarine deployments and behaviour, which, in turn, can help provide insight on enemy operations and strategy. This type of information has been pivotal of NATO's understanding of Soviet and later Russian strategy and operating concepts and capabilities. This level of intelligence can be termed *strategic maturity*, but is too time-consuming and complex to be performed in-flight. Strategically mature sensor data plays a crucial role for many processes, such as the development of own submarines, new sensors and the improvement of existing ones, the development of underwater weapons and counter-measures, and crucially: improving tactics and search parameters for the sensor operators for future tracking of the adversary submarine.

The hierarchy of tenets for airborne ISR can thus be depicted as follows:

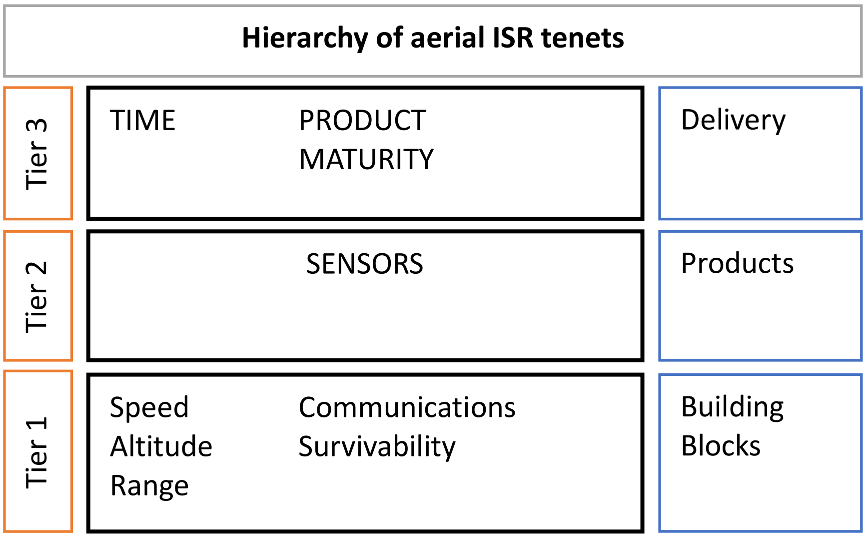

Figure 7-1. Hierarchy of aerial ISR tenets.

The key point of this overview is that any discussion on airborne ISR requires a holistic approach. This means that discussing single tenets, such as speed or sensors alone, will not give us any understanding of what the requirements are, nor what products in what format the respective asset is capable of delivering. In order to clarify the requirements for an airborne ISR service, we cannot stop at describing the basic building blocks (Tier 1) – we must go on to describe the actual intelligence product we require (Tier 2), and then in what format and with what urgency we expect this to be integrated with the force and the intelligence community (Tier 3).

A visualization of the top tier in a different way assists us in framing contemporary discussions on ISR in the same overview as potential, future technological capabilities:

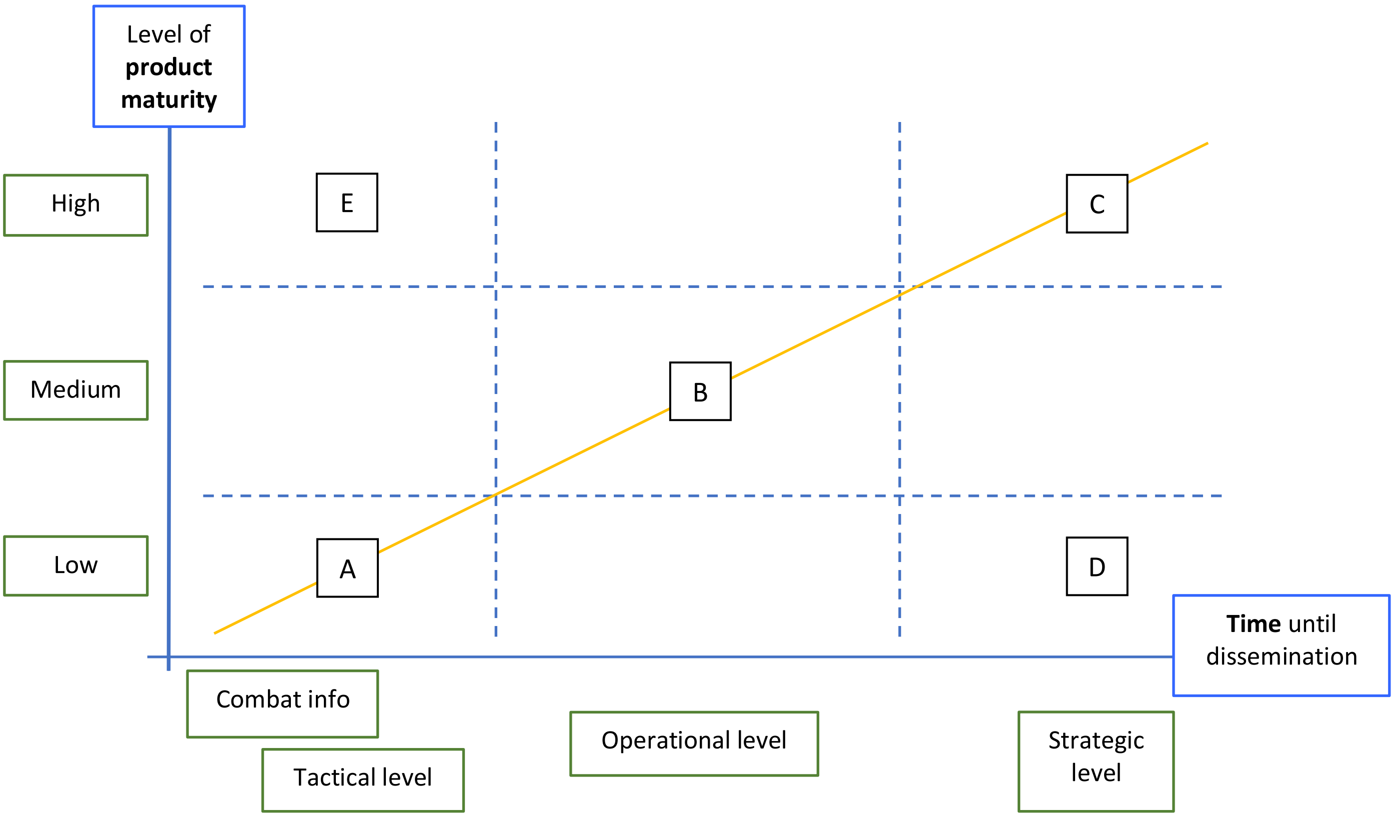

Figure 7-2. Time-product maturity matrix

The figure above shows the axes of time and product maturity, and the traditional, linear connection between the two. As a rule-of-thumb, the less time that has passed between when a sensor has intercepted a signal until the airborne asset has transmitted the information, the less mature the product necessarily is. If it is transmitted in real-time or near-real-time, the sensor data has not been processed [A]. This means that the responsibility to analyse and contextualize the data rests with the recipient. It is most often the case that this type of data is used during combat, and on the tactical level. If, however, a long time passes before the data is disseminated to the user, it is usually because the asset with the sensor cannot or will not transmit in-flight, and the sensor data will be thoroughly analysed post-mission. This further means that the data usually is obsolete for any tactical use, and thus is meant to support the operational or strategic levels [B][C]. Both [D] and [E] represent extreme cases, due to different rationales. In the case of [D], immature intelligence, or rather: not properly processed and analysed intelligence, is being utilized at the strategic level. This can be either improper use of intelligence, or incompetence in the strategic analysis process. Both situations can happen, however, one would hope that any responsible nation would strive to avoid them. The case of [E] is much more interesting, as this situation requires processed information to be disseminated in near-real-time. A contradiction-in-terms, some would say, but the next step for autonomous sensor analysis, others would argue. In the case of [E], the airborne asset is able to remotely sense whatever it is capable of intercepting, and immediately process and analyse the information as it is gathered. Artificial Intelligence (AI) will likely in the not too distant future be able to process information and sensor data in a manner and speed that humans simply are incapable of doing, and it is AI technology that will facilitate the extreme case of [E]. This discussion is made even more relevant when we know that future unmanned aircraft, or drones, will base their decision making on what they see themselves, including the release of weapons.[622] However, the dissemination of raw data, as in the situation of [A] raises the question of both relevance and utility of the data being transmitted. Who interprets the data on the ground? Are there sensor data where analytical interpretation is not even required? There are important questions to be answered when people make decisions based on unprocessed and uncontextualized data, as is taking place with real-time dissemination of sensor data.[623] The following figure is yet another way of depicting the relationship between time to dissemination and product maturity:

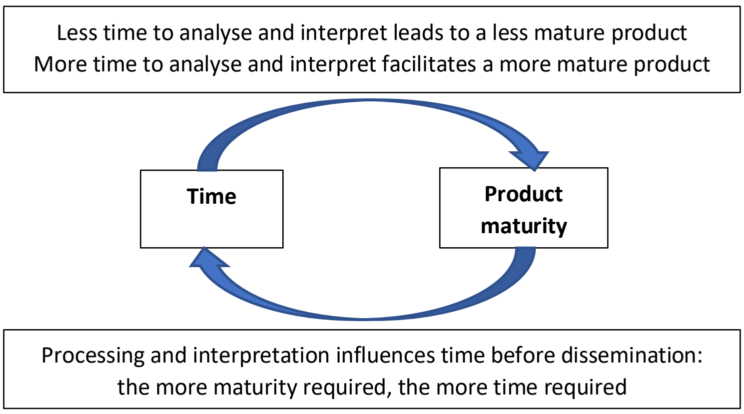

Figure 7-3. Time/product maturity symbiosis

[622] For an assessment on this, see Birkeland and Dyndal, "Fremtidig Autonom Droneteknologi Og -Konsepter."
[623] Former drone operators from modern drone warfare have revealed significant uncertainty with regards to the basis, that is the sensor data and information, upon which decisions of weapons release have been made. See for example Pilkington, "Life as a Drone Operator: 'Ever Step on Ants and Never Give It Another Thought?'"; Chamayou, *Drone Theory*.

7.6 Armed reconnaissance

The historical chapters of this thesis have shown how ASW and acoustic intelligence have constituted a significant part of airborne ISR in the High North since the end of WWII. MPAs on patrol are, at least in wartime, prepared to engage the submarines they are hunting with weapons. This means that for maritime patrol, engagement and targeting play important parts. Armed reconnaissance must briefly be discussed for two reasons. Most importantly, it will place ASW in the context of this theoretical framework. Secondly, it will contextualize the ongoing debate on Lethal Autonomous Weapons Systems (LAWS) in the sense that it provides more clarity to the basis for LAWS' decisions to apply military force.

The theoretical framework presented above also helps to explain the underlying factors facilitating targeting performed by aircraft. Targeting solutions can in the context of airborne assets be achieved either by an ISR asset providing targeting information to other assets carrying weapons, or an airborne asset providing targeting for its own weapons, often characterized as *armed reconnaissance*. The mission execution phase of targeting in military operations as described in NATO doctrine consists of the elements of find, fix, track, target, engage, exploit, and assess.[624] *Finding* the target relies on the basic intelligence support to operations, and an intelligence planning assessment of what elements in theatre constitute relevant targets for the force. *Fixing* is the process of geolocating and identifying the target, often based on cross-cueing of sensors and multiple intelligence disciplines. *Tracking* means that ISR assets are monitoring and following the target over time. *Targeting* is the process of acquiring attack criteria, and assessing collateral damage, the necessity of the strike, the relevance towards the prioritized targeting list, and ultimately receiving final approval to engage the target. *Engaging* the target means releasing a weapon in order to achieve the desired effect. *Exploitation* in this context means taking advantage of short and long-term opportunities that the immediate engagement presents. *Assessment* is an evaluation of the results of the engagement, assessing whether the desired effects have been achieved.[625] The elements can be structured as has been done in the following:

Function	ISR				Fires	Plans	ISR
Action	Find	Fix	Track	Target	Engage	Exploit	Assess

Table 7-2. NATO targeting sequence

[624] NATO, "Allied Joint Doctrine for Joint Targeting" (NATO Standardization Agency, April 2016), 2-4-2–6.
[625] NATO, 2-5-2–6.

It is clear that ISR is the foundation for any type of targeting – we require detailed information on a target before any lethal force is applied. This information has traditionally been gathered by designated aircraft, such as airborne ISR platforms, and the information corroborated by other types of intelligence, for example human intelligence (HUMINT).[626] As technology has evolved, more and more armed aircraft are capable of providing their own targeting solutions, or at least the final "piece of the puzzle", with other intelligence sources providing an important foundation before the aircraft arrives on the scene. In essence, this means that the aircraft is carrying sensors that can bring the firing solution up to the required attack criteria for the respective mission, and fire weapons based on that sensor information. Three examples are worth looking at briefly in order to contextualize this discussion.

Example #1. A modern fighter aircraft often carries a targeting pod, which is a capable imaging sensor in support of the aircraft's targeting.[627] The fighter aircraft is then able to find and track an enemy tank, or an enemy anti-air artillery battery on the ground, and fire weapons based on this sensor information.

Example #2. An MPA is capable of finding and tracking submarines. During operations, MPAs will carry torpedoes which enable them to attack the enemy submarines being hunted. This means that they can engage their targets in addition to finding and tracking them. This is slightly more complicated than the previous example, all the while there is a high probability that the enemy submarine will be submerged during the hunt. This further means that there is a good chance that the aircraft crew will drop a weapon on a target they cannot see. The crew has, however, achieved the required confidence level for a targeting solution based on their interpretation of sensor information. ASW requires relatively complex interpretation of sensor data before weapon release.

Example #3. A drone flies an armed reconnaissance mission, searching for a specific human target. The person targeted has been under surveillance for weeks, and several other pieces of intelligence have been accumulated before the drone mission. The aircraft finds a person that meets the parameters of the pre-mission briefing, but the imagery is hard to interpret for the sensor operator, among other things because of the altitude the aircraft is operating at to avoid

[626] HUMINT is a category of intelligence derived from information collected and provided by human sources. For details, see Joint Publication (JP) 2-0, "Joint Intelligence," B-4-B-5.
[627] Newer aircraft, such as the F-35 Lightning II, have built-in sensors for targeting, and are not carrying targeting pods.

detection. Together with the drone pilot and the mission commander, they declare attack criteria to be met, and release the weapon on the person as he is driving away in a car.

Example 1 is the least controversial, and the least demanding. Military targets are fairly easily distinguished from their surroundings by a trained operator. Example 2 is much more complex, all the while the sensor data is harder to interpret, and the attack criteria more demanding. Example 3 is a relatively new form of operating armed aircraft, and one that has attracted controversy.[628]

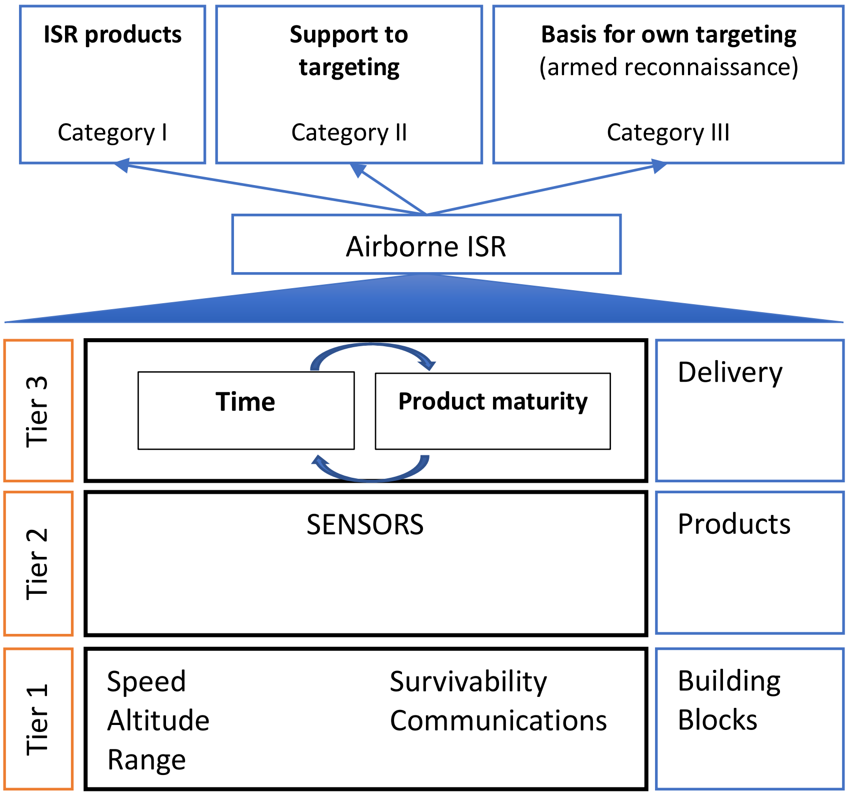

Figure 7-4. Airborne ISR as basis for targeting

This theoretical framework will not discuss the important question on the decision to fire a weapon *per se*, including rules of engagement, moral and ethical considerations on maintaining meaningful human control of autonomous weapons and more. However, it is important to highlight that the *underlying foundation* for making that decision rests on the *interpretation of sensor data*. And that is where the maturity and reliability of the sensor data

628 See for example Human Rights Watch, "Heed the Call - A Moral and Legal Imperative to Ban Killer Robots" (Human Rights Watch, August 21, 2018), https://www.hrw.org/report/2018/08/21/heed-call/moral-and-legal-imperative-ban-killer-robots; PAX, "Killer Robots - What Are They and What Are the Concerns?" (PAX, 2018), https://www.paxforpeace.nl/media/files/pax-booklet-killer-robots-what-are-they-and-what-are-the-concerns.pdf.

come into play: the level of maturity of the intelligence product that facilitates tactical, operational, and strategic decisions.

Working towards autonomous processing and analysis of sensor data will eventually lead to in-flight, near real-time processing of sensor data, and further near real-time dissemination of intelligence products. This will facilitate new ways of operating ISR aircraft, and potentially shorten the targeting sequence.

The three categories indicated in figure 7-5 above are relevant when we discuss what we require from the respective ISR asset vis-à-vis a targeting context. A category I delivery is not directed at targeting in the traditional sense, but rather supporting tactical, operational and strategic levels of warfare with intelligence products. A category II delivery is targeting information delivered to a third party, which is actually capable of engaging the target. This can be a drone giving detailed vectors to a frigate firing a torpedo or a missile. Finally, a category III delivery is a platform acquiring attack criteria, and being able to engage the target itself. A classic example is an MPA dropping a torpedo on a submerged target based on its own sensor information.

7.7 The theoretical framework and the hunt for submarines

In accordance with the theoretical framework presented, one would require the following for hunting submarines: the elements of Tier 1, to varying degrees; acoustic and other ASW sensors (Tier 2), and the ability to disseminate this information or to act on it by oneself (Tier 3). In discussing the airborne ISR requirements for ASW, some of the elements above stand out more than others.

First, there is an overlap between ASW and ISR. ISR includes general surveillance, more specific reconnaissance, and very specific tracking of targets.

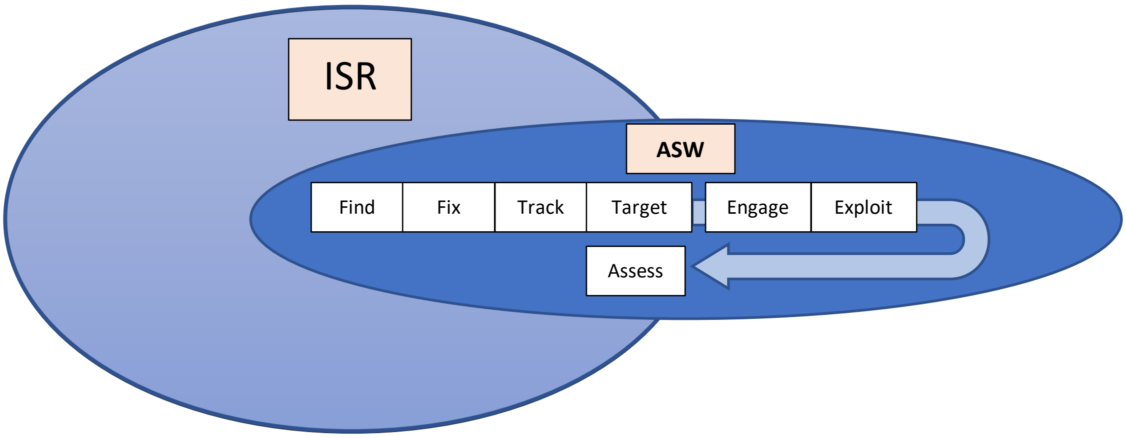

Figure 7-5. The overlap between ISR and ASW

ASW includes finding the target, fixing it, tracking it, targeting it, and then, possibly, engaging it. Only possibly, though, since we from our definition of ASW know that one can execute efficient anti-submarine warfare, not necessarily by *sinking* the adversary submarine, but by *denying* area access, *suppressing* its operations, and more. This overlap between ISR and ASW is illustrated in the figure above. When the NATO Group of Experts in the late 1950s were considering what aircraft they required, they were considering a long-range ASW aircraft, which, given the operational characteristics put forward, would be able to conduct other types of surveillance as well as ASW. When the Norwegian Chief of Defense in 2015 proposed to phase out the P-3 *Orion* from the Norwegian inventory and replace the MPA fleet with drones, he effectively removed the ability to conduct long-range airborne ASW. Instead, he focussed on the ability to conduct *surface* surveillance and reconnaissance with unmanned systems. No unmanned aircraft flying today are capable of conducting searches underwater, nor are drones today capable of carrying weapons that can neutralize adversary submarines. This is, however, expected to change in the future.

Second, the factor of *range* is crucial for any credible maritime airborne ISR platform. To begin with, the aircraft must have a minimum range to reach an adversary's operating areas. In addition, one would preferably be able to monitor that area for some time, not only fly out and back. This further leads to a requirement for range based on the extent one knows where the target is in the first place. If one is able to provide cueing to the aircraft, the aircraft would spend less time and fuel to search a given area. Another key factor that played an important role during the Cold War for NATO MPA was the sheer predictability of Russian submarine deployments, as we have seen. The aircraft operators were not only cued by SOSUS, but they knew the general direction of the submarine, broadly their patrol areas, and the approximate duration of their deployment. The very distances involved demanded long endurance, but if such knowledge had not been available, the search for enemy submarines would have taken even longer. And if cueing from other sensors is not available, one would be relying on historical *modus operandi*, intelligence reports, and the sensors of the aircraft itself in the initial search. Thus the longer the range, the more time an aircraft has to search, conduct general surveillance, and build general situational awareness in an area.

Third, *sensor interpretation* is key to ASW. Acoustic intelligence and in-flight processing of acoustic data have always been challenging. The acoustic environment in which the operators onboard an aircraft have to manoeuvre to find and track a submarine is constantly complicated by other sound sources in the water and by increasingly silent submarines. Many of these interpretation processes have been automated compared to the early days of ASW, however they have not been automated completely. This means that even in 2020, as new P-8 *Poseidon* MPAs are operationalized, there is still a requirement for human operators onboard to interpret acoustic sensor data. This further means that if one is to track a submarine in a complex acoustic environment, computers without human input or interpretation will likely fall short, even in 2020. We should expect, however, AI to assume this type of interpretation in the not too distant future, enabling autonomous drones, surface vessels and submarines to conduct acoustic intelligence and ASW. Autonomous PED will thus significantly influence Tier 3 of the theoretical framework and alter what unmanned aircraft and vessels are able to do in a communications-degraded environment.

Finally, if the airborne platform is not able to engage a target, the ISR asset will be somewhat of a lame duck. With the distances involved, for example in the Atlantic, there is little to no time for a flying asset to call for weapons support from another asset when it has found an enemy combatant that must be engaged. In the context of ASW, with the relatively short acoustic ranges involved from state-of-the art submarines such as the Russian *Severodvinsk* class, it is becoming increasingly difficult to find and keep track of enemy submarines. Once a targeting solution has been achieved, that targeting solution is very easily lost. This means that the target submarine will likely not be engaged at all if it is not engaged by the ISR asset tracking it. This, too, will in future factor into targeting and engagement by unmanned aircraft. Autonomous PED will likely facilitate unmanned systems engaging targets based on acoustic attack criteria, altering dynamics and facilitating new possibilities in modern ASW.

7.8 Chapter conclusion

The theoretical framework presented here seeks to identify and nuance the elements that comprise airborne ISR. The discussion on the basic building blocks can at times overshadow important elements such as processing capability of an ISR asset. In discussing the requirements for surveillance and reconnaissance one must not only bring out the respective factors of the three tiers, but also carefully consider the most efficient and effective means of satisfying those requirements. Is manned airborne ISR necessarily the answer to one's requirements? How much of the information required can be provided by space-based services? How much can be solved by unmanned systems? What does one gain and lose by shifting from manned to unmanned systems? These questions can be answered in the context of the presented framework, and it is the main objective of this presentation to bring clarity to any evaluation of modern airborne ISR requirements, particularly in the context of anti-submarine warfare. To illustrate how this might work, the final chapter will therefore use the theoretical framework to discuss the new threat environment that is emerging in the High North, and what role airborne ISR assets can play in mapping the elements of that environment. It will also discuss alternative technologies that in time are likely to push well known and trusted intelligence collecting aircraft towards obsolescence.

8. Discussion and conclusion: Where do we go from here?

8.1 Identifying the threat

Russian maritime doctrine aims at countering Western ASW technologies, and challenging NATO and the USA's presence in the Atlantic, the Baltic, the Mediterranean and the Black Sea through increasing the Russian presence in those areas, including the Arctic. The Russians are open about the fact that they are conducting testing and exercises in the Barents Sea, and has historically and will regularly publish the coordinates for such activity in order to ensure that no ship will sail or aircraft will fly into the danger areas.[629] They fire air defence missiles and strategic missiles; they will exercise coastal landings and assaults on Russian islands in the Arctic, and they will conduct advanced exercises with submarines. These activities are important in themselves for technical intelligence collection, but they also play a crucial role in demonstrating Russian capabilities and ambitions in the Arctic.[630] Vessels under development in the Russian navy will typically undergo sea trials in the Barents Sea before being commissioned in their respective fleets.[631] The Northern Fleet also regularly tends to announce test firings of strategic weapons concurrently with Western naval exercises, such as the announcement of the firing of a salvo of *Bulava* missiles during the NATO exercise *Cold Response* in Norway in 2016.[632]

In addition to actual operations and strategic patrols in the High North with SSBNs, Russian units have also conducted aggressive signalling through exercise and training in the North. Russians aircraft have flown attack profiles towards the intelligence service's radar in Vardø, against NATO units exercising off the coast of Norway, and against the National Joint Headquarters in Bodø.[633] The increase in Russian activity is also evident through the higher intensity and regularity in Russian military aircraft flying out from the Kola peninsula and down the Norwegian coast. Although not at the level of the Cold War, the numbers are much

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629 Sveinung Berg Bentzrød, "Etterretningsstasjoner i Nord Anklages for Hemmelighold. Nå Slår E-Sjefen Tilbake.," *Aftenposten*, October 8, 2016.
630 Bentzrød.
631 Trude Pettersen, "Black Sea Submarine Fires Cruise Missile from the Barents Sea," *The Barents Observer*, August 4, 2015.
632 Per Anders Johansen, "Russisk Atomubåt Testet Atomraketter i Barentshavet i Morges," *Aftenposten*, December 12, 2015; Trude Pettersen, "Nuclear Missile World Record Attempt," *The Barents Observer*, March 2, 2016.
633 Alf Bjarne Johnsen, "E-Sjefen: Russland Øvde På Angrep Mot Nord-Norge," *VG*, March 5, 2019.

higher now than at the turn of the millennium.[634] In addition, the Russian Armed Forces have deployed cruise missile batteries to the Kola peninsula and towards the Norwegian border during the Russian exercise *Zapad 2017*.

However, NATO units operating in other theatres have experienced significantly more tension than those operating in the Barents Sea: attack profiles were flown against the *USS Donald Cook* in the Baltic in 2016; a US surveillance aircraft was intercepted by a Russian fighter aircraft within 15 feet that same year; and an EP-3 *Aries* was intercepted and harassed in the Black Sea in early 2018.[635] The primary actors in the Barents Sea, the Russians and the Norwegians, have managed to maintain relatively low tensions in the High North, and aim to continue to do so in the foreseeable future. It seems fair to assume that the Norwegian policy of integration/deterrence – screening/reassurance has contributed to this.

Even so, there has been a marked increase of Russian exercises and operations when compared to the previous two decades. The Northern Fleet exercised in mid-June 2018, with the largest deployment of ships seen in 10 years.[636] The Russian Navy followed up with a major naval exercise in the Western Barents Sea in March 2019.[637] In mid-August 2019, the Russian Navy conducted another major naval exercise off the western and northern Norwegian coast. The Russian activities were closely monitored by Norwegian, American and Canadian MPA flying out of Andøya.[638] The Russian named Exercise *Ocean Shield* included cross-theatre coordinated manoeuvres between the Baltic, Barents and Black Sea fleets. It demonstrated the bastion defence, and clearly situated the northern part of Norway as engulfed by the Russian bastion.[639]

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634 Andrew Higgins, "Norway Reverts to Cold War Mode as Russian Air Patrols Spike," *The New York Times*, April 1, 2015.

635 Phil Stewart, "Russia Jets Make 'Simulated Attack' Passes near U.S. Destroyer," *Reuters*, April 13, 2016; Ben Werner, "Russian Su-27 Fighter Buzzes U.S. Navy EP-3 Aries Over Black Sea," *USNI News*, January 29, 2018; Tom Nilssen, "Nye Bildebevis Av Russisk Avskjæring," *NRK*, January 31, 2018; Barbara Starr and Brad Lendon, "Russian Fighter Came within 15 Feet of U.S. Air Force Jet," *CNN*, January 30, 2016.

636 Thomas Nilsen, "Alarm-Drill: 36 Russian Warships Sail out to Barents Sea," *The Barents Observer*, June 13, 2018.

637 Karin Madshus and Rolf Lofstad, "Norsk Lasteskip Ble Anropt Av Russisk Slagskip," *Dagbladet*, April 15, 2019.

638 Andreas Budalen and Henrik Ø. Heldahl, "Det Er Uvanlig Høy Russisk Aktivitet Utenfor Norskekysten," *NRK*, August 6, 2019; Markus Thonhaugen and Kåre Riibe Ramskjell, "Russerne Med 'Uvanlig Stor' Militærøvelse: - Lenge Siden vi Har Sett Noe Slikt," *NRK*, August 13, 2019.

639 Julie Vissgren, Tormod Strand, and Lokman Ghorbani, "Forsvarssjefen Om Russisk Militærøvelse: - En Nasjonal Utfordring," *NRK*, August 14, 2019, https://www.nrk.no/urix/forsvarssjefen-om-russisk-militaerovelse_-_-en-nasjonal-utfordring-1.14660898; Atle Staalesen, "30 Russian Naval Vessels Stafe Show of Force near Coast of Norway," *The Barents Observer*, August 15, 2019, https://thebarentsobserver.com/en/security/2019/08/30-russian-naval-vessels-stage-show-force-coast-norway.

Then, in October 2019, the Russian Navy initiated the largest submarine exercise conducted in the North Atlantic since the Cold War.[640] The exercise had similarities to the *Ocean Shield* surface combatant exercise conducted the previous month, but this time only submarines took part. NIS reported the submarines operated west, south and east of Bear Island in order to monitor the entry points for the Barents Sea, and further south into the Norwegian Sea. The latter was executed in order to exercise deep diving in the significant depths there, compared to the Barents Sea. The objective of the exercise, according to the NIS, was to show that the Russian Navy can deploy submerged into the North Atlantic and reach North America with cruise missiles from forward firing positions. A further objective was to test the West's ability to respond to such a substantial deployment of strategically important assets.[641] The US and Canada sent MPAs to Andøya in Norway to cover the Russian activities together with the Norwegians.[642] Large Russian naval exercises off the Norwegian coast seem to exercise fundamental elements of the bastion concept of sea control and sea denial. The mission of the Northern Fleet is still to protect the strategic nuclear deterrent in the High North.[643] Although the role of disrupting Western SLOCs across the Atlantic seems to be somewhat downplayed, the threat against the SLOCs in times of crisis and war should not be discarded.

In addition to the expanded conventional military activities on display from the Russians, there is another aspect of Russian warfare that has cemented itself in strategic discourse in the past years: hybrid warfare. The publishing in February 2013 of a military article by the Chief of the Russian General Staff, General Valeriy Gerasimov, did not gain much attention at first.[644] But when the Russians annexed Crimea mostly using tactics associated with what we term hybrid warfare one month later, the article stood out as a blueprint for methods used during that annexation. Hybrid warfare can be described as "*the synchronized use of multiple instruments of power tailored to specific vulnerabilities across the full spectrum of societal*

[640] Alf Bjarne Johnsen, "Russland i Gang Med Ubåtoperasjon i Nord: Største Siden Sovjet-Tiden," *VG*, October 29, 2019.
[641] Tormod Strand, "Hemmelig Ubåt-Operasjon: 'Målet Er å Vise at Russland Kan Nå USA,'" *NRK*, October 29, 2019, https://www.nrk.no/norge/hemmelig-ubat-operasjon_-_malet-er-a-vise-at-russland-kan-na-usa_-1.14761298; Johnsen, "Russland i Gang Med Ubåtoperasjon i Nord: Største Siden Sovjet-Tiden"; Tyler Rogoway, "Russia Sends Ten Subs into North Atlantic in Drill Unprecedented in Size since Cold War," *The Drive*, October 29, 2019.
[642] Johnsen, "Russland i Gang Med Ubåtoperasjon i Nord: Største Siden Sovjet-Tiden"; "Hektisk Jakt På Ubåter," *Vesterålen Online*, October 31, 2019.
[643] Norwegian Intelligence Service, "FOKUS 2019 - The Assessment of the Intelligence Service," Annual Unclassified Assessment| (Oslo, 2019), 26.
[644] Valery Gerasimov, "The Value of Science Is in the Foresight," *Military-Industrial Kurier (VPK)*, February 26, 2013, https://www.vpk-news.ru/articles/14632.

functions to achieve synergistic effects."[645] This is not new, nor revolutionary. However, the systematic use and scale of hybrid warfare tools as means to achieve ends outside of kinetic conflict is something to which the West must adapt quickly. There are discussions ongoing as to the validity of the Gerasimov doctrine as a doctrine, *per se*.[646] But regardless of these discussions, one fundamental factor on which most analysts concur, is that Russia will work to achieve her security policy objectives while remaining below the threshold of war. The Gerasimov doctrine provides a depiction of the vast range of tools available before the threshold of conventional military power is reached.

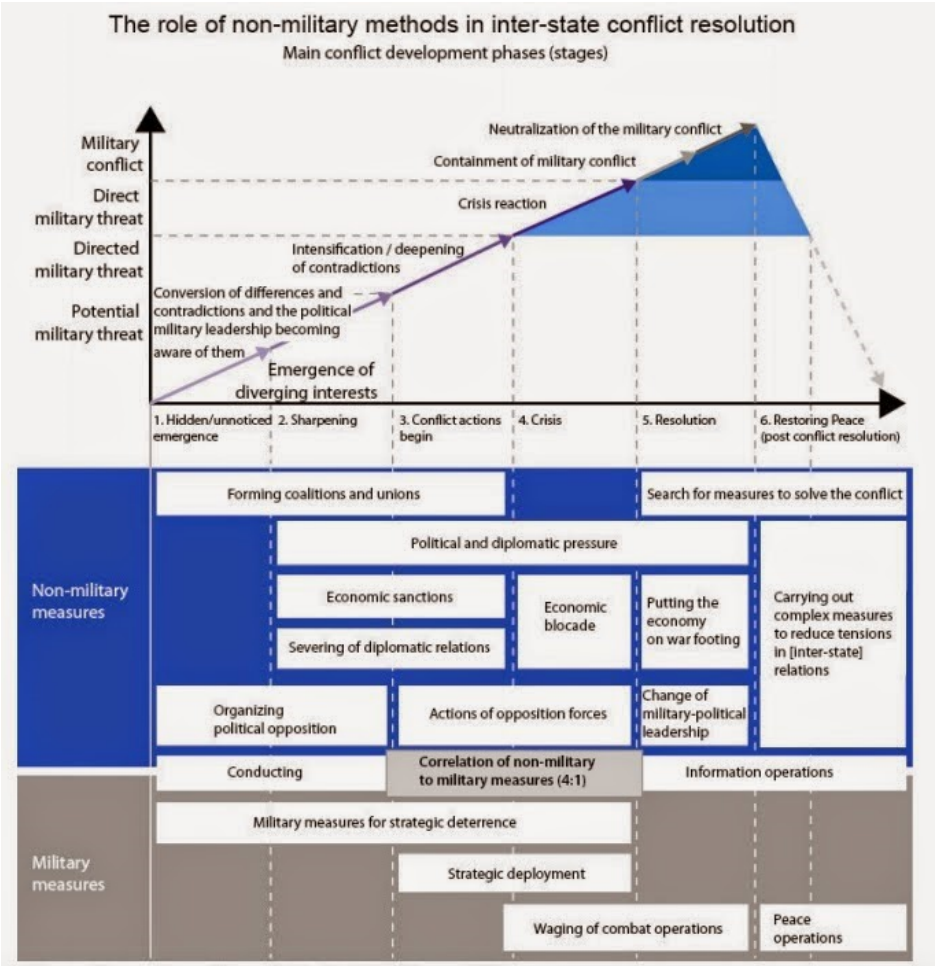

Figure 8-1. The role of non-military methods in inter-state conflict resolution[647]

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645 Patrick J. Cullen and Erik Reichborn-Kjennerud, "Understanding Hybrid Warfare," MCDC Countering Hybrid Warfare Project (Multinational Capability Development Campaign (MCDC), January 2017), 8. There is no agreed definition of hybrid warfare, not within NATO nor within academia. This MCDC report provides focussed description of the problem, and gives an excellent overview of the mechanisms in the application of power involved.

646 Molly M. McKew, "The Gerasimov Doctrine," *Politico Magazine*, October 2017; Michael Kofman, "Russian Hybrid Warfare and Other Dark Arts," *War On the Rocks*, March 11, 2016; Mark Galeotti, "I'm Sorry for Creating the 'Gerasimov Doctrine,'" *Foreign Policy*, March 5, 2018.

647 Kofman, "Russian Hybrid Warfare and Other Dark Arts."

Hybrid warfare in the maritime domain has not been discussed as much as in the land and informational domains. However, it seems increasingly clear that the maritime will be equally exploited as other domains in an effort to achieve policy goals without entering a conventional military conflict. As James Stavridis explains,

> *"The fundamental idea of hybrid warfare is to find the space short of clear-cut military action with direct and recognizable tactical, operational, and strategic impact and compress it into a zone wherein sufficient ambiguity is created to allow an offensive actor a better chance of accomplishing an objective without full-blown, overt offensive action."*[648]

The toolbox in maritime hybrid warfare includes the use of civilian and fishery vessels; larger ships that function as mother ships for unmanned underwater vessels or smaller surface vessels; fishermen that deploy fixed seabed listening devices on the sea bed; manipulation or destruction of underwater infrastructure such as pipelines for fossil fuels, communication cables and such; command & control over civilian, commercial-off-the-shelf (COTS) open networks; the use of laser dazzlers and small jamming devices; and more.[649] These tools will be supported by conventional means such as submarines and special forces, in a mix that will constitute maritime hybrid warfare. Russian captains on civilian vessels calling on Norwegian ports have reportedly been instructed to familiarize themselves as much as possible with the Norwegian coastline and ports, in case of a conflict.[650] This mixing of operating platforms, personnel and domains is and will be a fundamental challenge for determining the "normal situation", for example in the High North. In order to meet this challenge, it seems inevitable that the surveillance platforms of the future must be able to operate cross-domain, persistently, and with the ability to communicate with other sensors as well as home base and other elements of the intelligence cycle in real-time.

[648] James Stavridis, "Maritime Hybrid Warfare Is Coming," *United States Naval Institute Proceedings* 142, no. 12 (December 2016).
[649] Chris Kremidas-Courtney, "Countering Hybrid Threats in the Maritime Environment," *The Maritime Executive*, November 6, 2018, https://www.maritime-executive.com/editorials/countering-hybrid-threats-in-the-maritime-environment; Stavridis, "Maritime Hybrid Warfare Is Coming"; Jukka Savolainen et al., "Handbook on Maritime Hybrid Threats - 10 Scenarios and Legal Scans" (Helsinki, Finland: The European Centre of Excellence for Countering Hybrid Threats, November 2019).
[650] Jan Harald Tomassen, "Skal Ha Bedt Russiske Sjøkapteiner Gjøre Seg Godt Kjent Langs Norskekysten," *NRK*, February 27, 2015, https://www.nrk.no/troms/skal-ha-bedt-russiske-sjokapteiner-gjore-seg-godt-kjent-langs-norskekysten-1.12234101.

One example of such unconventional military activities is the Russian Navy's intelligence collection on undersea cables laying on the sea bed in international waters.[651] The Russian navy deploys special purpose submarines that can carry other, smaller submarines and autonomous or remotely piloted vessels. These are utilized for both research purposes and intelligence gathering. Rebuilt strategic submarines from the *Oscar* and *Delta* classes are being used for gathering intelligence on Western sea-bed communication systems.[652] NATO reports that Russian special purpose submarines have over time conducted operations around civilian, underwater communication cables between Europe and the United States.[653]

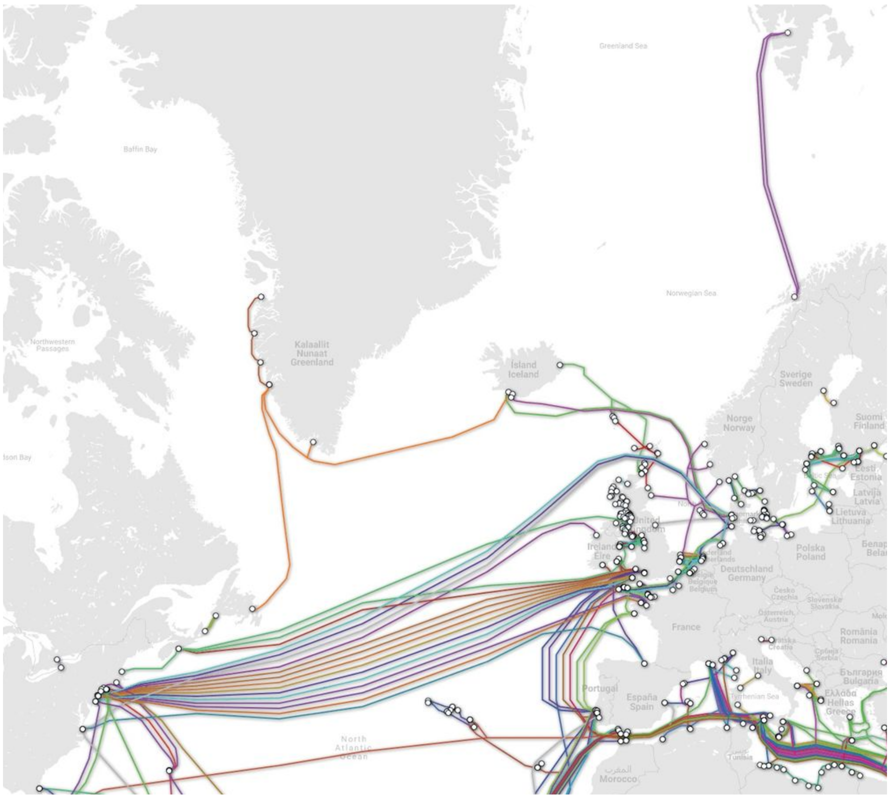

Figure 8-2. Overview over transatlantic communications cables.[654]

Reports suggest that the special purpose submarine AS-31 *Losharik*, which experienced a fatal fire on board whilst operating in the Barents Sea on 1 July 2019, is a part of an underwater intelligence unit that specialises in tapping into and preparing for the destruction

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[651] Hicks et al., "Undersea Warfare in Northern Europe," 4.
[652] Thomas Nilsen, "Now, Russia Builds a Submarine Even Bigger than the Typhoon," *The Barents Observer*, May 3, 2017, https://thebarentsobserver.com/en/security/2017/05/russias-new-military-research-submarine-arctic-waters-will-be-worlds-largest#.WQnEKkjm64w.facebook.
[653] Alf Bjarne Johnsen, "NATO: Russerne Kan Sabotere Internett Med Ubåt," *VG*, February 17, 2018, https://www.vg.no/nyheter/utenriks/i/gPday5/nato-russerne-kan-sabotere-internett-med-ubaat; Thomas Nilsen, "Russia in the High North" (Matpakkeseminar, Norwegian MoD, November 14, 2019).
[654] TeleGeography, "Submarine Cable Map" (TeleGeography), accessed October 23, 2019, https://www.submarinecablemap.com/.

of undersea communication cables.[655] It seems that with special purpose-built submarines such as the *Losharik*, *Paltus* and *Uniform* able to conduct advanced sea-bed operations, the submarine branches of the Russian armed forces are also an integrated part of hybrid warfare.[656] This type of activity has historically also been carried out by the US Navy.[657]

8.1.1 Submarines

Submarines remain the capital ships of the Russian Navy.[658] Open sources reveal that the Northern Fleet has somewhere between 20 and 30 operational submarines in its inventory.[659] Legacy SSN and SSGN submarines from the Cold War that are still operational are the *Victor III*, the *Akula*, the *Sierra II* class SSNs, the *Oscar II* class SSGN, and the *Delta IV* class SSBN. In addition, several new classes are inbound. The *Severodvinsk* is meant to replace the SSNs and SSGNs mentioned above. It is a multipurpose, nuclear attack submarine which is incredibly capable, exceptionally quiet, and vastly expensive.[660] Overall plans are to build eight to ten Severodvinsk class submarines.[661] However, the production tempo of the *Severodvinsk* class has slowed due to budgetary constraints. The submarine class is likely one of the more expensive pieces of military hardware in the Russian inventory, writ large.[662] The SSGN carries a wide array of missiles, namely the SS-N-26 *Strobile* supersonic anti-ship missile (range 190 nm/350 km), the SS-N-21 *Sampson* missile, similar to the US *Tomahawk* missile with the option to carry a nuclear warhead (land-attack, range 1,600 nm/3,000 km), the SS-N-27 *Sizzler* (anti-ship, range over 270 nm/500 km) and 32 units of the SS-N-30

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[655] Michael Kofman, "Fire Aboard AS-31 Losharik: Brief Overview," *Russian Military Analysis* (blog), July 3, 2019, https://russianmilitaryanalysis.wordpress.com/tag/gugi/; Bill Gertz, "Damaged Russian Sub Linked to Underwater Drone Program," *Soldier of Fortune* (blog), July 15, 2019, https://www.sofmag.com/damaged-russian-sub-linked-to-underwater-drone-program/; Heather A. Conley, Jeffrey Rathke, and Matthew Melino, "Enhanced Deterrence in the North - A 21st Century European Engagement Strategy" (Center for Strategic and International Studies, February 2018), 13; Hicks et al., "Undersea Warfare in Northern Europe," 4.
[656] Kofman, "Fire Aboard AS-31 Losharik: Brief Overview."
[657] Sherry Sontag and Christopher Drew, *Blind Man's Bluff - The Untold Story of American Submarine Espionage* (New York: HarperPaperbacks, 1999), 376, 389.
[658] Office of Naval Intelligence, "The Russian Navy - A Historic Transition," 17.
[659] Hicks et al., "Undersea Warfare in Northern Europe," 9–11.
[660] Office of Naval Intelligence, "The Russian Navy - A Historic Transition," 18.
[661] Hicks et al., "Undersea Warfare in Northern Europe," 14.
[662] Franz-Stefan Gady, "Russia's Pacific Fleet to Receive 2 Fast Attack Subs in 2020," *The Diplomat*, July 3, 2018; Conley, Rathke, and Melino, "Enhanced Deterrence in the North - A 21st Century European Engagement Strategy," 13.

Kalibr missile (land-attack, range approximately 1,300 nm/2,500 km).[663] Work is reportedly ongoing to find a more affordable follow-on for the *Severodvinsk* class.[664]

The *Husky* class may take on two separate designs in order to fulfil two particular roles: first, to protect surface strike groups from hostile submarines; and second, to function as a platform for cruise missiles.[665] The *Husky* will reportedly start construction in 2023, and will, in addition to *Kalibr* missiles and torpedoes, carry the hypersonic SS-N-33 *Zircon* anti-ship cruise missile – capable of flying more than eight times the speed of sound. It will cost far less than the *Severodvinsk* class, but is expected to continue the trend of ever more quiet acoustic characteristics for Russian submarines.[666] Between 15 and 20 *Husky* submarines are expected to be operational by 2040.[667]

The *Dolgorukiy* seems to be the future workhorse of the Russian SSBN fleet. Three have been commissioned, and plans are to build eight to ten *Dolgorukiy* class submarines in total. The follow-on vessels of the initial boat are expected to have redesigned hulls leading to improved acoustics and lower sound levels.[668] These vessels carry 16 missiles of the type SS-N-32 *Bulava*, with six to ten nuclear warheads in each missile and a range of 4,600 nm/8,500 km.[669] The *Dolgorukiy* class SSBN has been operationalized, and is patrolling at fairly regular intervals in tandem with remaining *Delta IV* SSBNs.

The diesel-electric *Kilo* class has been a successful design for both domestic use and for export. It has proven its worth in modern conflict through the firing of *Kalibr* missiles into

[663] Korolkov, "Russia's Top-Secret Nuclear Submarine Comes into Service"; Office of Naval Intelligence, "The Russian Navy - A Historic Transition," 18; Ministry of Defence of the Russian Federation, "Severodvinsk Nuclear Submarine of the Northern Fleet Carried out Missile Firing," August 18, 2017; Aleksandr Mozgovoy, "Russian Navy's Long Arm: Kalibr Missile Family," trans. J. Hawk, *Natsionalnaya Oborona/Southfront.Org*, October 8, 2015.
[664] Hicks et al., "Undersea Warfare in Northern Europe," 15; Charlie Gao, "Russia's New Husky-Class Stealth Submarines: Armed with Hypersonic Missiles?," *The National Interest*, October 1, 2019, https://nationalinterest.org/blog/buzz/russias-new-husky-class-stealth-submarines-armed-hypersonic-missiles-84626.
[665] Dmitry Gorenburg, "Russian Naval Shipbuilding - Is It Possible to Fulfill the Kremlin's Grand Expectations?" (CNA Harvard University, October 2015), 1–2, http://www.ponarseurasia.org/sites/default/files/policy-memos-pdf/Pepm395_Gorenburg_Oct2015.pdf.
[666] Gao, "Russia's New Husky-Class Stealth Submarines: Armed with Hypersonic Missiles?"; H I Sutton, "Husky_SSN," *Covert Shores* (blog), December 30, 2019, http://www.hisutton.com/Husky_SSN.html.
[667] Gorenburg, "PONARS Eurasia Memo No. 395," 2.
[668] Franz-Stefan Gady, "Putin's 'Red October': Russia's Deadliest New Submarine," *The Diplomat*, March 4, 2015, https://thediplomat.com/2015/03/putins-red-october-russias-deadliest-new-submarine/.
[669] Office of Naval Intelligence, "The Russian Navy - A Historic Transition," 17; Gady, "Putin's 'Red October': Russia's Deadliest New Submarine"; Kristensen and Norris, "Russian Nuclear Forces, 2015," 91; Pettersen, "Nuclear Missile World Record Attempt."

Syria.[670] The replacement submarine for the *Kilo* was planned to be the *Petersburg* class, but this project has been wrought with failures during development. So much so, that it is reported that the *Petersburg* class may be terminated altogether, in favour of a new design, the *Kalina* class SSK.[671] The *Kalina* will be an *Air Independent Propulsion* (AIP) submarine, and will take over the duties of the *Kilo* class as part of the layered defence of the bastion, and patrols in the littorals.[672]

8.1.2 Cruise missiles

The development of capable cruise missiles has been a priority for the Russian armed forces, to the point where the weapons being fielded are considered to be among the most capable in the world.[673] Cruise missiles provide a combination of tactical flexibility and strategic leverage.[674]

[670] Mark Episkopos, "Meet the First Russian Submarine to Fire in Anger since World War II (and Its New Cruise Missiles)," *The National Interest*, January 12, 2019, https://nationalinterest.org/blog/buzz/meet-first-russian-submarine-fire-anger-world-war-ii-and-its-new-cruise-missiles-41292; Lee Willett, "Game Changer: Russian Sub-Launched Cruise Missiles Bring Strategic Effect," *Jane's By IHS Markit*, 2017, https://www.janes.com/images/assets/147/70147/Game_changer_Russian_sub-launched_cruise_missiles_bring_strategic_effect_edit.pdf.
[671] Hicks et al., "Undersea Warfare in Northern Europe," 15–16.
[672] Office of Naval Intelligence, "The Russian Navy - A Historic Transition," 19; Gorenburg, "PONARS Eurasia Memo No. 395," 2; Hicks et al., "Undersea Warfare in Northern Europe," 15–16.
[673] Andresen and Bukkvoll, "Russian Weapons Development towards 2020," 47–48.
[674] Willett, "Game Changer: Russian Sub-Launched Cruise Missiles Bring Strategic Effect."

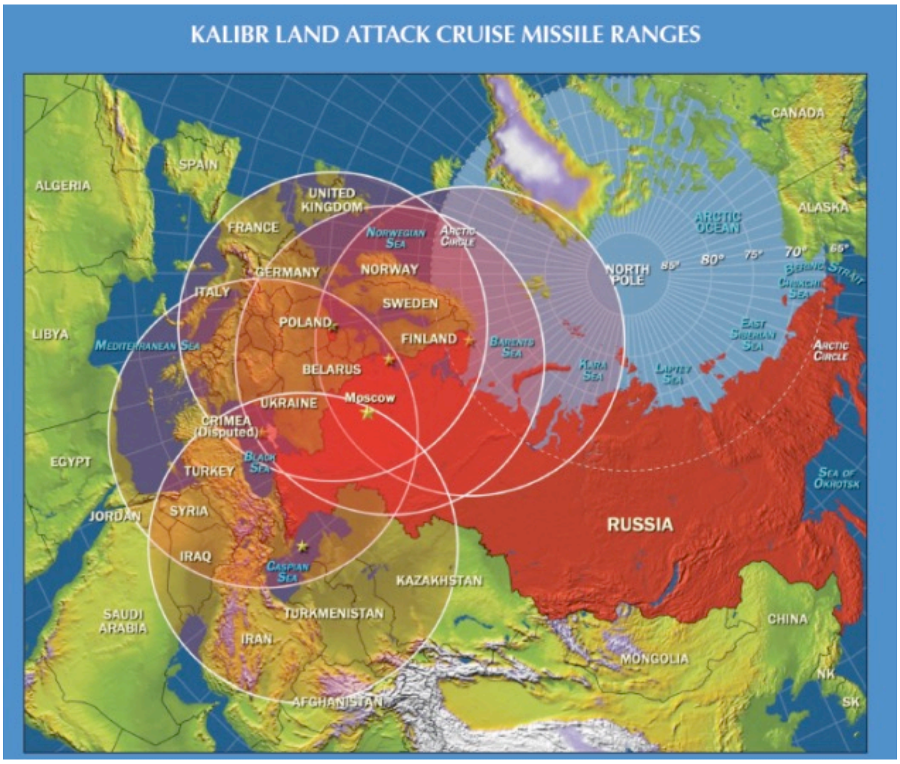

Figure 8-3. Nominal Kalibr LACM ranges from fleet areas.[675]

They are a tactical and operational threat to any adversary unit or force, and they can simultaneously hold strategic targets at risk from great distances. Russian cruise missiles are an increasing concern for strategic force planning in NATO.[676]

Likely the most prominent and versatile Russian cruise missile is the *Kalibr* family of missiles. There are more than ten variants of the *Kalibr* missile depending on launch platform, range, target profile and speed. The most common categories are the anti-ship and land-attack versions. Both carry high precision conventional munitions between 220-450 kg but are also capable of carrying nuclear payloads. The land-attack version is designated SS-N-30A *Kalibr* by NATO and has a maximum range of 1,350 nm/2,500 km at subsonic speeds.[677] Figure 8-3 above depicts the firing range for missiles launched approximately from the home ports of the respective Western Russian fleets (nominal range depicted is 1,000 nm). The following figure shows the nominal range of a *Kalibr* missile launched by a

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[675] Office of Naval Intelligence, "The Russian Navy - A Historic Transition," 35.
[676] Bård Wormdal, "Tidligere Forsvarssjef Om Nye Russiske Våpen: - En Trussel Som Må Tas Alvorlig," *NRK (Online)*, November 8, 2017, https://www.nrk.no/finnmark/tidligere-forsvarssjef-om-nye-russiske-vapen_-_-en-trussel-som-ma-tas-alvorlig-1.13767105.
[677] Office of Naval Intelligence, "The Russian Navy - A Historic Transition," 35; Mozgovoy, "Russian Navy's Long Arm: Kalibr Missile Family."

submarine situated north of the GIUK line. Note that Northern Europe's main ports are all within range.[678]

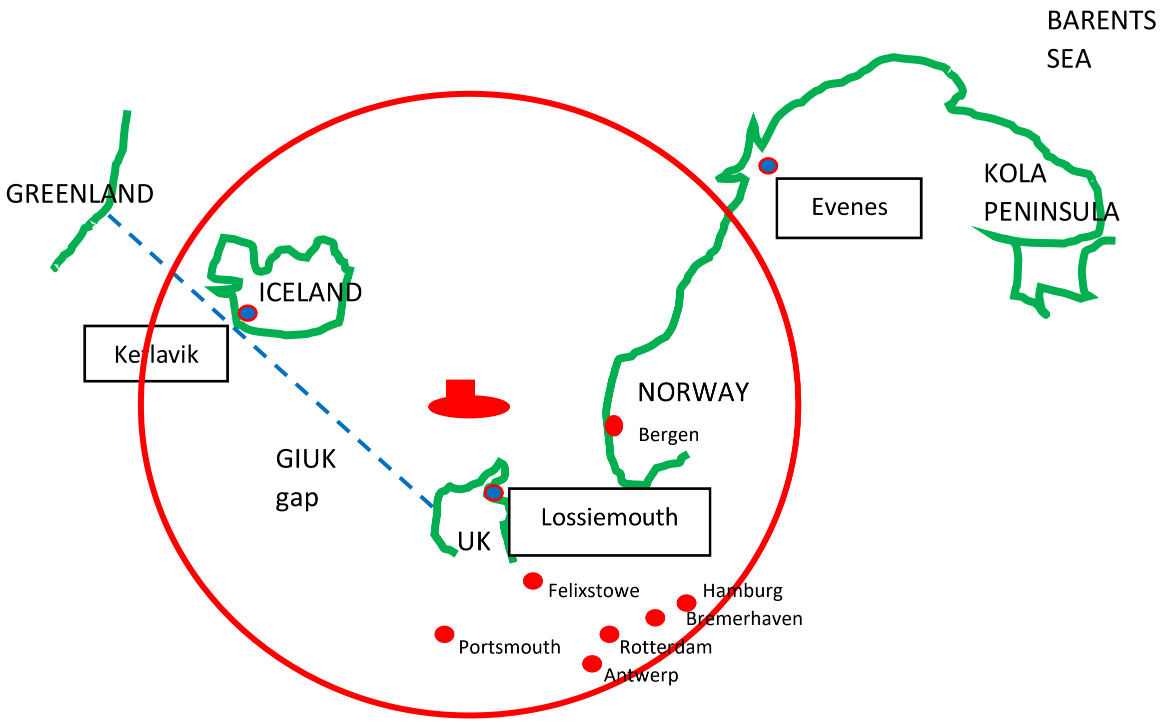

Figure 8-4. Russian sub-launched Kalibr missile holding Northern European ports at risk from a position well north of the GIUK line

Land-attack cruise missiles (LACM) are complex weapons, more so than their anti-ship brethren. LACMs have to navigate terrain, change communications environments, navigate through air defence layers, and differentiate their target from surrounding landscapes. One example of such a complex route to the missiles' target is the firing of *Kalibr* cruise missiles into Syria by two surface vessels in the Caspian Sea in autumn 2015. The missiles had to negotiate Iranian, Iraqi and Syrian territory before hitting their targets.[679]

The anti-ship version has a shorter range of approximately 160 nm/300 km, and skims low over the sea in order to avoid detection. The missile is active radar-homing, and performs evasive manoeuvres as it approaches its target. In doing so, it increases from Mach 0.8 in

[678] According to PortTechnology.org, the top 5 ports in Northern Europe are Rotterdam, Antwerp, Hamburg, Bremerhaven and Felixstowe. See Matteo Natalucci, "Top 5 Ports in Northern Europe," *Port Technology*, August 30, 2019, https://www.porttechnology.org/news/top-5-ports-in-northern-europe/.
[679] Robert Farley, "Is the Day of the Land Attack Cruise Missile upon Us?," *The Diplomat*, October 9, 2015, http://thediplomat.com/2015/10/is-the-day-of-the-land-attack-cruise-missile-upon-us/; Sebastian Roblin, "Why Russia's Enemies Fear the Kalibr Cruise Missile," *The National Interest*, January 22, 2017, https://nationalinterest.org/blog/the-buzz/why-russias-enemies-fear-the-kalibr-cruise-missile-19129.

cruising speed to Mach 3, and lowers its altitude to less than 5 meters over the water, making it very hard to detect and engage.[680] The NATO designation of the anti-ship version is SS-N-27 *Sizzler*, and the weapon can be launched against a single target or group, and approach the target(s) from different directions, significantly complicating the defensive task.[681] An anti-submarine variant is reportedly under development, a tactical ballistic missile with the range of 27 nm/50 km for the submarine-launched version and 22 nm/40 km for the ship-launched version. [682] Compared to a torpedo, this missile will have a much longer range and a significantly shorter delivery time.

The range and flexibility that are inherent in these weapons will be a significant factor for several theatres of operations, simultaneously. In short, a submarine from the Northern Fleet, operating in the North Atlantic, will potentially have enormous impact in the Baltic Sea and on the European continent. This intra-theatre approach and connectivity has among other things been exemplified by the aforementioned Caspian Sea flotilla firing *Kalibr* missiles into Syria. Commentators also noted that the way the relatively small flotilla carried out the attacks was a showcase for export of *Kalibr* weapons: One does not require a great missile cruiser or destroyer to deliver formidable naval fire power.[683] It is also a sign of a distributed force structure, with numerous smaller vessels distributed across the theatre being able to provide formidable firing power both in a tactical as well as a strategic setting.[684]

In addition to the Caspian Sea firings of missiles, on 08 December 2015 Russia fired four *Kalibr* cruise missiles into Syria for the first time from a *Kilo* class submarine in the eastern Mediterranean Sea.[685] The updated *Kilo* class is slightly longer and is fitted with improved engines and an improved combat system, in addition to new noise reduction technology. The submarine is reportedly able to operate on patrols for 45 days at a time.[686] It can fire both torpedoes and cruise missiles, the latter proven several times through the aforementioned

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680 Roblin, "Why Russia's Enemies Fear the Kalibr Cruise Missile"; Willett, "Game Changer: Russian Sub-Launched Cruise Missiles Bring Strategic Effect."
681 Office of Naval Intelligence, "The Russian Navy - A Historic Transition," 34.
682 Mozgovoy, "Russian Navy's Long Arm: Kalibr Missile Family."
683 Dave Majumdar, "Cruise Missiles Strikes in Syria: Russia's Big Ad Campaign?," October 8, 2015, https://nationalinterest.org/blog/the-buzz/cruise-missile-strikes-syria-russias-big-ad-campaign-14032.
684 Roblin, "Why Russia's Enemies Fear the Kalibr Cruise Missile."
685 Marta Portocarrero, "Russia Fires First Submarine Missiles against Isis Targets in Syria," *Independent*, December 10, 2015, https://www.independent.co.uk/news/world/europe/russia-fires-first-submarine-missiles-against-isis-targets-in-syria-a6766426.html; BBC News Online, "Russia Hits Targets in Syria from Mediterranean Submarine," *BBC News Online*, December 8, 2015, https://www.bbc.com/news/world-middle-east-35041656.
686 Gady, "Russia's Pacific Fleet to Receive 2 Fast Attack Subs in 2020."

firing into Syria.[687] This was a showcase of the new, credible Russian naval threat: the combination of quiet, stealthy submarines that are easy to defend, and capable long-range, multi-purpose cruise missiles that are hard to defend against.[688] In addition to the *Severodvinsk* class, the older submarines are also undergoing upgrades and retrofitting. In particular, the old *Akulas*, *Oscar II*s and *Delta IIIs* are being retrofitted to carry both anti-surface and land-attack missiles.[689] The *Oscar* class will replace the SS-N-19 *Shipwreck* anti-ship cruise missiles with *Kalibr* missiles, a mix of anti-ship and land-attack missiles – 72 missiles in total.[690] In comparison, the American *Ohio* class SSGN can carry 152 *Tomahawk* missiles, which is roughly considered to be a *Kalibr* equivalent. Part of the test and development regime is now the operational *Severodvinsk* class, which on occasion has been firing *Kalibr* missiles at test ranges on the Kola Peninsula.[691] A *Severodvinsk* class submarine also fired a *Kalibr* cruise missile from the Kola Peninsula in early 2019 while moored to a pier in Zapadnaya Litsa, some 60 km from the Norwegian border.[692]

In addition, the Russians are reportedly well underway in developing hypersonic missiles for launch from aircraft and missile silos on land, and have also initiated work to place such missiles on submarines.[693] Hypersonic missiles are hard to defend against, both because they manoeuvre at incredibly high speeds, but also because they are harder to detect and track by existing missile defence sensors. The *Zircon* hypersonic anti-ship cruise missile will likely be the main armament in the next class of multipurpose submarines, the *Husky* class, which is planned to be launched in 2027.[694] The *Zircon* is expected to have slightly shorter range than

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[687] Mark Episkopos, "Meet the First Russian Submarines to Fire in Anger since World War II (and Its New Cruise Missiles)," *The National Interest*, January 12, 2019, https://nationalinterest.org/blog/buzz/meet-first-russian-submarine-fire-anger-world-war-ii-and-its-new-cruise-missiles-41292; Willett, "Game Changer: Russian Sub-Launched Cruise Missiles Bring Strategic Effect"; Roblin, "Why Russia's Enemies Fear the Kalibr Cruise Missile."
[688] Cote, "The Third Battle - Innovation in the U.S.Navy's Silent War Struggle with Soviet Submarines," 86.
[689] Franz-Stefan Gady, "Russia to Upgrade 12 Nuclear-Powered Subs," *The Diplomat*, October 5, 2015, https://thediplomat.com/2015/10/russia-to-upgrade-12-nuclear-powered-subs/; Andrei Akulov, "Kalibr: Russia's Naval System Upping Cruise Missile Game," *Strategic Culture Foundation*, May 24, 2016, https://www.strategic-culture.org/news/2016/05/24/kalibr-russia-naval-system-upping-cruise-missile-game/.
[690] Willett, "Game Changer: Russian Sub-Launched Cruise Missiles Bring Strategic Effect."
[691] Thomas Nilsen, "Watch Russian Submarine Test Fire Cruise Missile in Barents Sea," *The Barents Observer*, August 18, 2017, https://thebarentsobserver.com/en/security/2017/08/watch-russian-submarine-test-fire-cruise-missile-barents-sea.
[692] Thomas Nilsen, "Russian Sub Launched Cruise Missile without Leaving Port," *The Barents Observer*, April 3, 2019, https://thebarentsobserver.com/en/security/2019/04/russian-sub-launched-cruise-missile-without-leaving-port#.XKQ_dO8JV7U.facebook.
[693] R. Jeffrey Smith, "Hypersonic Missiles Are Unstoppable. And They're Starting a New Global Arms Race.," *New York Times Magazine*, June 19, 2019, https://www.nytimes.com/2019/06/19/magazine/hypersonic-missiles.html.
[694] Matthew Bodner, "Russia Has Plans for Its Future Nuclear Subs, and It Involves Hypersonic Missiles," *Defense News*, June 1, 2018, https://www.defensenews.com/naval/2018/06/01/russia-has-plans-for-its-future-

the *Kalibr*. The *Severodvinsk* class will also reportedly carry the *Zircon* hypersonic cruise missile in the future.

The new missiles are eroding the distinction between attack submarines and multi-purpose submarines, further blurring the Allied understanding of roles and missions for each respective submarine class. When a scouting attack submarine, operating ahead of a naval force, is capable of engaging land targets with capable cruise missiles from distance, the threat scenario expands in scope. With a wider array of missiles on board, the respective submarine will pose a multi-dimensional threat, leading to a requirement to maintain situational awareness of more submarines than was earlier the case. The case for a robust ASW and underwater search force therefore only strengthens. The new and extremely capable Russian missiles that can be fired from submarines are shaping the naval battle for the future.[695] The stand-off distance for a submarine attacking an adversary naval force is increasing, seemingly making it all the more important to be able to neutralize the submarine at a distance.[696]

8.1.3 Russian strategy and posture

If Russian developments and deployments of submarine and missile technology prove anything it is that the bastion strategy remains alive and well. The concept is not only a topic for academic and military strategic discussion, but also an integral part of the political and media discourse on Norwegian security policy.[697] Russian naval operations and exercises have increasingly emphasized the concept as new and capable units are sent to sea.

Some naval experts doubt that the Russian fleet is sufficiently capable of providing adequate protection of their high value units through the bastion defence, due to the fact that the Russian fleet is so small compared to the fleet that comprised the original bastion defence of the late 1970s and 1980s.[698] But there is general consensus that the Russians are prioritizing

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nuclear-subs-and-it-involves-hypersonic-missiles/?utm_source=Sailthru&utm_medium=email&utm_campaign=DFN%20DNR%206/1/18&utm_term=Editorial%20-%20Daily%20News%20Roundup.

[695] Matthew Bodner, "Russia Adds 'Kazan' to Its Nuclear Attack Submarine Fleet," *Defense News*, accessed October 24, 2019, https://www.defensenews.com/naval/2017/03/31/russia-adds-kazan-to-its-nuclear-attack-submarine-fleet/.

[696] See for example Willett, "Game Changer: Russian Sub-Launched Cruise Missiles Bring Strategic Effect."

[697] Alf Bjarne Johnsen, "Søreide: Ber NATO Trekke Nordover," *VG*, February 15, 2016, https://www.vg.no/nyheter/innenriks/i/wWazo/soereide-ber-nato-trekke-nordover.

[698] Ståle Ulriksen, "Endring i Nord," *Bergens Tidende*, May 27, 2019.

quality over quantity, as is evident through the significantly improved modern Russian vessels when compared to previous generations. Focus is now given to smaller, multi-role vessels with capable long-range weapons. The Russian Navy is operating what can be termed a “dual fleet”, a combination of legacy vessels with new and modern units, as many units from the Cold War are still operational.[699] As we have seen throughout this thesis, this strategic ambivalence between the old school of thought, with a Mahanian focus on large surface combatants and aircraft carriers, versus the new school, with a focus on submarines as the primary fighting force of a lean, coastal defence navy, has actively influenced the operational capabilities of the Russian Navy.[700] The dual fleet seems to be a result of this. Russia established the Arctic Command in 2015, co-located with the Northern Fleet in Murmansk.[701] This command aims to streamline the operations of all the branches of the Northern Fleet in its area of responsibility in the Arctic under one hub for command & control.

In addition to the new, capable and quiet submarines of the Russian Navy, another prominent feature of Russian modernization and capabilities are measures for denying access and freedom to operate in designated areas, so-called anti-access/area denial (A2/AD) measures. Elements of A2/AD have been operating for decades, one can say centuries, as they are essentially capabilities meant to deny one’s adversary access to, or control over, a certain area of interest. What is new is the systematic approach to this type of denial, and the significantly improved capabilities of the weapons involved. Crucial elements of denial for air assets are missile threats, jamming of communications and jamming of positioning systems. One of the biggest concerns for NATO planners is the array of A2/AD elements in the Russian layered defence.[702] Below we will discuss how this affects airborne surveillance in the High North.

It seems clear that in terms of naval combat, submarines provide the most bang-for-the-buck. Or as Kathleen Hicks explains: “*the Russian Navy’s use of submarines to signal presence, reach and power achieves an effect that is disproportionate to the resources committed*.”[703]

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[699] Richard Connolly, “Towards a Dual Fleet? The Maritime Doctrine of the Russian Federation and the Modernisation of Russian Naval Capabilities,” *Russian Studies, NATO Defense College*, no. 2/17 (June 2017): 2.
[700] Liv Karin Parnemo, “Russia’s Naval Development — Grand Ambitions and Tactical Pragmatism,” *The Journal of Slavic Military Studies* 32, no. 1 (2019): 44.
[701] The Kremlin, “Meeting with Defence Ministry Leadership and Military-Industrial Complex Representatives,” May 12, 2015, http://en.kremlin.ru/events/president/news/49456.
[702] Matthew Bodner, “NATO Deputy SecGen: Russia’s Anti-Access/Area Denial Build-Up Is Biggest Worry,” *Security and Policy*, February 14, 2016, http://securityandpolicy.com/nato-deputy-secgen-russias-anti-accessarea-denial-build-up-is-biggest-worry/.
[703] Hicks et al., “Undersea Warfare in Northern Europe,” 2.

Although submarines are unable to command, or control, the sea, they are able to clear it of hostile surface forces.[704] The capable missile technology now being fielded facilitates a continued responsibility on the part of Russian SSGNs to deny NATO surface and sub-surface vessels entry into and freedom of manoeuvre in the North Atlantic where they would be able to conduct cruise missile strikes against the Russian mainland. The primary mission of Russian attack and multi-role submarines is therefore not only to protect the SSBNs on patrol behind them (pro-SSBN), but simultaneously to deny operations to adversary units such as aircraft carriers (anti-carrier).[705] The very essence of sea denial by submarines is the uncertainty projected on an approaching adversary based on the unpredictability of the submarines' whereabouts. This underlines the move from a predictable patrol pattern during the Cold War to an unpredictable operations *modus operandi* in contemporary submarine operations.

The secondary mission of the submarine fleet is power projection on land. Very quiet, multi-role submarines, capable of carrying several dozen *Kalibr* missiles, operating from virtually anywhere in the North Atlantic, will pose a credible threat to significant points of importance to NATO and its allies. The inherent potential in the offensive aspects of a layered defence such as the Northern Strategic Bastion mentioned above, are also increasingly being discussed among strategists and scholars. The Russian bastions are seen as a key element of future offensive warfare, particularly in terms of long-range precision guided cruise missiles.[706] Finally, the development of an anti-ship version of the *Kalibr* missile should be an indicator that the old SLOC mission of the Russian submarines has not been removed from their mission portfolio, contrary to Russian statements in the late 1990s.[707] Albeit not necessarily a SLOC mission in the traditional sense, where the threat to merchant shipping

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[704] James Holmes, "More Submarines and Less Aircraft Carriers: If the U.S. Navy Could Be Completely Rebuilt," *The National Interest*, December 3, 2017, https://nationalinterest.org/blog/the-buzz/more-submarines-less-aircraft-carriers-if-the-us-navy-could-23482?nopaging=1.

[705] The discussion of anti-SSBN versus pro-SSBN can be said to have been laid to rest in the late 90s, where the anti-SSBN mission in the North Atlantic was effectively cancelled. See Atland, "The Introduction, Adaptation and Implementation of Russia's 'Northern Strategic Bastion' Concept, 1992-1999," 519.

[706] Andrew Krepinevich, Barry Watts, and Robert Work, "Meeting the Anti-Access and Area-Denial Challenge" (Center for Strategic and Budgetary Assessments (CSBA), 2003), http://csbaonline.org/uploads/documents/2003.05.20-Anti-Access-Area-Denial-A2-AD.pdf; John O. Birkeland, "The Unsinkable Aircraft Carrier - An American Response to the Chinese Anti-Access/Area Denial (A2/AD) Challenge" (Master of Military Operational Art and Science, Maxwell AFB, Montgomery, Alabama, Air Command & Staff College, USAF, 2013), file:///C:/Users/JohnO/Downloads/ADA603131.pdf; James Lacey, "Battle of the Bastions," *War On The Rocks* (blog), January 9, 2020, https://warontherocks.com/2020/01/battle-of-the-bastions/.

[707] Atland, "The Introduction, Adaptation and Implementation of Russia's 'Northern Strategic Bastion' Concept, 1992-1999," 524.

has been submarines roaming the Atlantic in search of Allied convoys to sink, the mission for modern Russian submarines likely entails neutralizing key Allied ports and airfields. In future conflicts it seems likely that Russian submarines will pose a significant threat to the transatlantic logistics link without ever having to venture south of the GIUK gap. Some analysts suggest that if NATO is capable of controlling the GIUK gap, then the SLOCs will be secured.[708] Situated well above that line, a *Severodvinsk* class will still be able to hold all of Northern Europe's main ports at risk, as well as many of the important airfields used for logistics. It seems likely that the modern approach to the SLOC mission is to hold-at-risk NATO sea ports as opposed to patrolling the actual SLOCs at sea.[709]

8.2 Alliance steps to keep track of the threat

Although the political climate between Russia and the West, including Norway, for some time has been challenging at best, both Russia and Norway regularly point to the potential for cooperation on fishery regulation and administration, maritime trade, and technology.[710] There is also cooperation taking place between the two coastguards, as well as for search and rescue in the Arctic.

However, Norway has since 2008 consistently been working to get NATO to re-focus more on the North Atlantic and the maritime domain.[711] The lack of warning times in a potential modern conflict in the High North necessitates presence and encompassing surveillance, an understanding that has settled at the highest political level in Norway.[712] And indeed, NATO has in the past years shifted its focus back to the maritime domain and ASW in particular.[713] Exercise *Trident Juncture* in autumn 2018 was the largest exercise held in Norway in several decades, and during the exercise a US aircraft carrier sailed north of the Arctic circle off

[708] Conley, Rathke, and Melino, "Enhanced Deterrence in the North - A 21st Century European Engagement Strategy," 36.
[709] Magnus Nordenman, *The New Battle for the Atlantic - Emerging Naval Competition with Russia in the Far North* (Annapolis, MD: Naval Institute Press, 2019), 199–200.
[710] Per Anders Johansen, "Putin Med Overraskende Norge-Flørt: På Tide å Utvide Horisonten Og Samarbeidet," *Aftenposten*, October 21, 2018, https://www.aftenposten.no/verden/i/1kJozl/putin-med-overraskende-norge-floert-paa-tide-aa-utvide-horisonten-og-samarbeidet.
[711] Erik Lieungh, "Norge Trekker NATOs Øyne Mot Nordflanken," *NRK*, February 13, 2016, https://www.nrk.no/finnmark/norge-trekker-natos-oyne-mot-nordflanken-1.12801938; Alf Ole Ask, "NATO Møter Utfordringer i Alle Himmelretninger," *Aftenposten*, February 15, 2016, https://www.aftenposten.no/verden/i/o60K/nato-moeter-utfordringer-i-alle-himmelretninger.
[712] Øystein Antonsen and Arild Moe, "Alle Ser Mot Nord: -Arktis Gir Oss Flere Muligheter," *NRK*, January 22, 2018, https://www.nrk.no/troms/alle-ser-mot-nord_-_-arktis-gir-oss-flere-muligheter-1.13879346.
[713] NATO, "Warsaw Summit Communique," para 47.

Norway for the first time since 1991.[714] The recent rise in Western nuclear submarines calling on Norwegian ports is another sign of increased activity by Western submarines on highly classified missions in the High North.[715] Commentators also take note of NATO increasing the regularity and scope of the Alliance's ASW exercises since the Wales summit in 2014, in reaction to increased Russian submarines activities.[716] In mid-2017, the US, UK and Norway signed a trilateral Statement of Intent (SoI) that focusses on cost-efficient logistics and enhanced cooperation for the three nations' P-8 operations.[717] The statement does not elaborate as to what this operational cooperation looks like in practice. However, it is likely that the three nations, flying the same aircraft, will work closely in peacetime as well as during crises to monitor the North Atlantic, both above and under the surface. As we have seen in the previous chapters, there is much experience on this type of collaboration to build on from the Cold War. The US Navy is again showing interest in a regular presence at Keflavik, after closing the base in 2006.[718] But the US Navy has also considered regularly utilizing Evenes in Northern Norway as a base for maritime airborne surveillance in the High North, indicating that Keflavik is still not close enough to the areas of interest.[719] However, Norway still enforces her basing policy, and it will be interesting to see if dynamics on allied aircraft operating from Norwegian soil will change in the near future. Supported by tanker aircraft in coordinated missions, both American and British SIGINT aircraft regularly cover the Barents Sea, particularly during exercises or other activities of particular interest.[720]

In addition to this, two Norwegian intelligence collection ships operate more or less continuously in the High North. The ageing *Eger* has the main responsibility for monitoring the northern parts of the Norwegian Sea and Western Barents Sea, while the much larger

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714 Geoff Ziezulewicz and David B. Larter, "The Navy Sends a Carrier Back to Russia`s Arcic Haunts," *Navy Times*, October 19, 2018, https://www.navytimes.com/news/your-navy/2018/10/19/the-navy-sends-a-carrier-back-to-russias-arctic-haunts/#.W820deP9FUo.email.
715 Kjell Persen, "Amerikansk Atomubåt Søkte Nødhavn i Norge," *TV2.No*, October 27, 2017, https://www.tv2.no/a/9433425.
716 Willett, "Game Changer: Russian Sub-Launched Cruise Missiles Bring Strategic Effect."
717 George Allison, "US in Deal with UK and Norway to Form P-8 Poseidon Partnership," *UK Defence Journal*, July 4, 2017, https://ukdefencejournal.org.uk/us-deal-uk-norway-form-p-8-poseidon-partnership/.
718 Trude Pettersen, "U.S. Military Returns to Iceland," *The Barents Observer*, February 10, 2016, https://thebarentsobserver.com/en/security/2016/02/us-military-returns-iceland#.VsVfwxKHhBK.mailto.
719 NTB, "Evenes Flystasjon Kan Bli Overvåkingsbase for USA," *VG*, July 21, 2019, https://www.vg.no/nyheter/innenriks/i/bprjB/evenes-flystasjon-kan-bli-overvaakingsbase-for-usa#xtor=CS4-1.
720 Tyler Rogoway, "USAF`s Nuke Sniffing Plane Is Flying on a Mission near the Arctic Right Now," *The Drive*, February 22, 2017, https://www.thedrive.com/the-war-zone/7830/usafs-nuke-sniffing-plane-is-flying-on-a-mission-near-the-arctic-right-now?xid=emailshare; Sam LaGrone, "Russian Air Force Chief: U.S. Surveillance Flights Monitor Russia Daily," *USNI News*, December 17, 2014, https://news.usni.org/2014/12/17/russian-air-force-chief-u-s-surveillance-flights-monitor-russia-daily.

vessel *Marjata* monitors the Eastern parts of the Barents Sea.[721] The *Marjata* has been sailing in the Barents Sea since 2016, and is considered one of the most advanced vessels of its kind. The rationale for the more or less constant presence of these ships is to map all military activity and some civilian activity in the Barents Sea and areas close to Norway in order to establish what constitutes the normal situation or baseline activity.[722] The Norwegian Navy has also increased its presence in the High North, with regular frigate patrols, in particular.[723]

The re-establishment of the US Navy 2nd Fleet in Norfolk, VA, in May 2018, with a focus on high-end naval warfare in the Atlantic was another reaction to the rise in Russian naval activities.[724] The 2nd Fleet will have the entire North Atlantic as its area of responsibility (AOR), based on both the expansionist nature of Russian naval operations and the new long-range weapons that are being fielded.[725] The High North is to an increasing degree regarded as a potential battlespace of the future, as opposed to the protection of sea lines of communication further south.[726]

In the summer of 2018, moreover, NATO established Joint Force Command (JFC) in Norfolk, with a focus on NATO command and control of naval operations in the North Atlantic. It, too, was established as a direct consequence of increased military activity in the North Atlantic and the Arctic.[727] NATO has also boosted the personnel of the Alliance's primary naval commander and advisor, MARCOM.[728]

In sum, both NATO and individual member states have taken steps to respond to the re-emergence of a stronger, more adversarial Russian naval presence in the High North. This is now recognised as a field of strategic priority.

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[721] Sveinung Berg Bentzrød, "E-Sjefen: Derfor Trenger Norge to Spionskip i Nord," *Aftenposten*, September 26, 2016, https://www.aftenposten.no/norge/i/A9oqM/E-sjefen-Derfor-trenger-Norge-to-spionskip-i-nord.
[722] Trude Pettersen, "U.S. Builds up Arctic Intelligence Network," *The Barents Observer*, September 8, 2015, https://barentsobserver.com/en/security/2015/09/us-builds-arctic-intelligence-network-08-09.
[723] Anders Brekke and Joakim Reigstad, "- Dagens Forsvar Er Ikke Bærekraftig," *NRK*, April 11, 2016, https://www.nrk.no/norge/_-dagens-forsvar-er-ikke-baerekraftig-1.12894608.
[724] David B. Larter and Mark D. Faram, "The US Navy's New Command Puts Russia in the Crosshairs," *Defense News*, May 4, 2018, https://www.defensenews.com/naval/2018/05/04/the-us-navys-new-command-puts-russia-in-the-crosshairs/#.WuzF9tk3w80.email.
[725] Sam LaGrone, "CNO: New 2nd Fleet Boundary Will Extend North to the Edge of Russian Waters," *USNI News*, August 24, 2018, https://news.usni.org/2018/08/24/cno-new-2nd-fleet-boundary-will-extend-north-edge-russian-waters.
[726] LaGrone.
[727] Andrew ADM Lewis, "One Arctic: Maintaining Stability and Propserity in the High North" (Henry Bacon seminar, Washington, D.C., May 8, 2019).
[728] Deborah Haynes, "Putin's Submarines Spur NATO to Boost Its UK Nerve Centre," *The Times*, January 10, 2018, https://www.thetimes.co.uk/article/putin-s-submarines-spur-nato-to-boost-its-uk-nerve-centre-8h2bf95qp.

8.3 Discussion within the theoretical framework

The shift away from the predictable tracking patters of Soviet submarines during the Cold War to the more unpredictable operational movements of Russian submarines today has created new challenges for Norway and her allies in the High North. In particular, it has complicated the task of ASW.

In addition to reforming command structures, NATO and its member-states must update their ASW and especially their airborne ISR capabilities. It is this author's contention that the theoretical framework presented in the previous chapter, combined with historical precedence from the Cold War era, can point the way forward. The following section thus provides suggestions for how new technology and new approaches to airborne surveillance might facilitate an improved situational awareness and basis for targeting in the High North.

8.3.1 Altitude

One benefit for airborne ISR is that when an MPA is flying along a sovereign national border, or some other line of restriction (e.g. stand-off distance to surface-to-air weapons) the aircraft is able to look beyond that border, for example beyond the shoreline under surveillance.

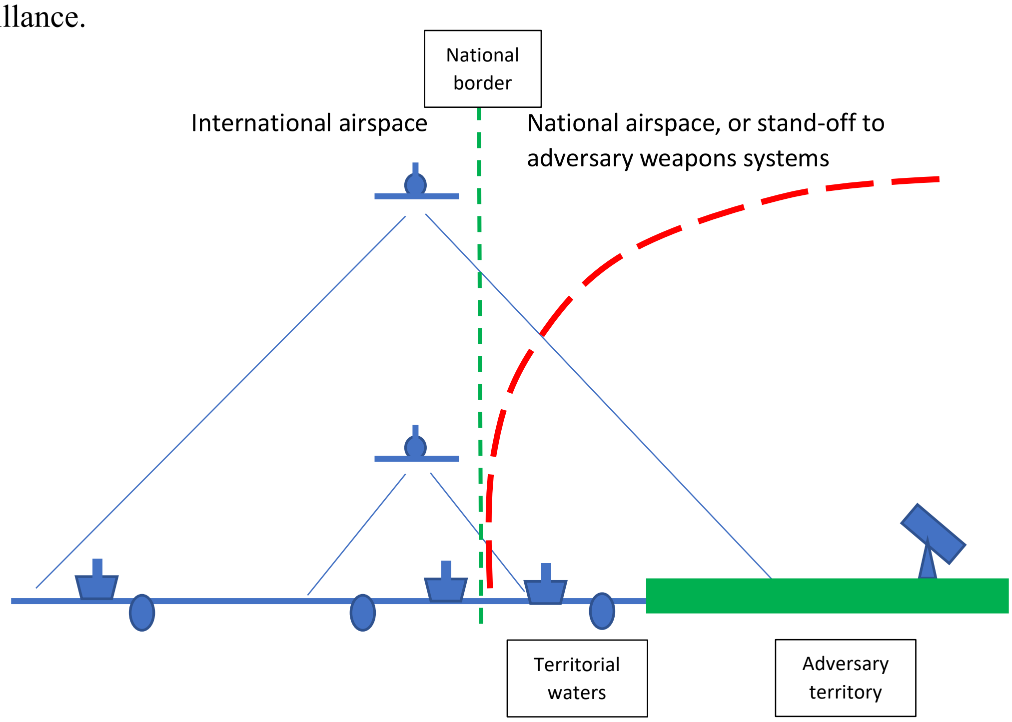

Figure 8-5. Increased sensor range with increased altitude

The P-8 is capable of operating at a higher altitude than the P-3 (41,000 feet versus approximately 29,000 feet, respectively).[729] The theoretical radar range at 29,000 feet is approximately 210 nm.[730] At 41,000 feet, this range increases to approximately 250 nm. If an asset is capable of operating at 60,000 feet, the theoretical radar range increases to a little over 300 nm. Figure 8-6 below emphasizes the increase in sensor range based on speed as a constant and altitude as a variable. With a baseline of 29,000 with a reference cruising speed of 330 knots, the area covered in one hour by the radar sensor increases by 20% at 41,000 feet, and 40% at 60,000 feet. For area coverage and particularly for non-acoustic sensors, altitude thus matters significantly.

One historic example of assets at different altitudes working together was the British *Vulcan* bombers flying high and the *Shackleton* MPA flying low. In working together, they made the search and surveillance of contacts more efficient.

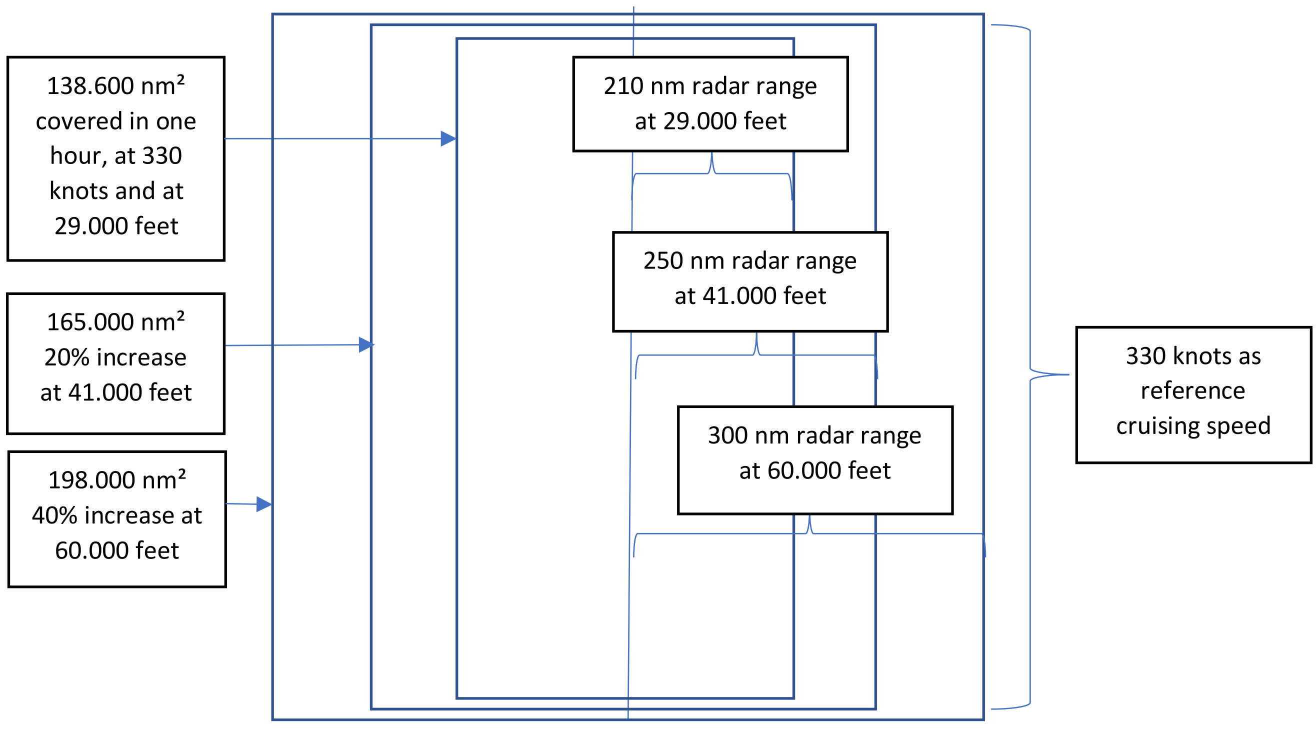

Figure 8-6. Increase in sensor coverage over time with increase in altitude

A modern example of such cooperation is a *High Altitude/Long Endurance* (HALE) unmanned system flying at 60,000 feet, maintaining area overview in support of a manned

[729] Boeing, "P-8A Poseidon," accessed November 28, 2019, https://www.boeing.com/defense/maritime-surveillance/p-8-poseidon/index.page; Naval History and Heritage Command, "P-3 Orion," May 29, 2014, https://www.history.navy.mil/research/histories/naval-aviation-history/naval-aircraft/current-aircraft-inventory/p-3-orion.html.

[730] The formula for theoretical radar range in nautical miles is 1.23√(height in feet).

MPA flying at lower altitudes, investigating and prosecuting contacts. NATO has dubbed such cooperation "*High boy/Low boy*" tactics.[731]

Other systems with an obvious high ground with regards to surveillance, are satellites. Extensively used for maritime surveillance already, the clear downside is the relatively short amount of time they can focus over a given area, and the lack of flexibility with regards to real-time tasking and changes to areas of focus and thus priority. In addition, satellites are limited to surface surveillance. But in combination with other assets, satellites provide extreme endurance, albeit only periodically, thus supporting the establishment of a pattern-of-life in an area. And perhaps most importantly, satellites can pass over adversary territory, without running the risk of being shot down.

Traditional airborne ASW, meanwhile, is characterized by aircraft flying at very low altitudes in order to react quickly to submarine movements, more precisely place sonobuoys into the water, and utilize sensors such as MAD and radar for fine tuning a submarine's position. Newer generations of MPA will work at high altitudes in order to gain overview of the area, but will to a larger degree be able to operate from medium to high altitudes also in the search and tracking phase of the prosecution. Historically, MPA crews have been forced through the cumbersome process of electronically relocating individual buoys at low altitudes at regular intervals and plotting them into the tactical overview, due to the set and drift in the ocean. Today, modern buoys with built-in Global Positioning System (GPS) will inform the aircraft tactical system of their position continuously throughout their lifespan, enabling tracking tactics to be executed from up high. This new technology also facilitates unmanned aircraft flying at high altitudes executing ASW search and tracking.

8.3.2 Speed

For maritime airborne ISR, speed means that the aircraft can get to the operations area or a datum of a submarine in a shorter amount of time. As a continuation of this, the sporadic nature of modern Russian submarine movements requires MPAs to be able to move quickly from one place to another to investigate a contact. And, once positive contact has been achieved, there is presumably less time to acquire attack criteria and execute an attack due to the short acoustic ranges of the sounds emitted by the submarine, as will be discussed below.

[731] AJP 3.3.3, "NATO Maritime Air Coordination" (NATO, December 2014), 5–2.

In this context, speed will be of critical essence. The combination of unpredictable operations patterns of the threat and short acoustic ranges means that the relevancy of a datum is shorter now than before. If the tracking aircraft (e.g. an unmanned aircraft carrying sensors but not weapons) cannot neutralize the target itself, then the platform employed to execute the attack (e.g. an MPA carrying torpedoes) must be able to transit quickly to the perishable datum.

A hypothetical datum, mid-way between the three core maritime air bases in the North Atlantic, lies approximately 950 nm from each base. A P-3 *Orion* will require approximately 2 hrs and 50 minutes to get to the scene, and a P-8 *Poseidon* will get there in 2 hrs and 10 minutes. Not only will the increased speed provide 1 hr and 20 minutes longer on-station time for the P-8, but the submarine will have had 40 minutes less time to evade the datum in the case of a P-8 hunting it. In a tactical example where the MPA is reacting to its own sensor hits, the difference is obviously less, though important. An MPA with a 210 nm radar horizon detecting a submarine at the edge of this range envelope will fly to investigate as soon as possible.

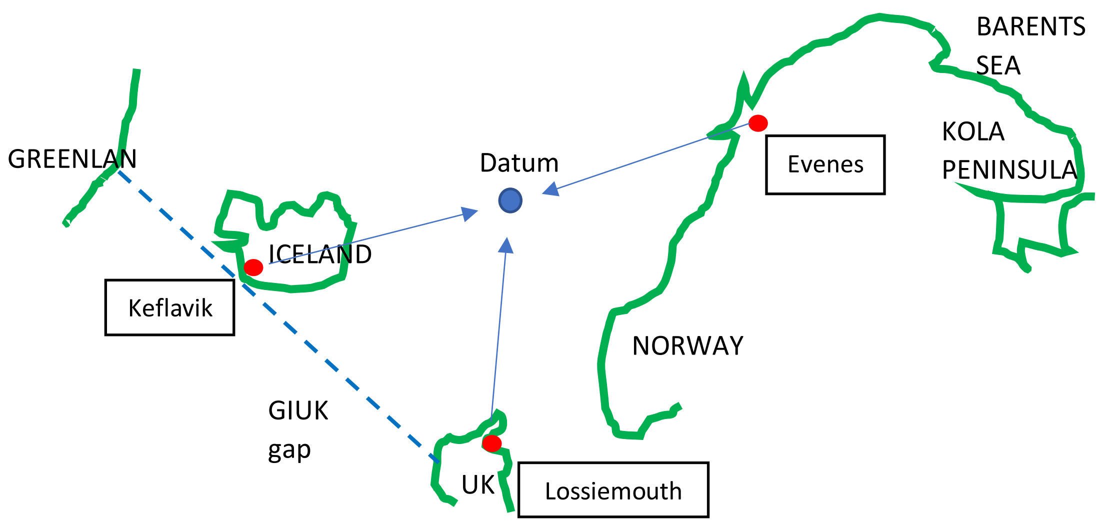

Figure 8-7. A hypothetical datum with equal distance to all three MPA bases in the North Atlantic.

210 nm is covered in 38 minutes at 330 knots (P-3) and in 30 minutes at 420 knots (P-8). In those eight minutes, the evading submarine will have transited anywhere from 1 to 3 nm (submarine speed between 5 and 15 knots), which with contemporary ranges (see below) can mean the difference between acquiring and losing contact.

Finally, speed allows for the coverage of a larger area in a shorter amount of time. For example, the P-8 flies faster than the P-3, with cruising speeds of 420 knots versus 330 knots, respectively. The following figure thus emphasizes the increase in sensor coverage based on altitude as a constant and speed as a variable.

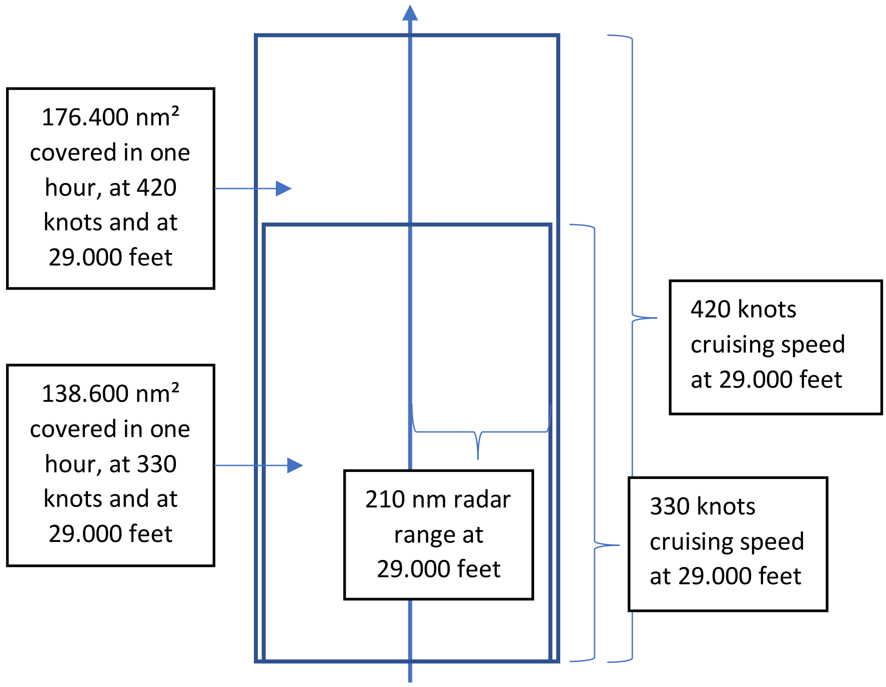

Figure 8-8. Increase sensor coverage with increased speed.

Calculating with altitude, and thus sensor range, as a constant, an increase in speed will facilitate an increase in sensor coverage. In a direct comparison between the P-8 and the P-3 where both aircraft are flying at an altitude of 29,000 feet, an increase from 330 knots to 420 knots gives an increase in sensor coverage in one hour of more than 27%.

8.3.3 Range

As we have seen time and again in this thesis, range in many ways epitomizes the very concept of maritime airborne ISR. The vast ocean areas that have been under surveillance by the aircraft discussed in this thesis have shaped the MPA force, and range was the single most debated operational characteristic among the Group of Experts for the NATO *Atlantic* program in the 1950s and 60s. One simply must be capable of reaching the point of interest in order to be relevant.

In the case of the Barents Sea, arguably the most relevant area for intelligence collection in the North Atlantic for NATO MPAs, the speed combined with range of the P-8 will be a factor for considering the relevance of the old 24-degree East guideline of the Norwegian government. The objective of the restrictions was always to facilitate Allied activity and presence in combination with maintaining low tensions in the North. Svein Efjestad of the Norwegian MoD points to new surveillance technology as crucial in facilitating new activities as well as old activities in new ways in areas of Norwegian interest.[732] The new technology will necessitate a more flexible and dynamic approach to the guidelines.

Figure 8-10 below shows the transit routes to the Barents Sea from the three main MPA bases in the North Atlantic, and the approximate position of the 24E guideline that applies for foreign MPA operating from Norwegian soil. A change in transit speed from 330 knots for the P-3 to 420 knots for the P-8 means that the transit from Keflavik to the Barents Sea (approximately 1,000 nm) will be reduced from 3 hours to less than 2,5 hrs. This reaps a 40% increase in on-station time from 3 hours to 4 hours and 14 minutes.

Throughout the Cold War, the 24E guideline gave the Norwegians a *de facto* monopoly in maritime airborne surveillance in the High North and the Barents Sea.[733] With new technology, new capabilities and a new security environment, it seems likely that other actors will carry out intelligence operations in areas such as the High North if the intelligence requirements in the area outpace the capacity of local actors to deliver. The most prominent change in the framework of the Norwegian maritime air monopoly on collection in the Barents Sea will be experienced by the former P-3 operating nations, the US and Norway. As transit speeds of new aircraft increase, more on-station time is gained. Also, increasingly capable unmanned aircraft will be able to take off from outside Norwegian soil and operate in the Barents Sea over extended periods of time. New technology may therefore challenge and force changes to the Norwegian guidelines for airborne operations off the coast of Kola.

With a more forward leaning Russian Navy, it seems natural that the notion that intelligence collection and presence in the Barents Sea shall be reserved strictly for Norwegian assets can once again be challenged in the near future by Norway's allies. The fact remains, however, that Norway will, due to geography, always boast the quickest response time and the longest on-station time in the Barents Sea.

[732] Efjestad, Norwegian self-imposed restrictions in the High North.
[733] Klevberg, 375–77; Tamnes, *The United States and the Cold War in the High North*, 216–17.

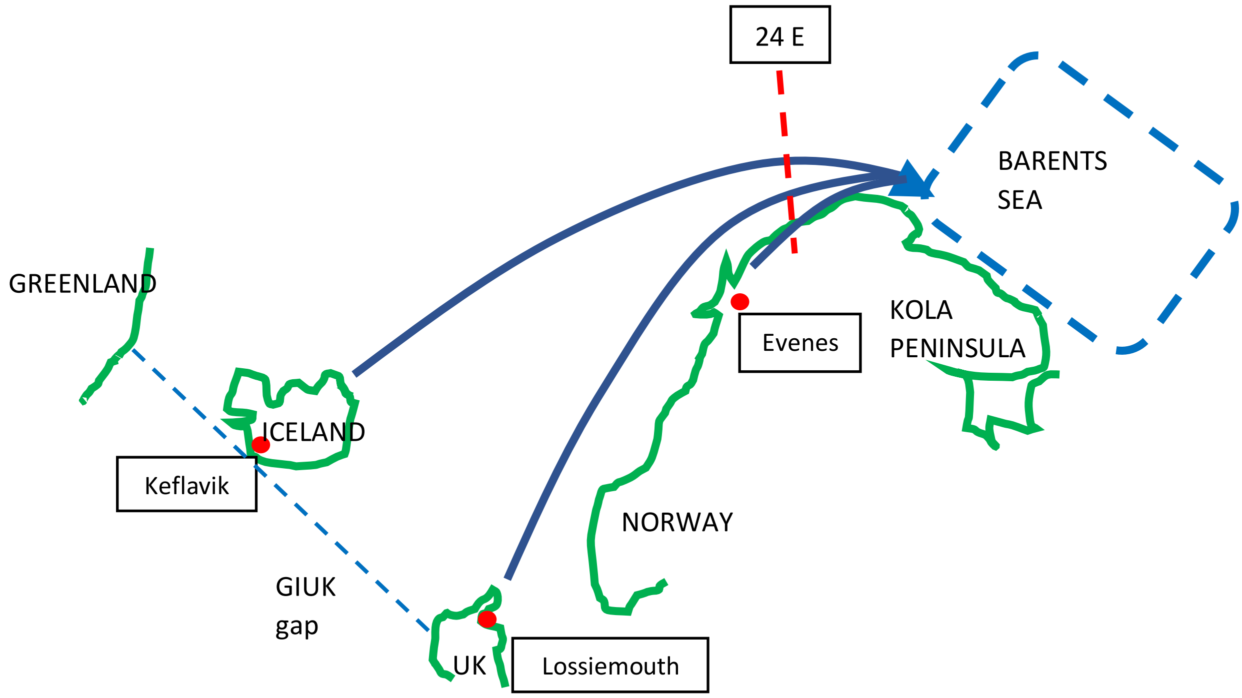

Figure 8-9. Transit and onstation times for MPA in the Barents Sea

The elements of hybrid warfare combined with the unpredictable *modus operandi* of Russian submarines are building the case for persistent surveillance in the High North. This persistency can only be facilitated by assets staying in the area for very long periods of time, and overlapping with a relieving asset. Satellites have regularity and predictability over a very long time period (several years), but they lack continuous persistency. They are continuously circling the globe, but over a given geographical area they are only intermittently present. MPAs have long endurance, but even with AAR the onstation time in unlikely to pass much more than 20 hours, if only due to human fatigue. Current and future technology therefore points to unmanned aircraft that can stay aloft for more than 30 hours today, and much more in the future. Ground crews operating and/or monitoring the aircraft can function in shifts, by definition removing the element of human fatigue. The case for high-altitude, unmanned aircraft for persistent maritime surveillance in the High North is pertinent indeed. They do not, however, have the capability to conduct underwater ASW.

Another point with the new *modus operandi* of Russian submarines, is that all three MPA bases stand to be good launch sites for MPA missions in search of Russian submarines in the North Atlantic, as shown below.

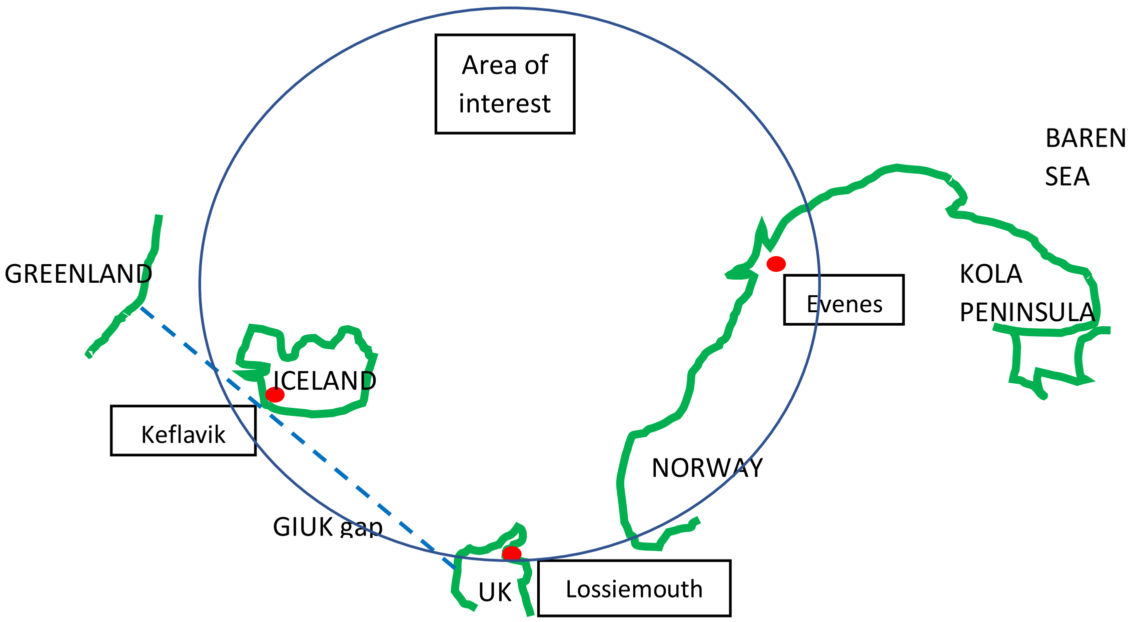

Figure 8-10. Short transit times to area of interest in the North Atlantic

In terms of air power, range facilitates two basic factors that play fundamental roles in the execution of a mission. Firstly, range provides the ability to fly a certain distance, perform a mission, and then either return to home-base or fly to a different destination. Secondly, endurance provides the ability to stay in and above an area and thus gather information from that area *over time*. Tracking Soviet submarines during the Cold War demanded range in the context of the first factor. An MPA would fly to a point along the transit route, and be prepared to track the submarine for a certain distance along that route (situation A, figure below). Searching for and tracking modern Russian submarines is a different matter, however, as the operations area essentially encompasses the entire North Atlantic.

This in turn demands ISR assets to be able to stay in the area over time in order to bring continuation to the search, and to be able to respond in an appropriately short amount of time to a sensor hit (situation B, figure below).

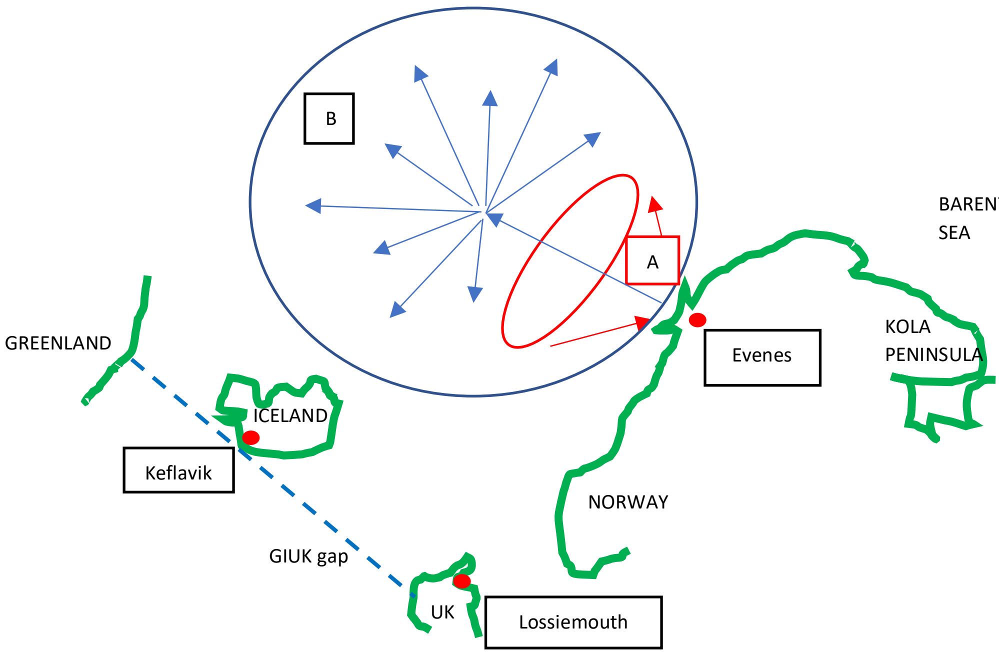

Figure 8-11. Efficient use of MPA range in a predictable submarine transit pattern (A, red). Demanding endurance requirements for unpredictable submarine modus operandi (B, black)

Given that the P-8 has approximately the same range and endurance as the P-3, the range factor in relation to ASW is reduced to the *modus operandi* of the target submarine.[734] As aforementioned, the predictability of the Cold War Soviet SSBN transit worked in favour of the Western MPA that were hunting it. The endurance available was utilized more efficiently than what is possible when the hunter effectively is searching large parts of the North Atlantic basin. This further evolves as modern search tactics are even more dependent on cueing – other assets that loiter above, on, or below the surface of a given area in search of indications of targets of interest, which in turn cue more capable search, track and attack assets for the actual prosecution of the target.

By flying faster and higher, however, the P-8 is able to cover a larger area in a shorter amount of time. Getting to the operations areas faster, the P-8 is also able to loiter in the operations area for longer than the P-3.

[734] The US Navy notes that the P-3 Orion is able to operate for 3 hours at 1346 nautical miles, and the P-8 Poseidon for 4 hours at 1200 nautical miles. See US Navy, "Fact File - P-3C Orion and EP-3 Aries" (US Navy, December 3, 2018), https://www.navy.mil/navydata/fact_display.asp?cid=1100&tid=1400&ct=1; US Navy, "Fact File - P-8A Posdeidon Multi-Mission Maritime Aircraft (MMA)" (US Navy, December 3, 2018), https://www.navy.mil/navydata/fact_display.asp?cid=1100&tid=1300&ct=1.

8.3.4 Communications

Traditional MPA operations did not require detailed analysis and reporting to be sent back to HQ at all times. MPAs were mainly operating far away from other units, hunting submarines, only sporadically reporting home. Today, submarines are far more integrated into joint operations. And in the case of Russia, we see integrated, cross-theatre submarine operations, which means that submarine operations for example in the Baltic can and will most likely affect submarine operations in the North Atlantic. In order to better understand this complexity in adversary behaviour, it is paramount that headquarters is able to fuse movements, indications and warnings nearly instantly, in order to understand what is happening and gain information superiority over one's adversary. Modern communication suites and support assets (such as satellites) are integral elements of this ability to build a tactical, operational and strategic picture of the battle. For example, encrypted, broadband satellite communication facilitates exchange of acoustic analyses in order to engage subject matter expertise for solving it, in such cases where the aircraft sensor operator is struggling with in-flight analysis. Instant dissemination of ISR information also enables faster detection of anomalies, if many sensors together are capable of monitoring large parts of the area of interest. In a hybrid warfare environment at sea, where adversary actions are not necessarily the traditional and conventional naval movements, it will require more persistent and detailed information gathering in order to detect anomalies from the normal situation.

Given the nature of the operations that MPA traditionally execute over the open ocean there was historically only a requirement for basic communication with other units and with headquarters and home base. The traditional setup consisted of HF long-range communications over voice and basic text messages (teletype). The NATO maritime *Link-11*, originally introduced in the mid-1960s, facilitated an exchange of tactical information, leading to a basic, common tactical picture. For radio communications with other military units, UHF was utilized, as remains common today. In essence, the transmission out of the aircraft were short bursts of either voice or text transmissions, consisting of very short safety or tactical updates. Mostly, MPAs operated by themselves and reported widely only after landing. An important element of the lack of communication has also been that radio silence removed the possibility of detection by enemy ELINT. Particularly, active transmissions from the aircraft would give away the presence of the MPA to a submarine at periscope depth checking whether it is safe or not to surface.

In addition to the traditional maritime NATO *Link-11*, the NATO *Link-16* has been integrated into the onboard systems of the P-8. *Link-16* provides more detailed information, with a significantly higher rate of updates, compared to *Link-11*. This means that the MPA can to a significantly higher degree be integrated into the joint theatre of operations, and thus share a comprehensive tactical overview.

Internet connection is also integrated in the new MPAs, enabling transfer of data to home-base in addition to the military SATCOM connection, the latter being a necessity for integration into modern operations. A significant challenge for SATCOM communications in the High North is that the most commonly used communication satellites are *geostationary*: they orbit the Earth directly outside the equator, with the same speed as the rotation of the Earth, leading them to be perceived as static to an observer on the Earth's surface. This gives poor coverage in very high and very low latitudes, and thus poor coverage in the High North.

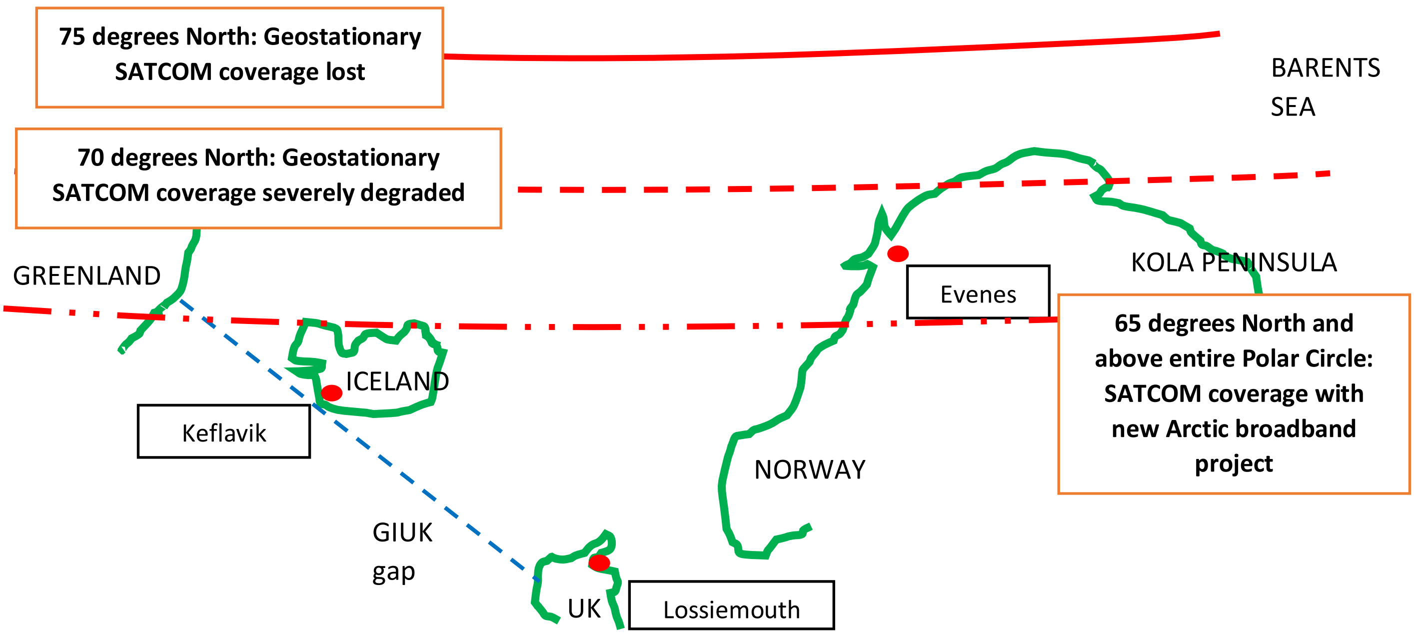

Figure 8-12. SATCOM coverage in the High North

There are commercial, global communication satellite networks available, but these are meant for civilian communications and usually provide a narrow bandwidth. In order to share intelligence products such as imagery, acoustic analyses or video, much broader bandwidth is required. This is part of a military assessment. One can lease bandwidth from a commercial contractor, which evades the cost of launching a satellite. But then there is a requirement for end-to-end encryption, further decreasing the usually narrow bandwidth. One can also conduct civilian-military cooperation, where a military communications payload is placed onboard a civilian satellite, and the overarching costs of launching and "flying" the satellite is shared. This is emerging as one of the most cost-efficient solution to the problem. Finally, one can launch a satellite by oneself, leading to full control of the satellite but having to bear the entire cost of launch and daily operations. The part government-owned company *Space Norway* is in the midst of a project that seeks to remedy this situation and plans to launch satellites in orbits that have a sufficient inclination in comparison to the equator, providing good communications coverage in the High North. When these satellites are up and running according to plan in 2023, NATO MPAs monitoring the Arctic will have their means of communication vastly improved for the foreseeable future.

8.3.5 Survivability

The issue of survivability is frequently neglected in discussions of MPA operations. This fact seems to be a remnant from the time when MPAs were operating by themselves, far out to sea, with limited or no real threat posed towards them. In general, MPAs feature in NATO military discourse as an asset that primarily can be utilized during peacetime and times of low tension, depending on the anti-air threat involved and the level of acceptable risk.

The main threat towards aircraft flying over the ocean are surface-to-air missiles (SAM) from submarines and surface ships, air-to-air missiles (AAM) from carrier-based aircraft, and SAM and AAM threats from shore-based assets when operating within range of the adversary coastline. The SAM systems onboard the *Kirov* battle cruiser include the SA-N-20 *Gargoyle* which has a range of up to 83 nm/150 km.[735]

[735] Russian name: S-300FM. John Wood, *Russia, the Asymmetric Threat to the United States - A Potent Mixture of Energy and Missiles* (Santa Barbara, California: Praeger Security International, 2009), 61.

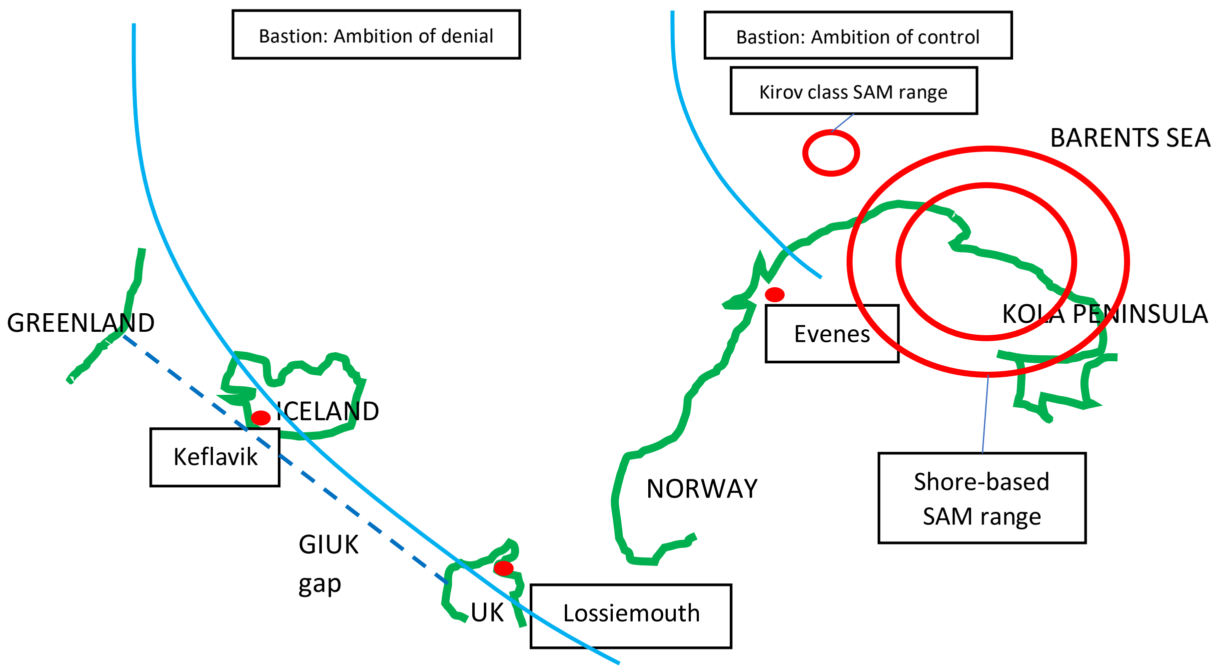

Figure 8-13. Russian SAM ranges in the Barents Sea.[736]

The *Udaloy* class destroyer carries the SA-N-9 *Gauntlet* which has a range of a little more than 8 nm/15 km.[737] The anti-aircraft armament of the relatively new *Admiral Gorshkov* class frigate is the *Hurricane* SAM system, a derivative of the land-based S-400 system with a range of up to approximately 66 nm/120 km.[738]

AAMs inherently have long ranges due to their airborne launch platforms. In addition to the range of the aircraft, the Russian AA-13 *Arrow*, for example, has a range in excess of 150 nm.[739] This poses a significant threat to any adversary flying asset in the area.

Finally, when operating close to the Russian coastline, any air asset will have to negotiate a three-layered missile defence system, based on some of the world's most capable long-range, medium-range and point defence systems. The S-200 and the S-400 create an outer layer air

[736] These generic range circles have been adopted from the interactive map posted by Ian Williams, "The Russia - NATO A2AD Environment," *Missile Threat Project (CSIS)*, January 3, 2017, https://missilethreat.csis.org/russia-nato-a2ad-environment/.
[737] Russian name: 3K95 *Kinzhal*. Wood, *Russia, the Asymmetric Threat to the United States - A Potent Mixture of Energy and Missiles*, 62.
[738]Russian technical designation: 9M96E/9M96E2. Military-Today.com, "Admiral Gorshkov Class - Multi-Role Frigate," *Military-Today*, accessed December 6, 2019, http://www.military-today.com/navy/admiral_gorshkov_class.htm.
[739] GlobalSecurity.org, "AA-13 ARROW / K-37/R-37 / RVV-BD," June 2, 2018, https://www.globalsecurity.org/military/world/russia/aa-13.htm.

defence bubble of more than 220 nm.[740] This is followed by a second, medium-range layer consisting of the S-300 or the *Buk* system. Then, the innermost layer consists of short-range systems such as 9K33 *Osa* and S-125 *Neva* for concentrated protection of key areas.

Figure 8-14 above illustrates the generic SAM threats from surface vessels north of Norway and from shore-based systems on the Kola peninsula. Not depicted on the figure are the shore-based interceptor and fighter aircraft that will carry AAMs, and that will pose a significant threat to any aircraft venturing into the area in which the Russian ambition of control stands firm.

All these threats taken into account, one would be hard pressed to send a manned, large (with a significant radar cross section, easily acquired by missile homing), relatively low flying (below SAM ceiling of minimum 70,000 feet[741]), slow moving (well below the speed of sound) and slow manoeuvring aircraft, lacking proper self-protection measures, into the Barents Sea to conduct ISR operations, including ASW, during times of tension or war. The *Orion* or the *Nimrod* had modest self-protection measures, consisting of chaff and flare.[742] This means that as the tension rises the risk to the aircraft does as well, which leads to a retreat by MPAs from the operational areas of responsibility. Continued MPA operations based out of Evenes and Andøya will therefore quickly become a part of an operational risk assessment.[743]

One natural reaction will be to move the MPA base further south, due to a combination of insufficient base protection and the lack of aircraft self-protection. The mere fact that the survivability of MPAs can lead to a strategic intelligence asset effectively being removed from the theatre of operations in times of war should be a significant cause for concern. MPAs will be moved back from the front lines in times when the need for accurate and actionable intelligence is greatest. This inherent weakness of the MPAs is a factor that has not been sufficiently discussed, not in the MPA community, nor in military nor civilian academia. There seems to be a sense of complacency towards MPAs in that a future threat

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[740] Andresen and Bukkvoll, "Russian Weapons Development towards 2020," 56, 58; Missile Defense Project, "Russia Air and Missile Defense" (Center for Strategic and International Studies (CSIS), June 14, 2018), https://missilethreat.csis.org/system/russian-air-defense/.
[741] Missile Defense Project, "Russia Air and Missile Defense."
[742] Reade, *The Age of Orion - The Lockheed P-3 Story*, 55–56; Valerie Insinna, "The US Military's Chaff and Flare Industry Is on Fragile Ground," *Defense News*, November 13, 2018, https://www.defensenews.com/industry/2018/11/13/the-militarys-chaff-and-flare-industry-is-on-fragile-ground/.
[743] The Norwegian Government, "Presiseringer Om Utbyggingen Av Evenes" (The Norwegian Government, April 17, 2018), https://www.regjeringen.no/no/aktuelt/presiseringer-om-utbyggingen-av-evenes/id2598125/.

that will deny the utilization of MPAs in crises and war is not properly discussed in peacetime. The obvious danger being that when the MPAs are pulled back from the front line, a gap in maritime situational awareness and understanding will emerge, as well as the ability to deliver long-range lethal force against a submarine threat.

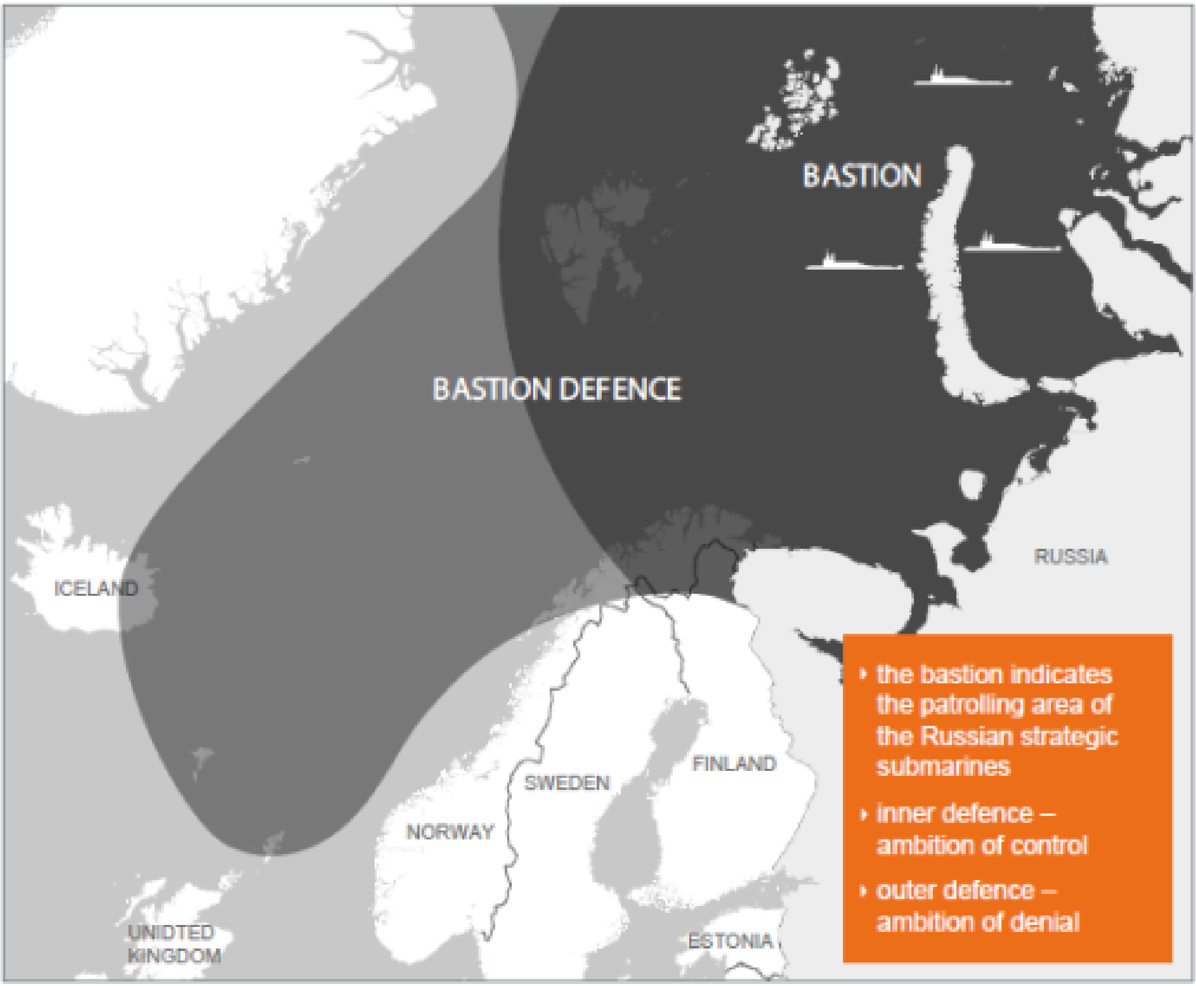

Figure 8-15. The Russian bastion and the reach of the bastion defence.[744]

This can be termed the *MPA mission portfolio paradox*: In times of war, the MPA fleet is geographically significantly restricted from executing its key mission: ACINT and ASW. Given the reach of modern surface-based SAMs and land-based aircraft with AAMs, the area in which there will be considerable risk associated with operating in the High North will stretch beyond the Barents Sea, likely further down into the North Atlantic, as depicted in Figure 8-15. If the capability to perform long-range, airborne ASW is not supplemented, this key capability will diminish as soon as the risk level rises.

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[744] Rolf Tamnes et al., "A Unified Effort to Strengthen the Defence of Norway" (Norwegian Ministry of Defense, April 28, 2015), 21.

Supplements to long-range airborne ASW aircraft *on the grounds of survivability* vary, and can be facilitated by several factors: the sensor can operate out of reach from the A2/AD measures (e.g. satellites carrying non-acoustic ASW technology[745]); the sensor can operate without being seen by adversary defensive systems (e.g. submarines, manned and unmanned, and in the future unmanned aircraft that have an extremely low radar cross section); the sensor can operate on a platform with extreme manoeuvrability (e.g. unmanned aircraft that can fly faster and that is more manoeuvrable than any known missile system); or the sensor can be carried by a platform with counter-measures that neutralize the respective A2/AD measures (e.g. a platform that carries credible and effective counter-measures to any known anti-air system, such as artificial intelligence-based reaction to threats and powerful lasers to neutralize them[746]). The latter three will effectively mean that such assets can operate inside denied areas at significantly reduced risk.

A2/AD threats are not denying ISR operations in peacetime. They are latent threats, waiting to be employed in times of crisis and war. However, the challenge of operating MPAs in denied areas will not disappear. On the contrary, it escalates precisely when one requires capable ASW assets the most.

8.3.6 Sensors

The principles for hunting submarines are essentially the same today as they were during the Cold War (and even WWII). It is the significantly improved *capacity* of the respective sensors that take the search to a new level, particularly when combined with highly improved onboard computer processing capacity and the ability to share and triangulate sensor information nearly instantly with other units.

Most important to this discussion is the airborne platform's acoustic sensor. The most significant progress achieved for this sensor has without a doubt been the processing capacity onboard the aircraft. The P-3 *Orion* is capable of monitoring 32 buoys simultaneously, while the P-8 *Poseidon* can monitor 64. New generation MPAs carry powerful processors. The

[745] It is possible to shoot down a satellite, but a kinetic anti-satellite kill is problematic due to the thousands of fragments of the destroyed satellite then automatically entering separate orbits. See for example Leonard David, "China's Anti-Satellite Test: Worrisome Debris Cloud Circles Earth," *Space.Com*, February 2, 2007, https://www.space.com/3415-china-anti-satellite-test-worrisome-debris-cloud-circles-earth.html.
[746] Tamir Eshel, "Lifting the Veil of Israel's Classified Laser Weapon Program," *Defense Update*, January 8, 2020, https://defense-update.com/20200108_hel_israel.html; CNN.com, "USAF: Fighter Jet Lasers 5 Years Away," *CNN*, December 15, 2015, https://edition.cnn.com/videos/us/2015/12/15/us-air-force-lasers-fighter-jets-orig-vstop.cnn.

operating environment for the sensor operators onboard the aircraft has also been improved through reduced noise and fewer vibrations. This allows operators to work with more concentration and focus for a longer time.[747]

The acoustic sensitivity of the buoys themselves, however, has not improved significantly. Some of the reasoning for this lies in what can be termed the "acoustic challenge."

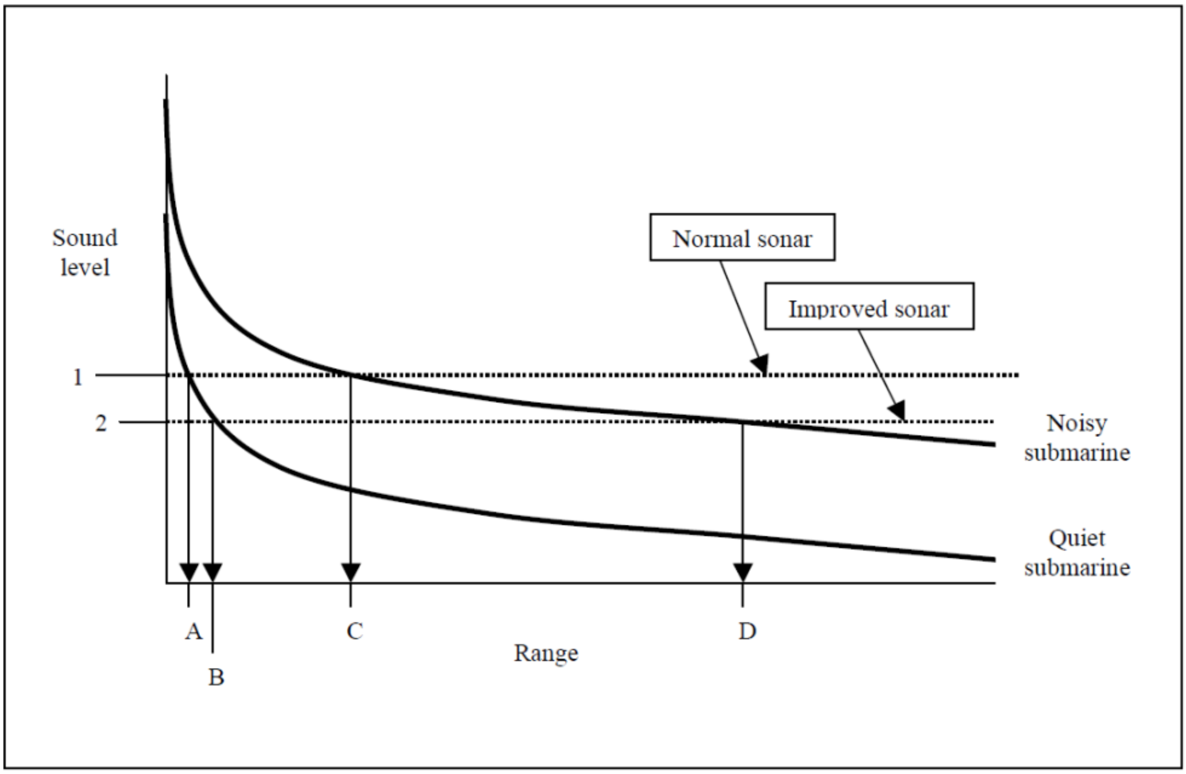

Figure 8-15. The acoustic challenge.[748]

Figure 8-16 depicts how sound in the water is reduced over distance, and the distance in this case is that between a sound emitting submarine and a sensor. The upper curve displays the sound from a relatively *noisy* submarine, and the curve below that from a relatively *quiet* submarine. Sound diminishes with the square of the distance, which means that by doubling the distance you cut the sound by a factor of four.[749] The upper dotted line illustrates the capacity of a *normal* sonar, and the lower dotted line that of an *improved* sonar. The normal sonar detects the *noisy* submarine at a range corresponding to that of point C, whilst an improved sonar detects the noisy submarine all the way out to point D. The sound curve of

[747] Fein and Jean, "Changing the Game: U Navy Applies New Approaches to Submainres Threats."
[748] U.S. House of Representatives, "Advanced Submarines Technology and Antisubmarine Warfare," § Committee on Armed Services (1990), 60; Birkeland, "The Potential of LIDAR as an Anti-Submarine Warfare Sensor," 18.
[749] Birkeland, "The Potential of LIDAR as an Anti-Submarine Warfare Sensor," 18.

the *quiet* submarine starts lower on the graph, and quickly drops to the point of detection for both the normal sonar as well as the improved one. This means that improving the sonar will help significantly when tracking a noisy submarine, but only marginally when searching for and tracking a quiet submarine. As a corollary to this, more passive sonar equipment is required in order to cover the same area acoustically than was the case before.[750] Tactically, one therefore seems forced to convert to active buoys and sonar at an earlier stage in the search for the quiet submarine, or relying more on non-acoustic search methods.[751] In order to search for a quiet submarine using passive acoustic sensors from the air, one requires many and capable buoys, spread out over a large area, to be monitored over time. This, in turn, requires extended MPA endurance (to stay longer in the area), higher altitude (to pick up the signals from more buoys/several buoy fields at the same time), and more processing capacity (to process and analyse more buoys simultaneously).

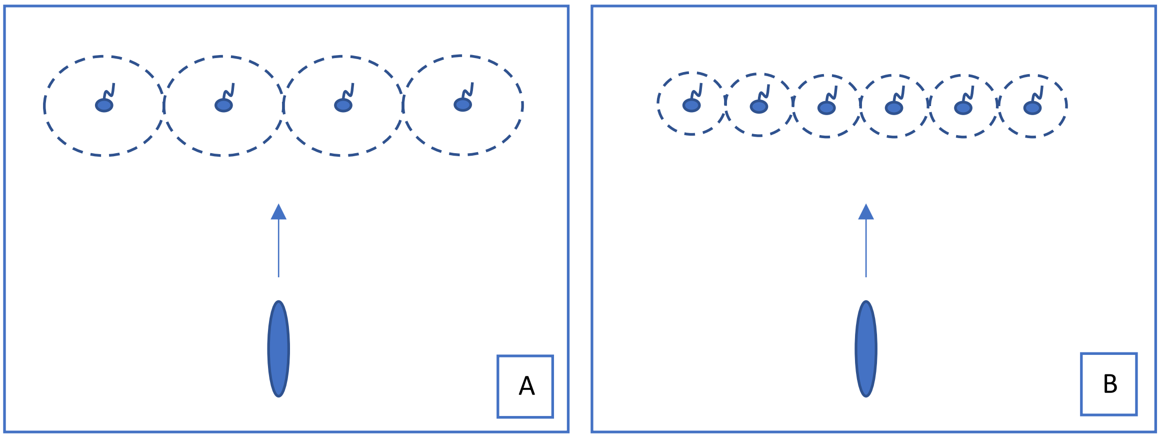

Figure 8-16. Sound range versus demand for buoys. The longer the range, the fewer buoys are demanded (A). The shorter the range, the more buoys are demanded (B).

In an example provided by a NATO report from 2016, passive sonobuoy ranges were in the 1970s and 80s often at 3,000 yards (1,5 nm).[752] These ranges had by the mid-2010s been reduced to less than 500 yards (0,25 nm). When modern submarines reduce their sound emissions, the sensitivity of the sensor must increase significantly – alternatively one can place more sensors in the water, reducing the distance between them.

[750] Birkeland, 18–19; Perkins, "Alliance Airborne Anti-Submarine Warfare - A Forecast for Maritime Air ASW in the Future Operational Environment," 39–40.
[751] Birkeland, "The Potential of LIDAR as an Anti-Submarine Warfare Sensor," 18–19.
[752] Perkins, "Alliance Airborne Anti-Submarine Warfare - A Forecast for Maritime Air ASW in the Future Operational Environment," 40.

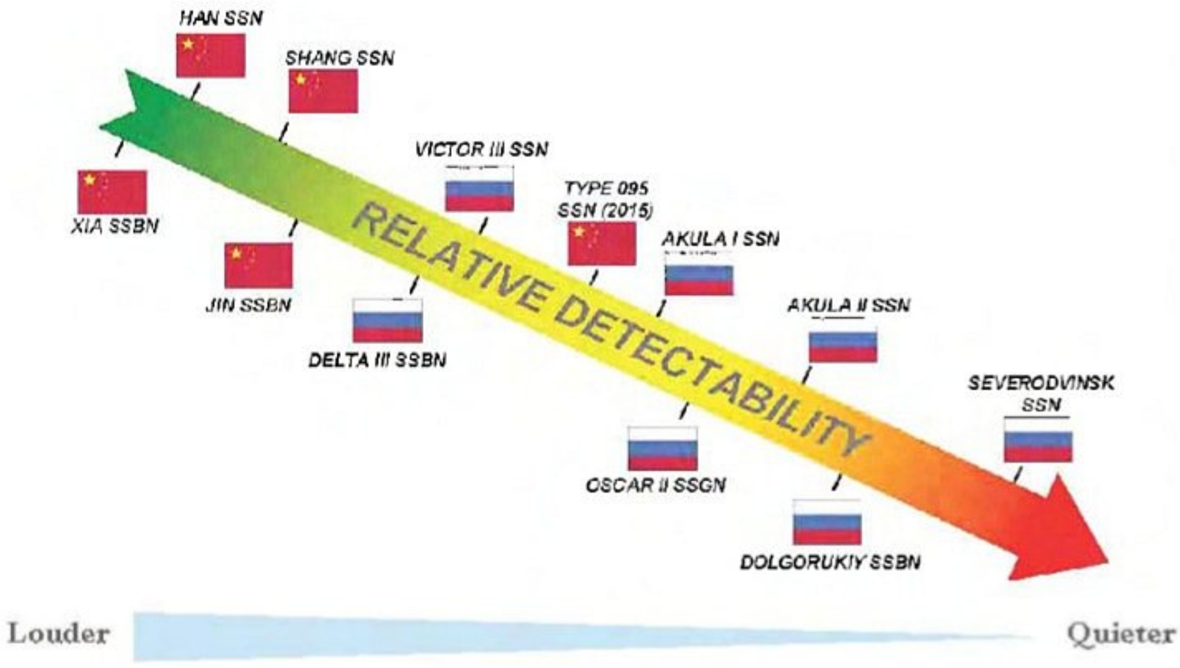

Figure 8-18. Development in detectability of Russian and Chinese submarines, as estimated by the US Navy Office for Naval Intelligence (ONI).[753]

Less sound emitted also leads to fewer instances (if any) of convergence zones at large distances. In addition, today's ocean is filled with more sounds, mainly from human activities, which leads to more ambient noise and clutter for the acoustic sensor operator to work through.[754] Several high-ranking American naval officials have explicitly stated in open sources that the *Severodvinsk* class will pose significant challenges to NATO's ability to maintain control of her whereabouts due to her capabilities and silent propulsion.[755] The second ship of the *Severodvinsk* class, which initiated sea trials in 2019, is reportedly an improved version of the first vessel.[756]

Following on from this, the previously mentioned *modus operandi* of the adversary submarine also comes into play for acoustic sensors. There is a fundamentally lower chance

[753] Office of Naval Intelligence, "The People's Liberation Army Navy - A Modern Navy with Chinese Characteristics" (Office of Naval Intelligence (ONI), August 2009), 22.
[754] Perkins, "Alliance Airborne Anti-Submarine Warfare - A Forecast for Maritime Air ASW in the Future Operational Environment," 38.
[755] Dave Majumdar, "U.S. Navy Impressed with New Russian Attack Boat," *USNI News*, October 28, 2014, https://news.usni.org/2014/10/28/u-s-navy-impressed-new-russian-attack-boat; Franz-Stefan Gady, "Russian Sub Combat Patrols Nearly Doubled in 2015," *The Diplomat*, March 23, 2016, https://thediplomat.com/2016/03/russian-sub-combat-patrols-nearly-doubled-in-2015/.
[756] Franz-Stefan Gady, "Russia's First Yasen-M Attack Sub to Begin State Trials in 2019," *The Diplomat*, December 8, 2018, https://thediplomat.com/2018/12/russias-first-yasen-m-attack-sub-to-begin-state-trials-in-2019/; Thomas Nilsen, "Sevmash Floats out Second Yasen-M Class Nuclear Attack Submarine," *The Barents Observer*, December 25, 2019, https://thebarentsobserver.com/en/security/2019/12/sevmash-floats-out-second-yasen-m-class-nuclear-attack-submarine.

of detection of sporadic movement pattern (B) than there is of predictable movement patterns (A).

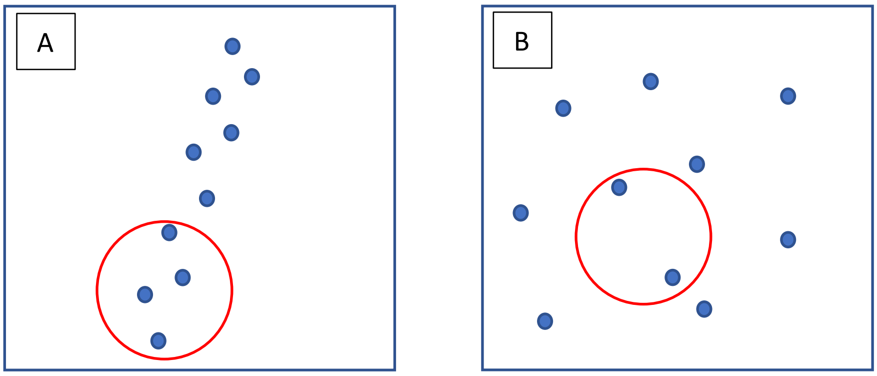

Figure 8-18. (A) Predictable submarine pattern: higher chance of detection of systematic datums. (B) Unpredictable submarine pattern: lower chance of detection of sporadic datums.

If one can increase the sensitivity of the passive acoustic sensors, the probability of detection in a sporadic submarine movement pattern will increase accordingly (C).

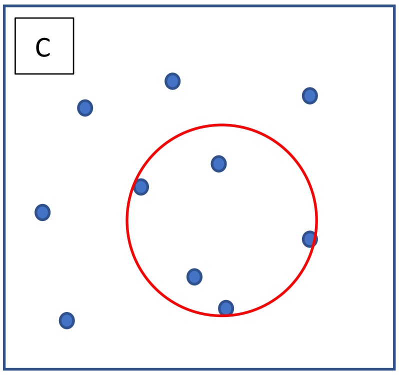

Figure 8-19. (C) Unpredictable submarine pattern: higher chance of detection of sporadic datums through increased sensor range.

Another challenge to the acoustic operator is the finite sonobuoy life. Sonobuoys usually used by airborne NATO units have a maximum life of approximately 8 hours. After this, they are automatically scuttled and sunk. The limited buoy life is based on the limited timespan of an MPA sortie: When dropped into the water, the buoy will rarely service the MPA with acoustic data for more than a few hours, and as a common MPA sortie rarely spans beyond 10 hours, there are obvious cost-saving measures in reducing battery life. When a submarine contact was historically handed over from one MPA to another, the frequency channel of the most relevant buoys to continue the tracking process were given to the oncoming aircraft. But the oncoming aircraft would use the same frequency channels on its buoys as the previous aircraft, and if they were searching or tracking in similar areas over time, the buoys from the previous aircraft would interfere with the buoys of the oncoming aircraft. It would then be in the interest of the overtaking asset that as many buoys as possible not relevant for the continued tracking were scuttled ahead of time.

Therefore, more feasible than significantly increasing the sensitivity of the buoys, one can increase their battery life. When a modern submarine is evading detection, she now has the benefit of two factors against the airborne ASW platform: her own reduced sound emissions, and the temporary nature of the airborne search. In one day, the submarine is sailing and operating for 24 hours, but a single MPA can only be onstation for approximately 10 of those hours. And within the time available, the MPA has to choose where to place its finite number of sonobuoys. If, however, the buoys could be monitored by other assets that operated in the area after the MPA left the scene, there would be a more efficient utilization and exploitation of the buoys' capacity, in addition to the reduction in manoeuvrable areas for the adversary submarine, due to the large areas of buoy patterns being monitored over time. For example, an MPA can place several buoy patterns in areas of interest, monitors these until offstation time, and then the buoys are monitored by a high-altitude unmanned aircraft with an endurance of more than 30 hours. Such tactics, however, demand an increased range of transmitting frequencies for the buoys than are available today, in order to deconflict all the frequencies in use.

The significantly improved processing capacity of modern MPAs presents possibilities for the further development of multi-static technology and procedures. This system facilitates two important aspects in a submarine search. First, it improves the active search by expanding the area under influence of any given active buoy.

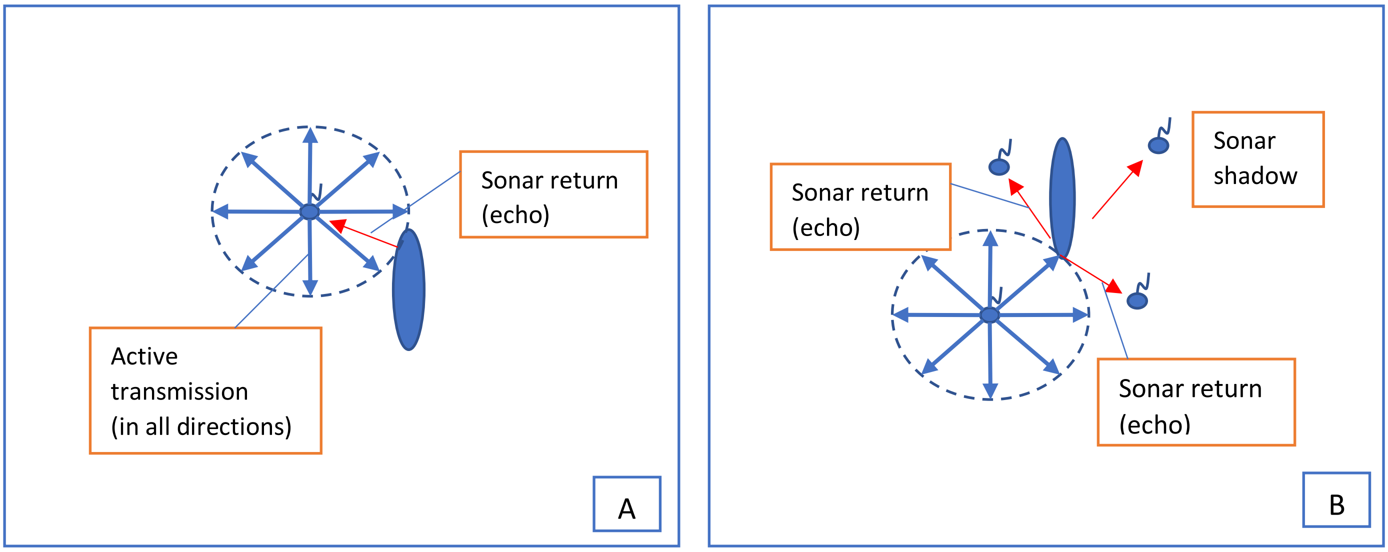

Figure 8-21. Increased search area for an active buoy in a MAC setup (B), compared to traditional use of active buoys (A).

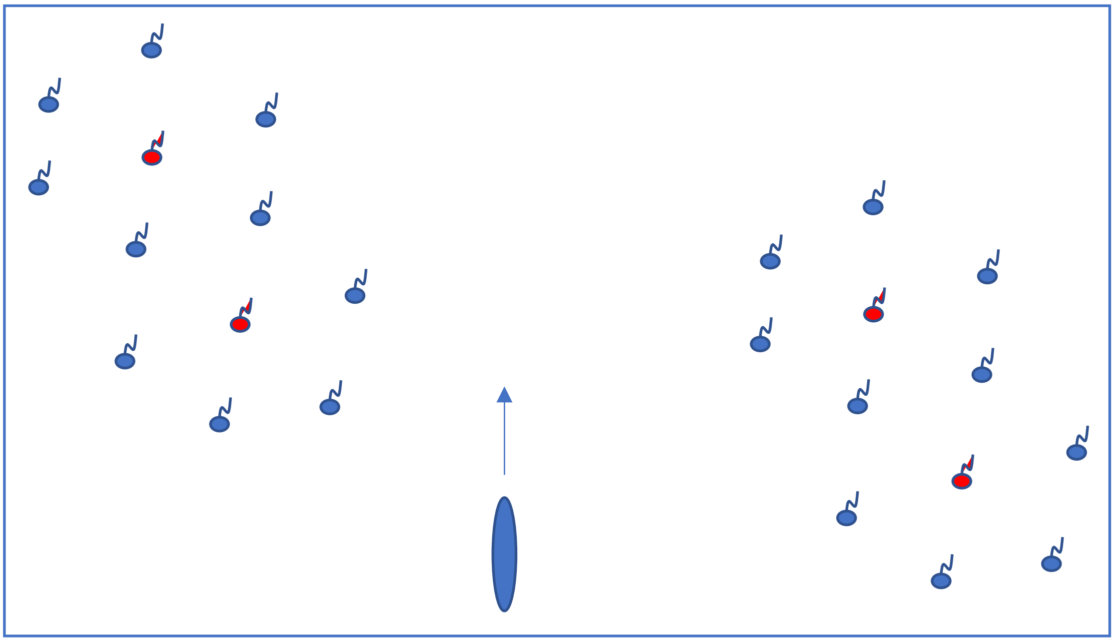

Figure 8-22. MAC fields supporting area denial operations

In a field of MAC buoys, one active transmission can be picked up and analysed by multiple buoys, either by detecting a return from the object (submarine), or by analysing the reduced signal and attenuation caused by the sonar shadow. One active buoy will together with a series of passive MAC buoys cover a larger area than is possible with a single active buoy. Second, a large area actively searched by MAC units will provide a stronger picture of where a submarine is *not* (a negative search). This approach to negative search results also support area denial operations. Active transmissions function as part of both search for adversary submerged units, as well as denying those units freedom to operate.

8.3.7 Maturity and time: Processing, exploitation and dissemination (PED)

Finally, the first tier of our theoretical framework consists of the processes that transform raw sensor products into actionable intelligence at some level of maturity. For airborne platforms prosecuting a submarine, the relevance is in the ability to reach *tactical* sensor data maturity. The technology for acoustic analysis has improved over the years, in particular in regards to processing capacity, for example for multi-static systems. However, the inherent problem with MAC is that it involves active procedures, which alert the submarine of the MPA focus area. In terms of passive detectability, some progress has been made, but not what is required to meet the significant quieting progress in submarine development, as figure 8-18 above from ONI demonstrates. All in all, a modern MPA such as the P-8 will be able to reach tactical sensor maturity in less time than the P-3, when the sound emitting submarine is used as a constant and the processing capability is used as a variable. However, when the search technology is used as a constant and the development of submarine silencing is used as a variable, it will take longer to reach tactical sensor maturity against a modern submarine than against the Soviet submarines that operated in the early 1980s. This gives us the following paradox:

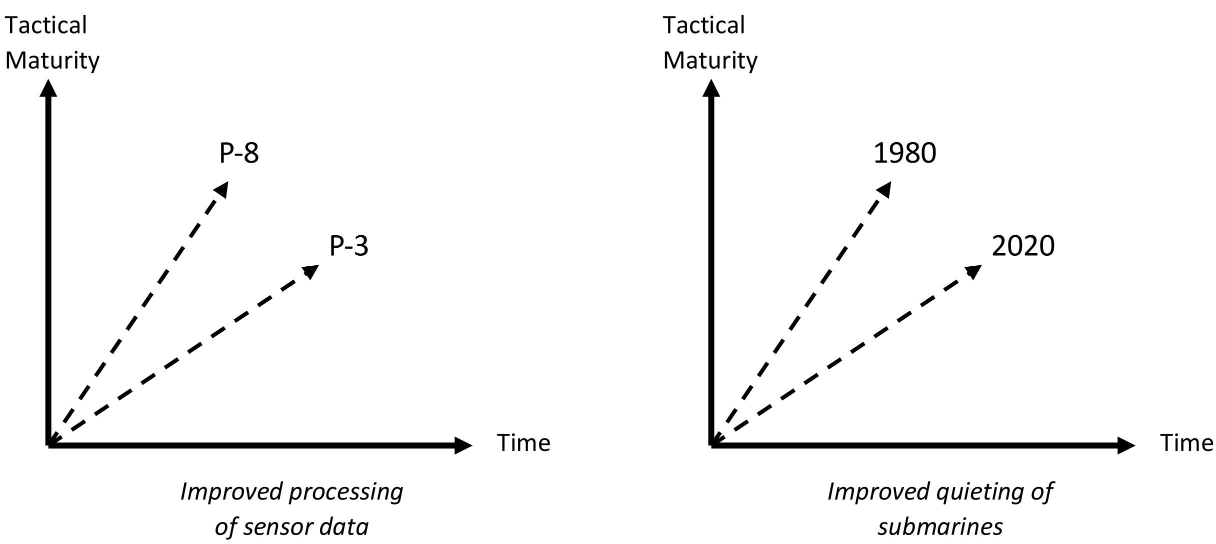

Figure 8-23. Acoustic range competition – sensor and processing capability vs submarine quieting

The louder sounds emitted by older submarines together with the older *modus operandi* of the target required less time before MPA reached attack criteria in the 1980s than is the case today. Once again, two fundamentally negative factors therefore stand out. Firstly, the adversary submarine has become significantly more quiet. Secondly, the adversary submarine is operating in an unpredictable pattern. As explained above, the quieting of submarines has more effect than the increased sensitivity of the sensor. The search for and subsequent tracking of a submarine by acoustic means is what can be termed a wicked problem, perhaps best explained by a former leading figure in British maritime airborne surveillance:

> *"A* simple *problem is orders: Run over there, take that Nimrod to Kinloss. That is a simple thing. (...) A* complex *problem is a bit like writing an ATO. It's lots of moving parts, it is difficult, but if you throw enough horsepower at it, it will get done. It is a process thing. (...) It is a bounded problem. ASW falls in the category of what I call wicked problems. When you start off on it, you don't know what the end result is going to look like. You haven't got a clue. You've got all the procedure you'll do, but it's a wicked problem because it is unbounded. And there will be lots of shades of grey that you have to interpret along the way."*[757]

Processing passive acoustic sensor information is in itself demanding. In short, the operator requires whatever help that can be provided. Developing technology for processing so-called Big Data will likely be pivotal for sifting through immense amounts of oceanographic information and detecting what is relevant. Modern sensors are simply picking up too much information for any human to handle, and complex sensor analysis is, and will only become, more dependent on Big Data analysis and artificial intelligence.[758] This will particularly be the case if drones are to take over ASW responsibilities from MPAs. And with sonobuoys increasingly incapable of detecting and tracking modern submarines by themselves, airborne ASW assets are dependent on close cooperation and coordination with other assets, in space, in the air, on the surface or below the surface. Finally, in today's fiscal environment it seems impossible to mount a fully layered approach to ASW by one single nation alone. A multi-national approach is required. The factors of silencing adversary submarines, their

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757 Porter, British Maritime Patrol Aircraft Operations during and after the Cold War.
758 Shane P. Hamilton and Michael P. Kreuzer, "The Big Data Imperative - Air Force Intelligence for the Information Age," *Air & Space Power Journal*, Spring 2018, https://www.airuniversity.af.edu/Portals/10/ASPJ/journals/Volume-32_Issue-1/F-Hamilton_Kreuzer.pdf?mc_cid=a2eed12543&mc_eid=c0b972d50d.

unpredictability in operating patterns, and the challenging sensor processing therefore demands an even more holistic approach to submarine search by air assets than was the case previously.

Three principled avenues for improving the chance of detection stand out. First, there is a requirement for *improved acoustic sensor processing*. It is telling that in 2020, when the world's most powerful Navy, backed by the most encompassing research and development environment in the world is fielding the state-of-the-art MPA that is the P-8 *Poseidon*, there is still a requirement for two *human* acoustic sensor operators onboard. Acoustic tactical analysis is a wicked problem, and if one is to delegate that work to a computer it will likely have to be one that runs on artificial intelligence. ASW is not just a mathematical problem. Oceanographic factors that come into play are changes in salinity and temperature that combine with pressure increase with depth and cause multiple sound layers in the water column; ambient noises caused by human activities and unpredictable animals and life in the sea complicate the background for the frequency analysis; and of course the human factor of submarine tactics and general unpredictable behaviour lead to qualified guessing being an integral part of ASW.

Further building on the idea of assistance, the sensor analysis process will be vastly improved if two computers would be able to correlate their findings in geographical areas that are in proximity to each other. One example is two P-8 *Poseidons* working in tandem on a tracking challenge, with one being able to "complete the picture" of the other asset. Similarly, there are likely benefits in transmitting acoustic data to an analysis centre ashore, with Big Data capable computers and more subject matter expertise able to assist as a reach-back solution.

Second, building on experiences from the past, there is a requirement for a *layered, multi-asset approach to searching for and tracking modern submarines*. In order to meet the challenge holistically, there is a need to approach the search through six layers.

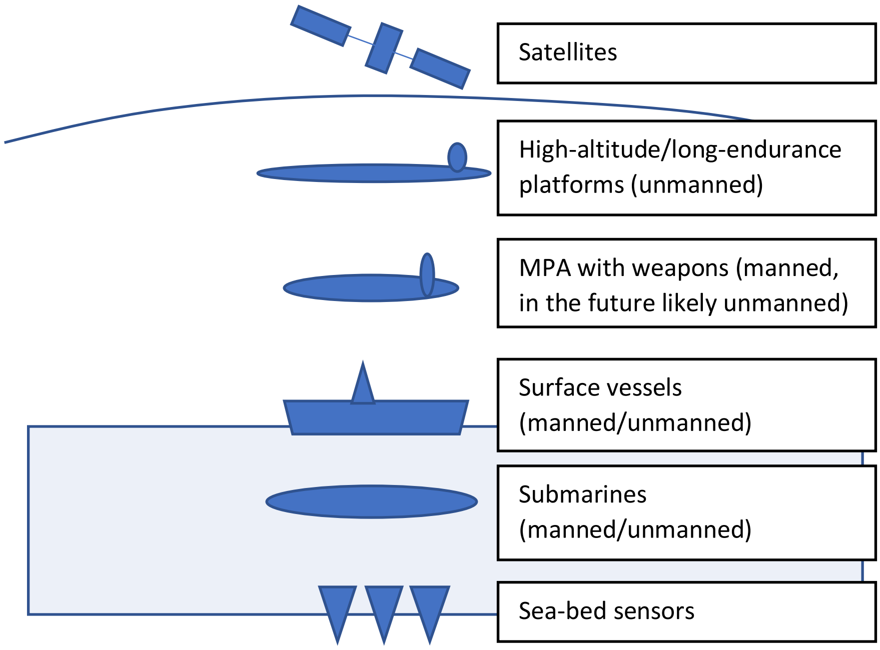

Figure 8-24. Six layers for a holistic approach to ASW

Together, these layers will cover as many search angles against the adversary submarine as possible. A layered approach like this will also provide redundancy in cases of elements, such as the MPA, being neutralized (or removed from the area of interest).

Finally, a comprehensive layered approach like the one described above requires *international cooperation*. Not even the mighty US Navy is able to muster all these layers in the High North at the same time. This is intelligence gathering and acoustic searches for some of the most capable submarines in the world. An Allied approach is required to build this order of battle. With regards to command & control, the fact remains, and the previous chapters have shown, that historical ASW operations in the North Atlantic have not been coordinated and executed by NATO *per se*, but by individual nations coordinating in a bi- and multilateral context.[759] They have been coordinated by national headquarters, controlling national assets on national missions. These nations happen to be NATO members, and they adhere to procedures that have been established by operating together with Allies in exercises and daily operations. In order to be capable of seamless and efficient multinational coordination of complex ASW operations, NATO should integrate as many national headquarters as possible into the Alliance command structure in peacetime. This might lead

[759] For examples of somewhat misleading portrayals, see Hicks et al., "Undersea Warfare in Northern Europe," 20; Perkins, "Alliance Airborne Anti-Submarine Warfare - A Forecast for Maritime Air ASW in the Future Operational Environment," 12; Nordenman, *The New Battle for the Atlantic - Emerging Naval Competition with Russia in the Far North*, 57–64.

to an Alliance command structure not sitting idly, waiting to have forces assigned to it, but an organization that is actively engaging in operations on a daily basis.

In addition, international cooperation will require close intelligence relationships, beyond those that exist within the framework of NATO. Proposals for surveillance cooperation within the framework of the Alliance are commendable, but there are show-stoppers as to intelligence-sharing in these projects: this kind of intelligence cannot be shared with just anyone.[760] It is clear that the US and the UK have a special relationship with regards to intelligence. Norway, too, has long-standing cooperation with the US with regards to surveillance in the High North. As was the case for tracking Russian strategic submarines on their way to and returning from patrols during the Cold War, these three nations stand to gain significant benefit from close operational cooperation. All three nations operating P-8 *Poseidons* in the future will certainly assist in this respect.

8.4 Conclusion

The early years after WWII and the 1950s were significantly formative for international security politics in the High North in general, and for security politics for Norway in particular. With the existential threat of the Nazis removed, the relationship between East and West turned confrontational in the late 1940s. Norwegian authorities had to find their place in the middle of great power competition between the US and the USSR. The neutral stands during WWI and the "forced" inclusion into the group of Western allies during WWII had made it abundantly clear to the Norwegian government that an active stands had to be taken, and in 1949, Norway became a founding member of the NATO alliance. This membership was to become the cornerstone of Norwegian security politics. NATO quickly assumed an offensive posture in the North Atlantic to contain any Soviet expansion. Exercises, both at sea and on land in the North, were the manifeststion of this posture. This posture brought with it an explicit and enduring challenge to Norwegian security policy: How best to integrate with the Alliance of which Norway was a member, and still maintain low tensions towards the increasingly powerful neighbour to the East? The basing policy of the late 1940s provided the grounds for the detailed operational restrictions that were put in place for allied activities on and based from Norwegian soil in the High North. These formal restrictions played a dual

[760] Brooks Tigner, "NATO Considers P-8 as Temporary Gap Filler until 2035," *Jane's Defense Weekly* 56, no. 15 (April 10, 2019); Magnus Nordenman, "NATO's next Consortium: Maritime Patrol Aircraft," Issue Brief (Washington, D.C.: Atlantic Council, Brent Scowcroft Center on International Security, May 2016).

role in Norwegian security policy in the North. Firstly, they did just what they were explicitly intended to do: They kept capable allies at arms length in order not to stir up tensions in what was becoming increasingly sensitive areas to the Russians. The military build-up on the Kola peninsula turned the areas neighbouring Norway into the heart of Russian military operations and strategic capabilities in the High North and the Atlantic. Secondly, the Norwegian restrictions for allied units indirectly made the areas off the coast of Kola the responsibility of Norwegian armed forces and intelligence assets. We know that allied aircraft and clandestine submarines regularly ventured into the Barents Sea without coordinating with, or receiving approval from, Norwegian authorities. Sailing from or taking off from foreign soil, the latter was not necessary. However, the main, regular effort of keeping track of Soviet naval operations and testing of new weapons and sensor systems in the Barents Sea had to be executed from Norwegian soil, if only due to the sheer distances involved. With the policy of restricting Allied assets from entering the Barents Sea from Norway, the restrictions became a political tool in both ensuring low tensions and establishing somewhat of a monopoly on intelligence collection in the High North, east of Norway.

The Norwegian MPAs that returned from the UK after WWII were incapable of keeping track of the developments on the Soviet side of the border. Norwegian authorities on their side did not see the requirement to monitor these developments either in the aftermath of WWII. In the mid-1950s, Norwegian authorities were sensing a mounting pressure on acquiring the proper tools to support the Americans and the Alliance with timely and relevant intelligence from the Kola peninsula. Norway, however, could not afford any heavy investments in new equipment. The aircraft that served during WWII were now taking part in re-building the country after five years of Nazi occupation. The NATO common project from the mid-50s therefore came at an opportune time.

The history portrayed in this thesis has examined how NATO debated the requirements for MPA in meeting the emerging Soviet submarine menace, and how the basic tenets of airborne ISR were involved in those discussions. These tenets play a key role also in establishing an understanding of today´s requirements. Norway, however, even in the face of a common alliance project that would presumably be cost-efficient compared to going it alone, had to rely on the support from the US and the MDAP. This led to the compromise that was the *Albatross*. The aircraft as affordable to operate for the Norwegians, and capable of providing just enough basic intelligence and surveillance for the Alliance, at least in the beginning. However, as the Soviet Union developed more capable submarines and missiles in the 1960s, NATO adhered to a defensive barrier strategy, which was dependent on capable airborne ASW platforms and a framework of international MPA cooperation. It became clear that the Norwegians did not provide sufficient intelligence through the use of their *Albatrosses*, and it was in the 1960s that Norway, all the way up to the highest political levels, established an understanding that Norwegian MPAs had to be capable of actual anti-submarine warfare, surveillance and reconnaissance, against Russian submarines. This led to negotiations in the mid-1960s between the US and Norway, conducted personally between the defense ministers of the two nations, culminating in the first P-3 *Orion* procurement. The *Orion* was operationalized in 1969 for Norway, and became the operational tool that would alleviate the pressure put on Norway´s retrictions on Allied operations in the North. For the first time, Norwegian authorities could follow up their severely limiting restrictions with significant operational intelligence deliveries from the Barents Sea.

The political dynamics of détente in the 1970s prolonged the defensive maritime approach to strategy in the North Atlantic and towards Russian submarines on patrol. This suited the Norwegian government well. The expansion of exclusive economic rights to 200 nm in the late 1970s meant that the dialogue with Soviet authorities on several delineations in the High North, as well as the management of natural resources, was demanding. Additional military tensions would only have exacerbated an already challenging dialogue. The 1970s and early 1980s were the golden years of airborne ASW in the North Atlantic. Norwegian MPAs conducted intelligence gathering which fed into US and NATO strategic assessments, and even though very few military investments and weapons systems can be considered low-cost, at least to the Norwegian government in the 1960s, the investment in an ASW capable MPA fleet provided significant political returns. The intelligence relationship between Norway and the US became a cornerstone of the security policy relationship between the two nations writ large.

In addition to the intelligence gathering in the Barents Sea, this study has underlined the signifncant international efforts that went into monitoring and holding at risk Soviet strategic submarines on patrol in the Atlantic. The three main nations executing this task were the US, the UK and Norway. Although based on NATO procedures and infrastructure, the operational coordination was a tri- and bilateral matter. This coordination was necessary, because one nation could not cover the vast ocean areas by itself. It was also successful, so much so that NIS estimated that it had overview of Soviet strategic submarine movements with a certainty of 80-90%. This “ASW happy time” would come to an end, however. As Soviet submarine quieting took hold in the 1980s, it became increasingly difficult to follow the Russian submarines. Even though the strategic submarines were increasingly kept in home waters and on patrol in the High North after the establishment of the bastion defense strategy, the attack submarines fielded in the 1980s that constituted the forwards elements of the bastion strategy gave cause for concern. The attack submarines of the 1980s were very hard to find and follow.

The early 1980s saw the new Maritime Strategy of the US Navy, and the CONMAROPS of NATO, manifest themselves through a forward naval posture reminiscent of that from the early 1950s. As the Soviet Northern Fleet established its defensive bastion in the Barents Sea, the US Navy followed it up north. Regular clandestine patrols with both US and UK attack and intelligence submarines were conducted in the backyard of the Russian fleet. This led to several individuals, to include the Norwegian defence minister, explaining that too much of an offensive posture in naval strategy in the High North would be inherently destabilizing. The Norwegians were thus back to their challenge from the 1950s: They desired credible allied presence in order to make allied reinforcements credible and thus a stable deterrent. However, too much offensive presence would be destabilizing and constitute a threat to low tensions in the North. Norwegian MPAs, on their side, continued to provide intelligence, surveillance and reconnaissance, backing up their Government in their efforts to execute a demanding security policy balancing act.

The challenge of modern, Russian submarines became mute with the collapse of the Soviet Union in 1991. Over a short period of time, the pendulum swung far to the other side: The Alliance looked towards dialogue and cooperation, and sought to capitalize on the peace dividend. Threats of the Cold War were increasingly downplayed, and the military organizations of both alliance members and the Alliance as a whole were downsized and organized towards expeditionary operations. The 1990s passed without the necessary reorganisation to military infratstructure in Norway, leading to a gap between the resource allocated by politicians and the vast basing infrastructure that was directed towards a defence from invasion. At the turn of the millennium, the armed forces of Norway was also reorganized towards expeditionary operations as opposed to an invasion defence.

The decades following the collapse of the Soviet Union led to an identity crisis within the MPA community, where NATO MPAs were extensively utilized in support of operations over land. Although the Russian activities in the Barents Sea as a whole did not drop as much as the number of strategic patrols did, the focus of the military and political entities were elsewhere. After the terrorist attacks on the US in 2001, the strategic focus on the Middle East became all-encompassing. Maritime air operations involved no ASW at all, and the ASW competency of the Alliance atrophied.

In 2008, the Norwegian defence minister presented a non-paper to her colleagues, which called for a renewed focus on the security challenges that lay within the more traditional geographical areas of the Alliance. This was the start of an enduring effort on the part of the Norwegians to bring the focus of the Alliance back to strategic matters closer to home, and the defence of NATO´s core geographical area. And when new and improved Russian submarines became operational in the 2010s, it became evident that the Alliance was ill prepared to meet the resurgent Russian submarine threat. NATO members had to make difficult decisions regarding their MPA communities in an ambiguous threat scenario. The increasingly forward leaning and offensive Russian posture in the North Atlantic, and the illegal annexation of Crimea in 2014 underlined the importance of the Norwegian initiative.

However, almost as a paradox if seen against the emerging security policy situation, the Norwegian CHOD decided in 2015 that he could perform maritime surveillance in the High North through the use of unmanned aircraft, without MPAs. This would effectively remove the Norwegian long-range airborne ASW capability that had served the nation so well for the past 55 years. The politicians, however, were convinced that the nation could not live without a capability of such strategic importance, and overturned the CHOD decision. This thesis has shown the rationale for the latter decision. It has also explained the fundamentals of the discussion of airborne surveillance in the High North, against the most fundamental naval asset the Russian Navy has at its disposal: its submarine fleet.

Over the past few years the submarine activites of the Russian fleet has increased significantly. Large exercises in the Barents Sea and the North Atlantic are both underlining the bastion concept of operations, and showing a capacity to break out from home waters and pose a significant threat to European cities and infrastructure. Missile firing into Syria have demonstrated, in live operations, the ability to operate cross-theatre with capable submarines with state-of-the-art cruise missiles. This increased activity shows the renewed requirement for anti-submarines capabilities and intelligence assets on the part of the Norwegian government: There is a renewed threat from Russian submarines, which now not only are more quiet than ever, but operate in a muc more unpredictable pattern posing a threat to a diverse set of potential targets. Also, the new weapons systems are being tested in the areas that are close to Norway, meaning that the relevance of strategic intelligence on weapons development and employment in the Barents Sea is only growing.

With the unpredictability that comes with modern Russian submarine *modus operandi*, it seems absolutely crucial that the effort to keep track of them must be approached from an international standpoint. This thesis has depicted the problem set of the acoustic challenge, and in order to approach modern adversary submarine operations holistically, the operations must be a multi-national and multi-asset endeavour. The main candidates for such a close cooperation are the US and the UK. The US have flown the P-8 since 2012, and the UK is operationalizing their first aircraft in 2020/2021. Norway is planning on phasing in their P-8 aircraft in 2022/2023. This means that in a few years´time, all three nations will be flying the same type of MPA for the first time. This facilitates close international cooperation on most, if not all, aspects of operating the P-8.

In order to understand the complexities of this challenge and how MPAs fit into it, it has been necessary to deconstruct the fundamentals of airborne ISR in general, and to place ASW within that framework. This has been done utilizing open sources and declassified material, which means that the entire discussion has tacitly been made available and understandable to the public. This latter point has been the core motivation for pursuing this thesis. A principled understanding of the elements that constitute the tenets of airborne ISR should inform any serious debate on why certain assets are necessary, or how their use has become obsolete, or how a certain framework for conducting surveillance in the High North must evolve.

The key research objective of this thesis has been to define the role of ASW within the airborne ISR mission set in the High North. The answer is that ASW is a fundamental and crucial element in airborne ISR in the High North, and without credible ASW search, tracking and neutralizing capability, nations will be blind to the most significant naval threat in the North Atlantic. Two factors stand out in futher explaining the complex.

First, submarines are the capital ships of the Russian Navy, and have been so since the early Cold War. They remain the key factor for Russian naval operations, and will likely continue to be so in the future. Submarines should be considered the centre of gravity for the Northern Fleet, and most likely the Navy as a whole. They are likely to expand as the crucial factor for naval and joint operations for the Russian Armed Forces. The Northern Fleet submarines’s mission is most likely first, to constitute an assured second-strike capability. Second, they are to comprise a forward and fundamental element of the bastion defence. Third, they are to pose a credible, dual-capable land-attack threat against both the European mainland (without crossing the GIUK gap) and the US East coast. And fourth, they are likely to pose a somewhat revised anti-SLOC threat, in the sense that they will likely not target the SLOCs directly, but indirectly through striking objects of fundamental strategic importance, such as ports. The movements of the submarines have changed, from a fairly predictable and repeated transit route to, in and from known patrol areas, to operating over periods of time in large patrol areas posing a threat to all of Europe – without having to pass the GIUK gap. They are far more silent than before, and carry significantly more capable missiles.

Second, MPAs are *by themselves* not a cost-efficient tool for conducting maritime airborne ISR in the High North in this contemporary context. It is fundamentally important to keep in mind that although the new MPAs are more capable than their predecessors, they do not fully address the submarine threat: they must be a part of a system of systems. If politicians and military strategists are concerned that vast resources are being invested in new aircraft, they must also be made aware that this expensive investment is just one piece of the puzzle. First, the onboard processing systems and operators are not capable of handling the acoustic quietness of modern Russian submarines as they are configured today. The way to bridge that gap is through the utilization of artificial intelligence, Big Data processing, and collaborative, real-time sensor processing in order to close in on the adversary submarine. In addition, the MPAs are just one of six layers that are necessary to cover the search holistically. Satellites, unmanned systems in the air, on the surface and below the surface, as well as sea-bed sensors, must also contribute to a comprehensive search picture. Finally, international cooperation is required. However, it is likely that established Alliance frameworks are not sufficient for the intelligence sharing agreements required. As before, a niche collection of partners must share the burden and work together.

8.5 Recommendations

This thesis has developed a set of concluding recommendations for maritime airborne ISR for Norway and her close allies as part of effectively tracking Russian submarine movements in the High North.

8.5.1 Altitude

High boy/low boy tactics

The US Navy is taking high boy/low boy tactics further with the BAMS concept, in which a MQ-4 *Triton* HALE unmanned aircraft operates at altitude, facilitating a significantly more efficient use of high cost, shorter-endurance assets such as the P-8 *Poseidon*. For mitigating the complexities of modern maritime surveillance, this combination stands out as a requirement for credible airborne surveillance of large ocean areas, until long-endurance unmanned aircraft are able to perform the entire mission portfolio of contemporary MPAs, including ASW. With the current state of technology, one or the other will not suffice – we need both.

Satellites should be an integrated element of maritime surveillance

Satellites are already extensively used for surveillance tasks, including in the maritime domain. Sensors from space do not penetrate water, but regular surveillance from space through the use of IMINT and ELINT sensors to cover more or less the entire area of interest in one pass will constitute the uppermost layer in a layered approach to covering vast ocean areas. The space dimension will support communications, surveillance and targeting.

8.5.2 Speed

Speed should be exploited for expanded area coverage and increased responsiveness

Increased speed means quicker reaction times to a datum and a larger area covered during a sortie. Decreased reaction time should be exploited, and improved in the future. This can be achieved through sensors operating at higher altitudes without the ability to act on their own findings (satellites, high-altitude unmanned aircraft), operating in an interconnected manner with weaponized platforms (today MPAs, in the future weapons-laden unmanned aircraft) that can move quickly and deploy sensors and weapons into the water.

8.5.3 Range

Norwegian guidelines for allied aircraft in the Barents Sea should be reconsidered

The Norwegian government should reflect on the guidelines for Allied activity in the High North and their relevance. New technology, particularly in terms of extremely long-endurance unmanned vessels and aircraft, coupled with new air-to-air refuelling capabilities, can shift the weight from Norwegian platforms to include Allied aircraft operating out of airfields far from Norwegian soil. This will lead to a more demanding dialogue in the future with Allies that want to operate in the High North.

In order to exploit range versus base location, international cooperation will be key

Due to the vast areas in question, and the uncertainties associated with the Russian submarine modus operandi, close international coordination will be key to efficiently covering the North Atlantic with capable platforms. Norway should look to the past and geographical delineation arrangements that can inform future constructs for international cooperation.

Long range is key for pattern of life

Not only necessary in order to reach the respective points of interest in the vast North Atlantic, range is crucial to establishing the pattern of life in the area of interest. *The modus operandi* of the Russian Navy seems to include more elements of what can be termed hybrid warfare, which complicates the building of a comprehensive understanding of what is normal and what is not. If the goal is to notice anomalies, a solid understanding of normal day-to-day operations is required. Long range, and near-constant presence is crucial to reach this understanding.

8.5.4 Communications

SATCOM for broadband communications and targeting

ASW assets will benefit greatly from being able to instantly exchange acoustic data with other units nearby, or as an analysis reach-back function in order to be able to analyse the large amounts of acoustic data that become available in a modern ASW prosecution. This will require broadband, over-the-horizon communications, that can only be facilitated by SATCOM. Also, long-range maritime platforms will require encrypted and robust space-based communications for providing targeting to Allied units at distance.

Civilian-military cooperation for space-based assets

New Space has brought with it an expanding civilian market for space services. This must be exploited for the military. Commercial capabilities should be utilized where possible in order to save costs. Civilian-military cooperation is a cost-efficient framework for modern capabilities, be it in support of communication or surveillance.

8.5.5 Survivability

MPAs must be supplemented by assets that can operate within the realm of A2/AD measures.

The MPA mission portfolio paradox demands that in order to facilitate long-range ASW in areas threatened by A2/AD measures, MPAs must be supplemented by platforms that are stealthy, or that have extreme manoeuvring capabilities. If MPAs are to be utilized in offensive operations in crises and war, irrespective of operating area, they must be protected (either by themselves or by other assets), capable of employing stand-off weapons, and/or capable of employing drones, either flying or sailing, that can operate within the range of A2/AD measures.

8.5.6 Sensors

Long-life sonobuoys – multi-platform exploitation

Very long-life sonobuoys with GPS-tracking of their own position could constitute a long-life search field in an area of interest, such as a choke point. An improved communications suite that can handle more frequency channels will mitigate the challenge of interference between different buoy fields being monitored and analysed at the same time. This means that an MPA can fly out and drop a field of sonobuoys, work and analyse the incoming acoustic information, and then hand off to a high-altitude, long endurance asset that would remain in the area for much longer than the MPA. This will mitigate the finiteness of the MPA presence, and complicate the options for movement available to the submarine.

Multi-statics

Multi-statics will be a revolution for ASW acoustic sensor operators, and seems to be evolving into an absolute necessity for modern submarine prosecution, even though it is an active sensor. MAC systems will be key for executing denial operations against adversary submarines. In the near future, one might be able to link up several MAC prosecutions into a system of systems, in order to cover an even larger area holistically. This will require significant data processing capabilities, in addition to encrypted broadband communications between the search units.

8.5.7 Maturity and time: PED

AI and Big Data processing

Artificial intelligence and Big Data processing should be incorporated into airborne ASW platforms as soon as feasible, in order to handle the complexities of modern acoustic analysis. Allies should investigate the possibility for collaborative analysis of acoustic data, based on instant or near-real time dissemination of own acoustic data. Processing capacity and the ability to exchange large amounts of data more or less instantly, should be fully exploited in order to mitigate the acoustic challenge.

Layered persistent sensor framework

A layered approach to ASW must be adopted. MPAs by themselves are not nearly enough to meet the emerging Russian submarine threat. Six layers for ISR and targeting of submarines should be sought: space-based asset for sensors, communications and targeting; high-altitude long-endurance unmanned aircraft for near-constant presence; MPAs for ISR and weapons employment; surface assets (manned and unmanned) for long-range, near-persistent presence with underwater sensors; underwater platforms (manned and unmanned) for near-persistent underwater presence, ISR and carrying weapons; and finally sea-bed sensors for persistent ISR and cueing for other ASW platforms.

International cooperation and intelligence exchange

Historically, airborne ASW operations were coordinated by NATO alliance members, but all coordination was done under a national, bilateral or multilateral framework. NATO procedures were used, as well as NATO funded infrastructure. However, stating that the operations were conducted "by NATO" undermines an important element in describing the operations: There are key nations that were, and to a degree still are, able to handle ASW coordination of this sort. For the North Atlantic, this has been the US, the UK and Norway. Whether the infrastructure, procedures and competency to coordinate and lead such operation is present in today's NATO Command Structure *per se* is quite a different matter. The close hold that is inherent in acoustic intelligence as discussed in the historical chapters is likely still a prominent factor, leading to a tension between intelligence collection and intelligence sharing. Close cooperation between selected partners thus stands out as crucial for releasing the potential inherent in international cooperation. As a continuation of this, NATO should integrate national headquarters closely with the NATO Command Structure writ large, in order to exploit the capability and situational awareness that is built on a daily basis outside the formal NATO networks.

Bibliography

Primary sources

Archive sources

NATO archives, Brussels

AC/126-D/1 (REV). "The Group of Experts on Maritime Patrol Aircraft - The Status of Development of Maritime Patrol Aircraft," June 28, 1957. CD: IS-AC-0385. NATO Archives, Brussel.

AC/126-D/2. "Group of Experts on Maritime Patrol Aircraft - Desired Operational Characteristics," August 22, 1957. CD: IS-AC-0385. NATO Archives, Brussel.

AC/126-D/3. "Group of Experts on Maritime Patrol Aircraft - Desired Operational Characteristics of the Maritime Patrol Aircraft," December 3, 1957. CD: IS-AC-0385. NATO Archives, Brussel.

AC/126-D/5. "Group of Experts on Maritime Patrol Aircraft - Report to the Armaments Committee - 16th December 1958," December 16, 1958. CD: IS-AC-0385. NATO Archives, Brussel.

AC/126-D/6. "Group of Experts on Maritime Patrol Aircraft - NATO Multilateral Procurement and/or Production for a Maritime Patrol Aircraft," November 10, 1958. CD: IS-AC-0385. NATO Archives, Brussel.

AC/126(DS)R/1. "Group of Experts on Maritime Patrol Aircraft - Sub-Group on Design Studies - Summary of Meeting Held on 10-11 March 1958," March 11, 1958. CD: IS-AC-0385. NATO Archives, Brussel.

AC/126(DS)R/4. "Group of Experts on Maritime Patrol Aircraft - Sub-Group on Design Studies - Summary Record of Meeting 9-10 July 1958," July 10, 1958. CD: IS-AC-0385. NATO Archives, Brussel.

AC/126-R/1. "Group of Experts on Maritime Patrol Aircraft - Summary of the First Meeting, 16 April 1957," April 23, 1957. CD: IS-AC-0385. NATO Archives, Brussel.

AC/126-R/2. "Group of Experts on Maritime Patrol Aircraft - Summary Record of the Meeting Held at Palais de Chaillot, Paris, 11 October 1957," October 23, 1957. CD: IS-AC-0385. NATO Archives, Brussel.

AC/126-R/3. "Group of Experts on Maritime Patrol Aircraft - Summary of Meeting Held on 16 and 17 January 1958," January 17, 1958. CD: IS-AC-0385. NATO Archives, Brussel.

AC/126-R/4. "Group of Experts on Maritime Patrol Aircraft - Summary Record of Meeting on 10 March 1958," March 10, 1958. CD: IS-AC-0385. NATO Archives, Brussel.

AC/126-R/5. "Group of Experts on Maritime Patrol Aircraft - Summary Record of Meeting 22-24 October 1958," October 24, 1958. CD: IS-AC-0385. NATO Archives, Brussel.

AC/137/D/20. "Statement on Future Trends in Anti-Submarine Warfare Made at the Second Meeting of the Science Committee by the SACLANT Representative." NATO, July 17, 1958. CD: IS-AC-0385. NATO Archives, Brussel.

AC/137-R/3. "Science Committee - Summary Records of Meetings Held at the Palais de Chaillot, Paris, 5-8 January 1959." North Atlantic Treaty Organization (NATO), January 19, 1959. CD: IS-AC-0385. NATO Archives, Brussel.

AR(56)GENERAL-WP/1. "Report on the 1956 Annual Review," November 23, 1956. Electronic Document Folder: IMS/1955-1959. NATO Archives, Brussel.

C-M(59)39. "Standing Group - SACLANT Anti-Submarine Warfare Centre." NATO, April 14, 1959. CD: IS-AC-0385. NATO Archives, Brussel.
C-R(68)5. "Summary Record of a Meeting of the Council Held at the Headquarters, Brussels, on Wednesday, 24th January at 10.15 A.M." NATO, February 7, 1968. Electronic Document Folder: IMS/MC-MCM-SG/1953-1970. NATO Archives, Brussel.
IPT 098-195. "Military Comments on the 1956 Annual Review - Note by the International Planning Team," November 8, 1956. Electronic Document Folder: IMS/1955-1959. NATO Archives, Brussel.
MC 14/2. "The Overall Strategic Concept for the Defence of the NATO Area," October 14, 1956. Electronic Document Folder: IMS/MC-MCM-SG/1953-1970. NATO Archives, Brussel.
MC 48/3. "Measures to Implement the Strategic Concept for the Defence of the NATO Area." North Atlantic Treaty Organization (NATO), December 8, 1969. Electronic Document Folder: IMS/MC-MCM-SG/1953-1970. NATO Archives, Brussel.
MC 70. "A Report by the Military Committee to the North Atlantic Council on The Minimum Essential Force Requirements, 1958-1963," January 29, 1958. Electronic Document Folder: IMS/1955-1959. NATO Archives, Brussel.
SG 161/8 (Part II). "The Soviet Bloc Strength and Capabilities 1955-1959." NATO, March 18, 1955. NATO, online archive.
SG 161/10. "The Soviet Bloc Strength and Capabilities 1957-1961 - Part I," March 20, 1957. Electronic Document Folder: IMS/MC-MCM-SG/1953-1970. NATO Archives, Brussel.

National archives, Kew, United Kingdom

AIR 27/2978. "Operational Records - 201 Squadron - 1961-1963." UK Ministry of Defense, 1963 1961. UK National Archives, Kew.
AIR 27/2979. "Operational Records - 201 Squadron - 1963-1965." Royal Air Force, 1965 1963. UK National Archives, Kew.
AIR 27/3161. "Operational Records - 201 Squadron - 1966-1968." Royal Air Force, 1968 1966. UK National Archives, Kew.
AIR 27/3162. "Operational Records - 201 Squadron - 1969-1970." Royal Air Force, 1970. UK National Archives, Kew.
AIR 27/3357. "Operational Records - 201 Squadron - 1972-1975." Royal Air Force, 75 1972. UK National Archives, Kew.
AIR 27/3694. "Operational Records - 201 Squadron - 1983-1984." Royal Air Force, 1984 1983. UK National Archives, Kew.
AIR 27/3697. "Operational Records - 201 Squadron - 1981-1982." Royal Air Force, 1982 1981. UK National Archives, Kew.
DEFE 24/20. "British Surveillance Efforts against the Soviet Northern Fleet - Summer Exercises 1965." UK Director of Naval Intelligence, 1965. UK National Archives, Kew.
———. "Operation Beresford - Letter from Deputy Director of Naval Intelligence to the Ministry of Defence." UK Director of Naval Intelligence, October 5, 1965. UK National Archives, Kew.
———. "Operation Beresford - Planning Guide." UK Director of Naval Intelligence, 1965. UK National Archives, Kew.

Naval History and Heritage Command, Washington, D.C., USA

"Command History Report (CHR) for VP-5 (1960-1963)." US Navy, 1963 1960. FOIA case number: DON-NAVY-2018-001782. Naval History and Heritage Command.
"Command History Report (CHR) for VP-5 (1992)." US Navy, 1992. FOIA case number: DON-NAVY-2018-00574. Naval History and Heritage Command.
"Command History Report (CHR) for VP-5 (1993)." US Navy, 1993. FOIA case number: DON-NAVY-2018-00574. Naval History and Heritage Command.
"Command History Report (CHR) for VP-7 (1952)." US Navy, 1952. FOIA case number: DON-NAVY-2018-001782. Naval History and Heritage Command.
"Command History Report (CHR) for VP-10 (1955)." US Navy, 1955. FOIA case number: DON-NAVY-2018-00574. Naval History and Heritage Command.
"Command History Report (CHR) for VP-10 (1970)." US Navy, 1970. FOIA case number: DON-NAVY-2018-001782. Naval History and Heritage Command.
"Command History Report (CHR) for VP-16 (1978)." US Navy, 1978. FOIA case number: DON-NAVY-2018-001782. Naval History and Heritage Command.
"Command History Report (CHR) for VP-16 (1995)." US Navy, 1995. FOIA case number: DON-NAVY-2018-001782. Naval History and Heritage Command.
"Command History Report (CHR) for VP-21 (1959)." US Navy, 1959. FOIA case number: DON-NAVY-2018-00574. Naval History and Heritage Command.
"Command History Report (CHR) for VP-21 (1960-1965)." US Navy, 1965 1960. FOIA case number: DON-NAVY-2018-001782. Naval History and Heritage Command.
"Command History Report (CHR) for VP-23 (1965)." US Navy, 1965. FOIA case number: DON-NAVY-2018-00574. Naval History and Heritage Command.
"Command History Report (CHR) for VP-23 (1979)." US Navy, 1979. FOIA case number: DON-NAVY-2018-001782. Naval History and Heritage Command.
"Command History Report (CHR) for VP-23 (1980)." US Navy, 1980. FOIA case number: DON-NAVY-2018-001782'. Naval History and Heritage Command.
"Command History Report (CHR) for VP-23 (1981)." US Navy, 1981. FOIA case number: DON-NAVY-2018-001782. Naval History and Heritage Command.
"Command History Report (CHR) for VP-24 (1968)." US Navy, 1968. FOIA case number: DON-NAVY-2018-001782. Naval History and Heritage Command.
"Command History Report (CHR) for VP-24 (1969)." US Navy, 1969. FOIA case number: DON-NAVY-2018-001782. Naval History and Heritage Command.
"Command History Report (CHR) for VP-24 (1974)." US Navy, 1974. FOIA case number: DON-NAVY-2018-001782. Naval History and Heritage Command.
"Command History Report (CHR) for VP-24 (1991)." US Navy, 1991. FOIA case number: DON-NAVY-2018-001782. Naval History and Heritage Command.
"Command History Report (CHR) for VP-44 (1967)." US Navy, 1967. FOIA case number: DON-NAVY-2018-001782. Naval History and Heritage Command.
"Command History Report (CHR) for VP-44 (1969)." US Navy, 1969. FOIA case number: DON-NAVY-2018-001782. Naval History and Heritage Command.
"Command History Report (CHR) for VP-44 (1979)." US Navy, 1979. FOIA case number: DON-NAVY-2018-001782. Naval History and Heritage Command.
"Command History Report (CHR) for VP-44 (1986)." US Navy, 1986. FOIA case number: DON-NAVY-2018-001782. Naval History and Heritage Command.
"Command History Report (CHR) for VP-44 (1987)." US Navy, 1987. FOIA case number: DON-NAVY-2018-001782. Naval History and Heritage Command.
"Command History Report (CHR) for VP-49 (1970)." US Navy, 1970. FOIA case number: DON-NAVY-2018-001782. Naval History and Heritage Command.

"Command History Report (CHR) for VP-49 (1972)." US Navy, 1972. FOIA case number: DON-NAVY-2018-00574. Naval History and Heritage Command.
"Command History Report (CHR) for VP-49 (1974)." US Navy, 1974. FOIA case number: DON-NAVY-2018-00574. Naval History and Heritage Command.
"Command History Report (CHR) for VP-49 (1993)." US Navy, 1993. FOIA case number: DON-NAVY-2018-00574. Naval History and Heritage Command.
"Command History Report (CHR) for VP-56 (1962)." US Navy, 1962. FOIA case number: DON-NAVY-2018-00574. Naval History and Heritage Command.
"Command History Report (CHR) for VP-56 (1970)." US Navy, 1970. FOIA case number: DON-NAVY-2018-001782. Naval History and Heritage Command.
"Command History Report (CHR) for VP-56 (1971)." US Navy, 1971. FOIA case number: DON-NAVY-2018-001782. Naval History and Heritage Command.
"Command History Report (CHR) for VP-56 (1973)." US Navy, 1973. FOIA case number: DON-NAVY-2018-001782. Naval History and Heritage Command.
"Command History Report (CHR) for VP-56 (1975)." US Navy, 1975. FOIA case number: DON-NAVY-2018-001782. Naval History and Heritage Command.
"Command History Report (CHR) for VP-56 (1978)." US Navy, 1978. FOIA case number: DON-NAVY-2018-001782. Naval History and Heritage Command.
"Command History Report (CHR) for VP-56 (1984)." US Navy, 1984. FOIA case number: DON-NAVY-2018-00574. Naval History and Heritage Command.

Intelligence assessments

Defense Intelligence Agency (DIA). "Russia Military Power - Building a Military to Support Great Power Aspirations." Defense Intelligence Agency, 2017.
NIE 11-3-55. "Soviet Capabilities and Probable Soviet Courses of Action through 1960." Director of National Intelligence, May 17, 1955. CIA, Online archive.
NIE 11-6-54. "Soviet Capabilities and Probable Programs in the Guided Missile Field." National Intelligence Estimate. Director of National Intelligence, October 5, 1954. CIA, Online archive.
Norwegian Intelligence Service. "FOKUS 2011 - The Assessment of the Intelligence Service." Annual Unclassified Assessment. Oslo, 2011. https://forsvaret.no/fakta_/ForsvaretDocuments/FOKUS-2011.pdf.
———. "FOKUS 2013 - The Assessment of the Intelligence Service." Annual Unclassified Assessment. Oslo, 2013. https://forsvaret.no/fakta_/ForsvaretDocuments/FOKUS-2013.pdf.
———. "FOKUS 2015 - The Assessment of the Intelligence Service." Annual Unclassified Assessment. Oslo, 2015. https://forsvaret.no/ForsvaretDocuments/FOKUS2015-endelig.pdf.
———. "FOKUS 2019 - The Assessment of the Intelligence Service." Annual Unclassified Assessment|. Oslo, 2019.
Office of Naval Intelligence. "The People's Liberation Army Navy - A Modern Navy with Chinese Characteristics." Office of Naval Intelligence (ONI), August 2009.
———. "The Russian Navy - A Historic Transition." Office of Naval Intelligence (ONI), December 2015. http://www.oni.navy.mil/Portals/12/Intel%20agencies/russia/Russia%202015print.pdf?ver=2015-12-14-082038-923.

NATO and military publications and official statements

AAP-6. “NATO Glossary of Terms and Definitions.” NATO Standardization Agency, April 3, 2013.
AJP 3.3.3. “NATO Maritime Air Coordination.” NATO, December 2014.
Annex 2-0. “Global Integrated Intelligence Surveillance and Reconnaissance Operations.” US Air Force, January 29, 2015.
Joint Doctrine Publication 0-30. “UK Air and Space Operations.” UK Ministry of Defense, July 2013.
Joint Doctrine Publication 2-00. “Understanding and Intelligence Support to Operations.” UK Ministry of Defense, 2011.
Joint Publication (JP) 1-02. “Department of Defense Dictionary of Military and Associated Terms.” United States Department of Defense, February 15, 2016. http://www.dtic.mil/doctrine/new_pubs/jp1_02.pdf.
Joint Publication (JP) 2-0. “Joint Intelligence.” United States Department of Defense, October 22, 2013.

Official government statements and transcripts

Barth Eide, Espen. “Forsvarets Oppdrag i Nordområdene (‘The Mission of the Armed Forces in the High North’).” Speech presented at the Nordområdekonferansen, Bodø, March 30, 2006.
Defense Contracts Online. “P-8A Programme Progresses.” Defense Contracts Online, (date unknown). https://www.contracts.mod.uk/do-features-and-articles/p-8a-programme-progresses/.
Forsvarsdepartementet. “NATO-Toppmøtet: Viktige Avklaringer Om Fremtidens NATO.” The Norwegian Government, September 3, 2014. https://www.regjeringen.no/no/aktuelt/NATO-toppmotet-Viktige-avklaringer-om-fremtidens-NATO/id766528/.
———. “Norge Har Inngått Kontrakt Om Kjøp Av Fem Nye P-8A Poseidon.” The Norwegian Government, March 29, 2017. https://www.regjeringen.no/no/aktuelt/norge-har-inngatt-kontrakt-om-kjop-av-fem-nye-p-8a-poseidon-maritime-patruljefly/id2546045/.
Haddon-Cave, Charles. “The Nimrod Review - An Independent Review into the Broader Issues Surrounding the Loss of the RAF Nimrod MR2 Aircraft XV230 in Afghanistan in 2006.” Report to the House of Commons. London: House of Commons, October 2009.
Innst. S nr.151 (1995-1996). “Recommendation to Parliament by the Defense Committee - Confirmation of Norway’s Self-Imposed Restrictions in Security Policy.” Stortinget, March 13, 1996. Stortinget, online archive.
Kremlin. “Maritime Doctrine of the Russian Federation.” Translated by Anna Davis. U.S. Naval War College, 2015.
Ministry of Defence of the Russian Federation. “Severodvinsk Nuclear Submarine of the Northern Fleet Carried out Missile Firing,” August 18, 2017. http://eng.mil.ru/en/news_page/country/more.htm?id=12138913@egNews.
NATO. “Active Engagement, Modern Defense - Strategic Concept for the Defense and Security for the Members of NATO.” NATO, November 20, 2010. NATO, online archive.
———. “Allied Joint Doctrine for Joint Targeting.” NATO Standardization Agency, April 2016.

———. "Brussels Summit Declaration." NATO, July 11, 2018. NATO, online archive.
———. "Counter-Piracy Operations." NATO, December 19, 2016. NATO, online archive. https://www.nato.int/cps/en/natolive/topics_48815.htm#Protector.
———. "Declaration of the Heads of State and Government - Brussels Summit." NATO, January 11, 1994. NATO, online archive.
———. "Final Communique - Berlin." NATO, June 3, 1996. NATO, online archive.
———. "First NATO AGS Remotely Piloted Aircraft Ferries to Main Operating Base in Italy." NATO, November 21, 2019. https://www.nato.int/cps/en/natohq/news_171171.htm.
———. "Istanbul Summit Communique." NATO, June 28, 2004. NATO, online archive.
———. "Lisbon Summit Declaration." NATO, November 20, 2010. NATO, online archive.
———. *NATO - Facts about the North Atlantic Treaty Organization - 1962*. Paris: NATO Information Service, 1962.
———. *NATO Handbook 1995*. Brussels: NATO Office of Information and Press, 1995.
———. "NATO's Readiness Action Plan (RAP) - Fact Sheet." NATO, July 2016. NATO, online archive.
———. "Operation Active Endeavour." NATO, October 27, 2016. NATO, online archive. https://www.nato.int/cps/en/natolive/topics_7932.htm.
———. "Prague Summit Declaration." NATO, November 21, 2002. NATO, online archive.
———. "Strasbourg/Kehl Summit Declaration." NATO, April 4, 2009. NATO, online archive.
———. "The Alliance's New Strategic Concept." NATO, November 8, 1991. NATO, online archive.
———. "The Alliance's Strategic Concept." NATO, April 24, 1999. NATO, online archive.
———. "Wales Summit Declaration." NATO, September 5, 2014. NATO, online archive.
———. "Warsaw Summit Communique." NATO, July 9, 2016. NATO, online archive.
Norwegian Chief of Defense (CHOD). "A Defense Undergoing Change - Fagmilitært Råd (FMR) - Defense White Paper." Norwegian Defense Staff (FST), n.d.
Norwegian Minister of Defence Jørgen Kosmo. Official correspondance. "Letter from the Minister of Defence to the Defense Committee." Official correspondance, February 26, 1996. Stortinget, online archive.
———. "Long Term Challenges for the Armed Forces." Speech. Oslo Militære Samfund, Oslo, January 8, 1996. Stortinget, online archive.
Norwegian Ministry of Defense. "Response from the Ministry of Defense to the Foreign Affairs and Defense Committee on Questions Related to the Long Term Plan - Prop. 151 S (2015-2016)." Stortinget, August 17, 2016. Stortinget, online archive.
Putin, Vladimir. "Speech and the Following Discussion at the Munich Conference on Security Policy." Kremlin, February 19, 2007. http://en.kremlin.ru/events/president/transcripts/24034.
Rear Admiral Butts, John. Department of Defense Authorization for Appropriations for Fiscal Year 1986, Pub. L. No. Part 8, § Committee on Armed Services, U.S. Senate, 4364 (1985).
Robertson, Sue. "Defence Committee - Future Maritime Surveillance." Written Evidence. Government of the United Kingdom, Defence Committee, September 19, 2012. http://www.publications.parliament.uk/pa/cm201213/cmselect/cmdfence/110/110vw10.htm.
Stortinget. Skriftlig spørsmål fra Willfred Nordlund (Sp) til forsvarsministeren, Pub. L. No. 15:607 (2018-2019) (2019).
St.prop. 151 S (2015-2016). "Long-Term Plan for the Norwegian Armed Forces." Norwegian Ministry of Defense, June 16, 2016.

The Kremlin. “Meeting with Defence Ministry Leadership and Military-Industrial Complex Representatives,” May 12, 2015. http://en.kremlin.ru/events/president/news/49456.

The Norwegian Government. “Presiseringer Om Utbyggingen Av Evenes.” The Norwegian Government, April 17, 2018. https://www.regjeringen.no/no/aktuelt/presiseringer-om-utbyggingen-av-evenes/id2598125/.

———. “Prop. 27 S (2016-2017) - Endringer i Statsbudsjettet 2016 under Forsvarsdepartementet.” The Norwegian Government, November 25, 2016. https://www.regjeringen.no/contentassets/a38d11296b8f4d2a8df432ac430335c4/nn-no/pdfs/prp201620170027000dddpdfs.pdf.

The Norwegian Ministry of Foreign Affairs. “St.Meld.Nr.38 (2008-2009) - Om Samarbeidet i NATO i 2008.” The Norwegian Government, 2008.

The Office of the Director, Operational Test and Evaluation. “FY2014 DOT&E Annual Report.” Annual Report, 2014.

The Royal Norwegian Air Force. “Forsvarets Doktrine for Luftoperasjoner.” The Norwegian Armed Forces, 2018.

UK Defense Committee. “Future Maritime Surveillance.” Vol I. London: House of Commons, September 5, 2012.

UK MoD. “National Security Strategy and Strategic Defense and Security Review (SDSR) 2015.” HM Government, November 2015.

UK MoD. “Major Projects Report 2005 - Project Summary Sheets.” London: National Audit Office, November 25, 2005.

USAF Chief Scientist. *Technology Horizons - A Vision for Air Force Technology 2010-2030*. Maxwell AFB, Montgomery, Alabama: Air University Press, 2010. http://www.defenseinnovationmarketplace.mil/resources/AF_TechnologyHorizons2010-2030.pdf.

U.S. House of Representatives. Advanced Submarines Technology and Antisubmarine Warfare, § Committee on Armed Services (1990).

Wilson, Clay. “Network Centric Warfare: Background and Oversight Issues for Congress.” Washington, D.C.: Congressional Research Service, June 2, 2004.

Interviews

Efjestad, Svein. Norwegian self-imposed restrictions in the High North. Interview, September 2, 2019. Norwegian Ministry of Defense.

Håvoll, Harald. Norwegian Maritime Patrol Aircraft operations during and after the Cold War. Nesodden, Norway, October 22, 2018.

Klevberg, Håvard. Discussion - Norwegian MPA capability. Norwegian Ministry of Defense, Oslo, May 24, 2018.

Porter, Air Commodore (r) Garfield “Garry.” British Maritime Patrol Aircraft Operations during and after the Cold War. Royal Air Force Club, London, May 31, 2017.

Newspaper articles

Akulov, Andrei. “Kalibr: Russia’s Naval System Upping Cruise Missile Game.” *Strategic Culture Foundation*, May 24, 2016. https://www.strategic-culture.org/news/2016/05/24/kalibr-russia-naval-system-upping-cruise-missile-game/.

Allison, George. “First British P-8A Poseidon Will Be ‘Ready to Fly with a UK Crew’ on Day One of Arriving in the UK.” *UK Defence Journal*, July 25, 2018.

https://ukdefencejournal.org.uk/first-british-p-8-poseidon-will-be-ready-to-fly-with-a-uk-crew-on-day-one-of-arriving-in-the-uk/.

———. “US in Deal with UK and Norway to Form P-8 Poseidon Partnership.” *UK Defence Journal*, July 4, 2017. https://ukdefencejournal.org.uk/us-deal-uk-norway-form-p-8-poseidon-partnership/.

Antonsen, Øystein, and Arild Moe. “Alle Ser Mot Nord: -Arktis Gir Oss Flere Muligheter.” *NRK*, January 22, 2018. https://www.nrk.no/troms/alle-ser-mot-nord_-_-arktis-gir-oss-flere-muligheter-1.13879346.

Ask, Alf Ole. “NATO Møter Utfordringer i Alle Himmelretninger.” *Aftenposten*. February 15, 2016. https://www.aftenposten.no/verden/i/o60K/nato-moeter-utfordringer-i-alle-himmelretninger.

Avionews. “The United Kingdom Has No Maritime Patrol Aircraft, Asks NATO for Help.” *Avionews*. October 12, 2014. https://www.avionews.com/item/1164814-the-united-kingdom-has-no-maritime-patrol-aircraft-asks-for-nato-help.html.

BBC. “US Senate Votes to Begin Debate on New Start Treaty.” *BBC.Com*. Accessed October 4, 2018. https://www.bbc.com/news/world-us-canada-12004945.

BBC News Online. “Russia Hits Targets in Syria from Mediterranean Submarine.” *BBC News Online*, December 8, 2015. https://www.bbc.com/news/world-middle-east-35041656.

Bennett, Brian, and W.J. Hennigan. “U.S. Builds up Arctic Spy Network as Russia and China Increase Presence.” *Los Angeles Times*, September 7, 2015. https://www.latimes.com/world/europe/la-fg-arctic-spy-20150907-story.html.

Bentzrød, Sveinung Berg. “E-Sjefen: Derfor Trenger Norge to Spionskip i Nord.” *Aftenposten*. September 26, 2016. https://www.aftenposten.no/norge/i/A9oqM/E-sjefen-Derfor-trenger-Norge-to-spionskip-i-nord.

———. “Etterretningsstasjoner i Nord Anklages for Hemmelighold. Nå Slår E-Sjefen Tilbake.” *Aftenposten*. October 8, 2016. https://www.aftenposten.no/norge/i/mwgog/Etterretningsstasjoner-i-nord-anklages-for-hemmelighold-Na-slar-E-sjefen-tilbake.

Berger, Eric. “Blue Origin Just Validated the New Space Movement.” *Arstechnica.Com*, October 6, 2016. https://arstechnica.com/science/2016/10/blue-origin-just-validated-the-new-space-movement/.

Bodner, Matthew. “NATO Deputy SecGen: Russia’s Anti-Access/Area Denial Build-Up Is Biggest Worry.” *Security and Policy*, February 14, 2016. http://securityandpolicy.com/nato-deputy-secgen-russias-anti-accessarea-denial-build-up-is-biggest-worry/.

———. “Russia Adds ‘Kazan’ to Its Nuclear Attack Submarine Fleet.” *Defense News*. Accessed October 24, 2019. https://www.defensenews.com/naval/2017/03/31/russia-adds-kazan-to-its-nuclear-attack-submarine-fleet/.

———. “Russia Has Plans for Its Future Nuclear Subs, and It Involves Hypersonic Missiles.” *Defense News*, June 1, 2018. https://www.defensenews.com/naval/2018/06/01/russia-has-plans-for-its-future-nuclear-subs-and-it-involves-hypersonic-missiles/?utm_source=Sailthru&utm_medium=email&utm_campaign=DFN%20DNR%206/1/18&utm_term=Editorial%20-%20Daily%20News%20Roundup.

Brekke, Anders, and Joakim Reigstad. “- Dagens Forsvar Er Ikke Bærekraftig.” *NRK*, April 11, 2016. https://www.nrk.no/norge/_-dagens-forsvar-er-ikke-baerekraftig-1.12894608.

Budalen, Andreas, and Henrik Ø. Heldahl. “Det Er Uvanlig Høy Russisk Aktivitet Utenfor Norskekysten.” *NRK*, August 6, 2019. https://www.nrk.no/nordland/_-det-er-uvanlig-hoy-russisk-aktivitet-utenfor-norskekysten-1.14650593.

Budalen, Andreas, and Beth Pettersen. “Orion-Flyene Er På Vingene Igjen.” *NRK (Online)*. November 8, 2016. https://www.nrk.no/nordland/orion-flyene-er-pa-vingene-igjen-1.13216832.

Cass, Stephen. “We May Be Heading for a Space Bubble.” *MIT Technology Review* Online (September 14, 2010). https://www.technologyreview.com/s/420776/we-may-be-heading-for-a-space-bubble.

CNN.com. “USAF: Fighter Jet Lasers 5 Years Away.” *CNN*, December 15, 2015. https://edition.cnn.com/videos/us/2015/12/15/us-air-force-lasers-fighter-jets-orig-vstop.cnn.

David, Leonard. “China’s Anti-Satellite Test: Worrisome Debris Cloud Circles Earth.” *Space.Com*, February 2, 2007. https://www.space.com/3415-china-anti-satellite-test-worrisome-debris-cloud-circles-earth.html.

Episkopos, Mark. “Meet the First Russian Submarine to Fire in Anger since World War II (and Its New Cruise Missiles).” *The National Interest*, January 12, 2019. https://nationalinterest.org/blog/buzz/meet-first-russian-submarine-fire-anger-world-war-ii-and-its-new-cruise-missiles-41292.

Eshel, Tamir. “Lifting the Veil of Israel’s Classified Laser Weapon Program.” *Defense Update*, January 8, 2020. https://defense-update.com/20200108_hel_israel.html.

Farley, Robert. “Is the Day of the Land Attack Cruise Missile upon Us?” *The Diplomat*, October 9, 2015. http://thediplomat.com/2015/10/is-the-day-of-the-land-attack-cruise-missile-upon-us/.

Faulconbridge, Guy. “Russian Navy to Start Sorties in Mediterranean.” *Reuters*, December 5, 2007. https://www.reuters.com/article/us-russia-navy/russian-navy-to-start-sorties-in-atlantic-tass-idUSL0518563620071205.

Fein, Geoff, and Grace Jean. “Changing the Game: U Navy Applies New Approaches to Submainres Threats.” *IHS Jane’s Navy Internatioinal*, 2014. https://www.janes.com/images/assets/836/46836/US_Navy_applies_new_approaches_to_submarine_threats.pdf.

Flight International. “RMPA Contenders Step up Campaign.” *Flight International*, no. 1 (May 7, 1996): 16.

Gady, Franz-Stefan. “Putin’s ‘Red October’: Russia’s Deadliest New Submarine.” *The Diplomat*, March 4, 2015. https://thediplomat.com/2015/03/putins-red-october-russias-deadliest-new-submarine/.

———. “Russia to Upgrade 12 Nuclear-Powered Subs.” *The Diplomat*, October 5, 2015. https://thediplomat.com/2015/10/russia-to-upgrade-12-nuclear-powered-subs/.

———. “Russian Sub Combat Patrols Nearly Doubled in 2015.” *The Diplomat*, March 23, 2016. https://thediplomat.com/2016/03/russian-sub-combat-patrols-nearly-doubled-in-2015/.

———. “Russia’s First Yasen-M Attack Sub to Begin State Trials in 2019.” *The Diplomat*, December 8, 2018. https://thediplomat.com/2018/12/russias-first-yasen-m-attack-sub-to-begin-state-trials-in-2019/.

———. “Russia’s Pacific Fleet to Receive 2 Fast Attack Subs in 2020.” *The Diplomat*, July 3, 2018. https://thediplomat.com/2018/07/russias-pacific-fleet-to-receive-2-fast-attack-subs-in-2020/.

Gertz, Bill. “Damaged Russian Sub Linked to Underwater Drone Program.” *Soldier of Fortune* (blog), July 15, 2019. https://www.sofmag.com/damaged-russian-sub-linked-to-underwater-drone-program/.

Gibbons-Neff, Thomas. “With No Sub-Chasing Aircraft of Its Own, UK Calls on Allies to Help Find Russian Submarine.” *Washington Post*. November 23, 2015. https://www.washingtonpost.com/news/checkpoint/wp/2015/11/23/with-no-sub-chasing-aircraft-of-its-own-uk-calls-on-allies-to-help-find-russian-submarine/?noredirect=on&utm_term=.fd82147b45bf.

Gorenburg, Dmitry. “Russian Naval Shipbuilding - Is It Possible to Fulfill the Kremlin’s Grand Expectations?” CNA Harvard University, October 2015. http://www.ponarseurasia.org/sites/default/files/policy-memos-pdf/Pepm395_Gorenburg_Oct2015.pdf.

Gutterman, Steve. “New Russian Nuclear Submarine Goes into Service.” *Reuters*, January 10, 2013. https://www.reuters.com/article/us-russia-submarine/new-russian-nuclear-submarine-goes-into-service-idUSBRE9090YR20130110.

Haynes, Deborah. “Putin’s Submarines Spur NATO to Boost Its UK Nerve Centre.” *The Times*. January 10, 2018. https://www.thetimes.co.uk/article/putin-s-submarines-spur-nato-to-boost-its-uk-nerve-centre-8h2bf95qp.

“Hektisk Jakt På Ubåter.” *Vesterålen Online*, October 31, 2019. https://www.vol.no/pluss/2019/10/31/Hektisk-jakt-p%C3%A5-ub%C3%A5ter-20289339.ece.

Higgins, Andrew. “Norway Reverts to Cold War Mode as Russian Air Patrols Spike.” *The New York Times*, April 1, 2015. https://www.nytimes.com/2015/04/02/world/europe/a-newly-assertive-russia-jolts-norways-air-defenses-into-action.html?emc=eta1.

Holmes, James. “More Submarines and Less Aircraft Carriers: If the U.S. Navy Could Be Completely Rebuilt.” *The National Interest*, December 3, 2017. https://nationalinterest.org/blog/the-buzz/more-submarines-less-aircraft-carriers-if-the-us-navy-could-23482?nopaging=1.

Insinna, Valerie. “The US Military’s Chaff and Flare Industry Is on Fragile Ground.” *Defense News*, November 13, 2018. https://www.defensenews.com/industry/2018/11/13/the-militarys-chaff-and-flare-industry-is-on-fragile-ground/.

Johansen, Per Anders. “Putin Med Overraskende Norge-Flørt: På Tide å Utvide Horisonten Og Samarbeidet.” *Aftenposten*, October 21, 2018. https://www.aftenposten.no/verden/i/1kJozl/putin-med-overraskende-norge-floert-paa-tide-aa-utvide-horisonten-og-samarbeidet.

———. “Russisk Atomubåt Testet Atomraketter i Barentshavet i Morges.” *Aftenposten*. December 12, 2015.

Johnsen, Alf Bjarne. “E-Sjefen: Russland Øvde På Angrep Mot Nord-Norge.” *VG*. March 5, 2019. https://www.vg.no/nyheter/innenriks/i/1kye4W/e-sjefen-russland-oevde-paa-angrep-mot-nord-norge.

———. “NATO: Russerne Kan Sabotere Internett Med Ubåt.” *VG*, February 17, 2018. https://www.vg.no/nyheter/utenriks/i/gPday5/nato-russerne-kan-sabotere-internett-med-ubaat.

———. “Russland i Gang Med Ubåtoperasjon i Nord: Største Siden Sovjet-Tiden.” *VG*, October 29, 2019. https://www.vg.no/nyheter/innenriks/i/opxAP0/russland-i-gang-med-ubaat-operasjon-i-nord-stoerste-siden-sovjet-tiden?utm_source=vgfront&utm_content=row-2.

———. “Solberg: Vil Overvåke Mer Med Fly Som Forsvarssjefen Vil Skrote.” *VG*. October 12, 2015. https://www.vg.no/nyheter/innenriks/i/22RKr/solberg-vil-overvaake-mer-med-fly-som-forsvarssjefen-vil-skrote.

———. “Søreide: Ber NATO Trekke Nordover.” *VG*. February 15, 2016. https://www.vg.no/nyheter/innenriks/i/wWazo/soereide-ber-nato-trekke-nordover.

Kofman, Michael. “Fire Aboard AS-31 Losharik: Brief Overview.” *Russian Military Analysis* (blog), July 3, 2019. https://russianmilitaryanalysis.wordpress.com/tag/gugi/.

———. “Russian Hybrid Warfare and Other Dark Arts.” *War On the Rocks*, March 11, 2016. https://warontherocks.com/2016/03/russian-hybrid-warfare-and-other-dark-arts/.

Korolkov, Alexander. “Russia’s Top-Secret Nuclear Submarine Comes into Service.” *Russia Beyond*. June 17, 2014. https://www.rbth.com/defence/2014/06/17/russias_top-secret_nuclear_submarine_comes_into_service_37483.html.

Lacey, James. “Battle of the Bastions.” *War On The Rocks* (blog), January 9, 2020. https://warontherocks.com/2020/01/battle-of-the-bastions/.

LaGrone, Sam. “CNO: New 2nd Fleet Boundary Will Extend North to the Edge of Russian Waters.” *USNI News*, August 24, 2018. https://news.usni.org/2018/08/24/cno-new-2nd-fleet-boundary-will-extend-north-edge-russian-waters.

———. “Russian Air Force Chief: U.S. Surveillance Flights Monitor Russia Daily.” *USNI News*, December 17, 2014. https://news.usni.org/2014/12/17/russian-air-force-chief-u-s-surveillance-flights-monitor-russia-daily.

Larter, David B., and Mark D. Faram. “The US Navy’s New Command Puts Russia in the Crosshairs.” *Defense News*, May 4, 2018. https://www.defensenews.com/naval/2018/05/04/the-us-navys-new-command-puts-russia-in-the-crosshairs/#.WuzF9tk3w80.email.

Lieungh, Erik. “Norge Trekker NATOs Øyne Mot Nordflanken.” *NRK*, February 13, 2016. https://www.nrk.no/finnmark/norge-trekker-natos-oyne-mot-nordflanken-1.12801938.

Lysvold, Susanne Skjåstad. “Klimaendringene Tapper Havet for Oksygen - Fisken Rømmer Nordover.” *NRK*, October 10, 2018. https://www.nrk.no/nordland/klimaendringene-tapper-havet-for-oksygen---fisken-rommer-nordover-1.14240007.

Lewis, Jeffrey. “Led Zeppelin Comes to Washington.” *Foreign Policy*, January 5, 2015. https://foreignpolicy.com/2015/01/05/led-zeppelin-comes-to-washington-russia-nukes-putin-arms-control/.

Madsen, Anders. “Etterretning Er Politisk Kapital.” *Aftenposten*. February 24, 2016. https://www.aftenposten.no/meninger/kommentar/i/vAkl/etterretning-er-politisk-kapital-per-anders-madsen.

Madshus, Karin, and Rolf Lofstad. “Norsk Lasteskip Ble Anropt Av Russisk Slagskip.” *Dagbladet*, April 15, 2019. https://www.dagbladet.no/nyheter/norsk-lasteskip-ble-anropt-av-russisk-slagskip/70985345.

Majumdar, Dave. “Cruise Missiles Strikes in Syria: Russia’s Big Ad Campaign?,” October 8, 2015. https://nationalinterest.org/blog/the-buzz/cruise-missile-strikes-syria-russias-big-ad-campaign-14032.

———. “U.S. Navy Impressed with New Russian Attack Boat.” *USNI News*, October 28, 2014. https://news.usni.org/2014/10/28/u-s-navy-impressed-new-russian-attack-boat.

Mazzetti, Mark, and Thom Shanker. “Russian Subs Patrolling Off East Coast of U.S.” *New York Times*. August 4, 2009.

McCurley, T. Mark. “I Was a Drone Warrior for 11 Years. I Regret Nothing.” *Politico*, October 18, 2015. https://www.politico.com/magazine/story/2015/10/drone-pilot-book-213263.

Military-Today.com. “Admiral Gorshkov Class - Multi-Role Frigate.” *Military-Today*. Accessed December 6, 2019. http://www.military-today.com/navy/admiral_gorshkov_class.htm.

Maceda, Steven. “Control of Theater Intelligence, Surveillance, and Reconnaissance for the Ground Commander.” *Air & Space Power Journal* 22, no. 4 (Winter 2008).

Martin, Matthew J. “Unifying Our Vision - Joint ISR Coordination and the NATO Joint ISR Initiative.” *Joint Force Quarterly (JFQ)*, no. 72 (Quarter 2014). http://ndupress.ndu.edu/Portals/68/Documents/jfq/jfq-72/jfq-72_54-60_Martin.pdf?ver=2014-03-13-152411-000.

Martyanov, Andrei. “Russia’s Navy in Search of a Mission.” *United States Naval Institute Proceedings* 140, no. 12 (December 2014).
McKew, Molly M. “The Gerasimov Doctrine.” *Politico Magazine*, October 2017.
McLaughlin, Kevin. “Would Space-Based Systems Defenses Improve Security?” *Washington Quarterly* 25, no. 3 (2002): 177–91.
Min, Pan. “Fisheries Issue in the Central Arctic Ocean and Its Future Governance.” *The Polar Journal* 7, no. 2 (2017).
Missile Defense Project. “Russia Air and Missile Defense.” Center for Strategic and International Studies (CSIS), June 14, 2018. https://missilethreat.csis.org/system/russian-air-defense/.
Mitchell, Simon, ed. *Jane’s Civil and Military Aircraft Upgrades 1994-95*. Coulsdon, UK: Jane’s Information Group Ltd, 1994.
Mizin, Victor, and Michael Jasinski. “The Future of the Russian Sea-Based Deterrent.” *The Journal of Slavic Military Studies* 16, no. 1 (2003): 69–83.
Moe, Arild. “The Northern Sea Route> Smooth Sailing Ahead?” *Strategic Analysis* 38, no. 6 (2014).
Moen, Knut E. “Norway’s Self-Imposed Restrictions in the High North, 1945-65.” *Forsvarsstudier*, no. 5/1998 (1998).
Mozgovoy, Aleksandr. “Russian Navy’s Long Arm: Kalibr Missile Family.” Translated by J. Hawk. *Natsionalnaya Oborona/Southfront.Org*, August 10, 2015. https://southfront.org/russian-navys-long-arm-kalibr-missile-family/.
Nilsen, Thomas. “Alarm-Drill: 36 Russian Warships Sail out to Barents Sea.” *The Barents Observer*, June 13, 2018. https://thebarentsobserver.com/en/security/2018/06/36-russian-warships-sails-out-barents-sea.
———. “Now, Russia Builds a Submarine Even Bigger than the Typhoon.” *The Barents Observer*, May 3, 2017. https://thebarentsobserver.com/en/security/2017/05/russias-new-military-research-submarine-arctic-waters-will-be-worlds-largest#.WQnEKkjm64w.facebook.
———. “Russia in the High North.” Presented at the Matpakkeseminar, Norwegian MoD, November 14, 2019.
———. “Russian Navy Announces Comprehensive Naval Exercises off Northern Norway.” *The Arctic Today*, August 6, 2019. https://www.arctictoday.com/russian-navy-announces-comprehensive-naval-exercises-off-northern-norway/.
———. “Russian Sub Launched Cruise Missile without Leaving Port.” *The Barents Observer*, April 3, 2019. https://thebarentsobserver.com/en/security/2019/04/russian-sub-launched-cruise-missile-without-leaving-port#.XKQ_dO8JV7U.facebook.
———. “Sevmash Floats out Second Yasen-M Class Nuclear Attack Submarine.” *The Barents Observer*, December 25, 2019. https://thebarentsobserver.com/en/security/2019/12/sevmash-floats-out-second-yasen-m-class-nuclear-attack-submarine.
———. “Watch Russian Submarine Test Fire Cruise Missile in Barents Sea.” *The Barents Observer*, August 18, 2017. https://thebarentsobserver.com/en/security/2017/08/watch-russian-submarine-test-fire-cruise-missile-barents-sea.
Nilssen, Tom. “Nye Bildebevis Av Russisk Avskjæring.” *NRK*, January 31, 2018. https://www.nrk.no/urix/nye-bildebevis-av-russisk-avskjaering-1.13894490.
NTB. “Det Vil Ta Én Til to Måneder for NATO å Hjelpe Norge.” *NRK*, April 5, 2016.
———. “Evenes Flystasjon Kan Bli Overvåkingsbase for USA.” *VG*, July 21, 2019. https://www.vg.no/nyheter/innenriks/i/bprjB/evenes-flystasjon-kan-bli-overvaakingsbase-for-usa#xtor=CS4-1.

Persen, Kjell. “Amerikansk Atomubåt Søkte Nødhavn i Norge.” *TV2.No*, October 27, 2017. https://www.tv2.no/a/9433425.
Pettersen, Trude. “Black Sea Submarine Fires Cruise Missile from the Barents Sea.” *The Barents Observer*, August 4, 2015. https://barentsobserver.com/en/security/2015/08/black-sea-submarine-fires-cruise-missile-barents-sea-04-08.
———. “Nuclear Missile World Record Attempt.” *The Barents Observer*, March 2, 2016. https://thebarentsobserver.com/en/security/2016/03/nuclear-missile-world-record-attempt.
———. “U.S. Builds up Arctic Intelligence Network.” *The Barents Observer*, September 8, 2015. https://barentsobserver.com/en/security/2015/09/us-builds-arctic-intelligence-network-08-09.
———. “U.S. Military Returns to Iceland.” *The Barents Observer*, October 2, 2016. https://thebarentsobserver.com/en/security/2016/02/us-military-returns-iceland#.VsVfwxKHhBK.mailto.
Pilkington, Ed. “Life as a Drone Operator: ‘Ever Step on Ants and Never Give It Another Thought?’” *The Guardian*. November 15, 2015.
Portocarrero, Marta. “Russia Fires First Submarine Missiles against Isis Targets in Syria.” *Independent*, December 10, 2015. https://www.independent.co.uk/news/world/europe/russia-fires-first-submarine-missiles-against-isis-targets-in-syria-a6766426.html.
Press Release. “GRAB Satellite Declassified - NRL Built and Deployed First Reconnaissance Satellite System.” U.S. Naval Research Laboratory, June 17, 1998. https://www.nrl.navy.mil/media/new-news-releases/1998/grab-satellite-declassified--nrl-built-and-deployed-first-reconnaissance-satellite-system.
Roblin, Sebastian. “Why Russia’s Enemies Fear the Kalibr Cruise Missile.” *The National Interest*, January 22, 2017. https://nationalinterest.org/blog/the-buzz/why-russias-enemies-fear-the-kalibr-cruise-missile-19129.
Rogoway, Tyler. “Russia Sends Ten Subs into North Atlantic in Drill Unprecedented in Size since Cold War.” *The Drive*, October 29, 2019. https://www.thedrive.com/the-war-zone/30728/russia-sends-ten-subs-into-north-atlantic-in-drill-unprecedented-in-size-since-cold-war.
———. “USAF`s Nuke Sniffing Plane Is Flying on a Mission near the Arctic Right Now.” *The Drive*, February 22, 2017. https://www.thedrive.com/the-war-zone/7830/usafs-nuke-sniffing-plane-is-flying-on-a-mission-near-the-arctic-right-now?xid=emailshare.
RT. “Finaly Flying Colors: Yury Dolgoruky Nuclear Sub Joins Russian Navy.” *RT.Com*, January 10, 2013. https://www.rt.com/news/yury-dolgoruky-submarine-ceremony-678/.
Simpson, John. “How Greenland Could Become China’s Arctic Base.” *BBC News Online*, December 18, 2018. https://www.bbc.com/news/world-europe-46386867.
Sivertsen, Tony. “Må Forvente Noe Lavere Flyaktivitet.” *Vestrålen Online (VOL)*. January 5, 2019. https://www.vol.no/pluss/2019/01/05/%E2%80%93-M%C3%A5-forvente-noe-lavere-fly-aktivitet-18189636.ece.
Staalesen, Atle. “30 Russian Naval Vessels Stafe Show of Force near Coast of Norway.” *The Barents Observer*, August 15, 2019. https://thebarentsobserver.com/en/security/2019/08/30-russian-naval-vessels-stage-show-force-coast-norway.
Starr, Barbara, and Brad Lendon. “Russian Fighter Came within 15 Feet of U.S. Air Force Jet.” *CNN*, January 30, 2016. https://edition.cnn.com/2016/01/29/politics/us-russia-planes-intercept/index.html.

Stewart, Phil. “Russia Jets Make ‘Simulated Attack’ Passes near U.S. Destroyer.” *Reuters*, April 13, 2016. https://www.reuters.com/article/us-usa-russia-simulatedattack-idUSKCN0XA1UW.
Stormark, Kjetil. “Bare ETT Operativt Overvåkningsfly.” *Aldrimer.No*. October 29, 2016. https://www.aldrimer.no/norge-har-bare-ett-operativt-overvakingsfly/.
Strand, Tormod. “Hemmelig Ubåt-Operasjon: ‘Målet Er å Vise at Russland Kan Nå USA.’” *NRK*, October 29, 2019. https://www.nrk.no/norge/hemmelig-ubat-operasjon_-_malet-er-a-vise-at-russland-kan-na-usa_-1.14761298.
Thonhaugen, Markus, and Kåre Riibe Ramskjell. “Russerne Med ‘Uvanlig Stor’ Militærøvelse: - Lenge Siden vi Har Sett Noe Slikt.” *NRK*, August 13, 2019. https://www.nrk.no/nordland/russerne-med-_uvanlig-stor_-militaerovelse_-_-lenge-siden-vi-har-sett-noe-slikt-1.14658213.
Tigner, Brooks. “NATO Considers P-8 as Temporary Gap Filler until 2035.” *Jane’s Defense Weekly* 56, no. 15 (April 10, 2019).
Tomassen, Jan Harald. “Skal Ha Bedt Russiske Sjøkapteiner Gjøre Seg Godt Kjent Langs Norskekysten.” *NRK*, February 27, 2015. https://www.nrk.no/troms/skal-ha-bedt-russiske-sjokapteiner-gjore-seg-godt-kjent-langs-norskekysten-1.12234101.
Vikøyr, Harald. “Historisk Vinteråpning Av Polhavet.” *VG*. March 4, 2018. https://www.vg.no/nyheter/utenriks/i/0Er3n0/historisk-vinter-aapning-av-polhavet.
Vissgren, Julie, Tormod Strand, and Lokman Ghorbani. “Forsvarssjefen Om Russisk Militærøvelse: - En Nasjonal Utfordring.” *NRK*, August 14, 2019. https://www.nrk.no/urix/forsvarssjefen-om-russisk-militaerovelse_-_-en-nasjonal-utfordring-1.14660898.
Werner, Ben. “Russian Su-27 Fighter Buzzes U.S. Navy EP-3 Aries Over Black Sea.” *USNI News*, January 29, 2018. https://news.usni.org/2018/01/29/30987.
Willett, Lee. “Game Changer: Russian Sub-Launched Cruise Missiles Bring Strategic Effect.” *Jane’s By IHS Markit*, 2017. https://www.janes.com/images/assets/147/70147/Game_changer_Russian_sub-launched_cruise_missiles_bring_strategic_effect_edit.pdf.
Wormdal, Bård. “Tidligere Forsvarssjef Om Nye Russiske Våpen: - En Trussel Som Må Tas Alvorlig.” *NRK (Online)*, August 11, 2017. https://www.nrk.no/finnmark/tidligere-forsvarssjef-om-nye-russiske-vapen_-_-en-trussel-som-ma-tas-alvorlig-1.13767105.
Ziezulewicz, Geoff, and David B. Larter. “The Navy Sends a Carrier Back to Russia`s Arcic Haunts.” *Navy Times*, October 19, 2018. https://www.navytimes.com/news/your-navy/2018/10/19/the-navy-sends-a-carrier-back-to-russias-arctic-haunts/#.W820deP9FUo.email.
Ulriksen, Ståle. “Endring i Nord.” *Bergens Tidende*. May 27, 2019.

Secondary sources

Journal articles

Anderson, Dagvin R.M. “A Holistic Approach to Intelligence, Surveillance and Reconnaissance.” *Air & Space Power Journal* 25, no. 4 (Winter 2011).
Andresen, Rolf-Inge V., and Tor Bukkvoll. “Russian Weapons Development towards 2020.” *Forsvarets Forskningsinstitutt (FFI)* FFI-rapport 2008/01957 (January 12, 2009).

Angus, Dave. “Command and Control of MPA Assets on the Northern Flank.” *Maritime Patrol Aviation* 2, no. 1 (September 1991).
Archer, Clive, and David Scrivener, eds. *Northern Waters*. London: Croom Helm, 1986.
Ashworth, Chris. *Avro’s Maritime Heavyweight: The Shackleton*. Bourne End: Aston Publications Limited, 1990.
Atland, Kristian. “The Introduction, Adaptation and Implementation of Russia’s ‘Northern Strategic Bastion’ Concept, 1992-1999.” *Journal of Slavic Military Studies* 20, no. 4 (2007): 499–528.
Ballast, Jan. “Merging Pillars, Changing Cultures: NATO and the Future of Intelligence Cooperations within the Alliance.” *International Journal of Intelligence and Counterintelligence* 31, no. 4 (2018).
Bamford, James. “The Walker Espionage Case.” *United States Naval Institute Proceedings* 112, no. 5 (May 1986).
Berdal, Mats. “Forging a Maritime Alliance - Norway and the Evolution of American Maritime Strategy 1945-1960.” *Forsvarsstudier* 4 (1993).
Borgeld, Warner. “Keflavik - from the Past to the Present.” *Maritime Patrol Aviation*, 2004.
Borst, Marco. “Under Arctic Conditions in Europe: Norwegian Orions.” *AIR International*, January 1998, 57–58.
Bottom, David. “Overcoming ISR Data Challenges.” National Geospatial Agency (NGA), 2013. spie.org/Publications/Proceedings/Paper/10.1117/12.2019033.
Breemer, Jan S. “The Soviet Navy’s SSBN Bastions: Evidence, Inference and Alternative Scenarios.” *RUSI Journal* 130, no. 1 (1985): 18–26.
Brown, Jason M. “Airpower Is Intelligence, Surveillance, and Reconnaissance.” *Air & Space Power Journal* 27, no. 4 (August 2013).
Chernyavskii, Sergei. “The Era of Gorshkov: Triumph and Contradictions.” *Journal of Strategic Studies* 28, no. 2 (2005): 281–308.
Clift, A. Denis. “Intelligence in the Internet Era - From Semaphore to Predator.” *Studies in Intelligence* 47, no. 3 (2003).
Coleman, I.M. “Journal 33.” *Royal Air Force Historical Society Journal* 33 (2005): 89–102.
Conley, Heather A., Jeffrey Rathke, and Matthew Melino. “Enhanced Deterrence in the North - A 21st Century European Engagement Strategy.” Center for Strategic and International Studies, February 2018.
Connolly, Richard. “Towards a Dual Fleet? The Maritime Doctrine of the Russian Federation and the Modernisation of Russian Naval Capabilities.” *Russian Studies, NATO Defense College*, no. 2/17 (June 2017).
Cote, Owen R. jr. “The Third Battle - Innovation in the U.S.Navy’s Silent War Struggle with Soviet Submarines.” *Naval War College Newport Papers*, no. 16 (2003).
Cowan, Nicholas P. “Rethinking Command and Control of Intelligence, Surveillance and Reconnaissance (ISR).” U.S. Air Force, July 2015. https://dodccrp-testorg.squarespace.com/s/094-i2ln.pdf.
Cullen, Patrick J., and Erik Reichborn-Kjennerud. “Understanding Hybrid Warfare.” MCDC Countering Hybrid Warfare Project. Multinational Capability Development Campaign (MCDC), January 2017.
Danskine, William B. “Aggressive ISR in the War on Terrorism - Breaking the COld War Paradigm.” *Air & Space Power Journal* 19, no. 2 (Summer 2005).
Day, Dwayne A. “Above the Clouds: The White Cloud Ocean Surveillance Satellites.” *The Space Review*, April 13, 2009, Online edition. http://www.thespacereview.com/article/1351/1.

Deptula, David A., and R. Greg Brown. "A House Divided - The Indivisibility of Intelligence, Surveillance and Reconnaissance." *Air & Space Power Journal* 22, no. 2 (Summer 2008).

Deptula, David A., and Michael Fransisco. "Air Force ISR Operations - Hunting versus Gathering." *Air & Space Power Journal* 24, no. 4 (Winter 2010).

Donnelly, Harrison. "Q&A - Lt.Gen. John C. Koziol, Deputy Under Secretary of Defense, Joint and Coalition Warfighter Support, Directore DoD ISR Task Force." *Geospatial Intelligence Forum* 8, no. 6 (September 2010).

Downs, Michael L. "Rethinking the Combined Force Air Component Commander's Intelligence, Surveillance, and Reconnaissance Approach to Counterinsurgency." *Air & Space Power Journal* 22, no. 3 (Fall 2008).

Duvsete, Svein. "Fra Luftforsvar Til Strategisk Angrep. Norsk Luftmilitær Doktrine 1945-1955." *Forsvarsstudier* 2 (1998).

Dyndal, Gjert Lage. "How the High North Became Central in NATO Strategy: Revelations from the NATO Archives." *Journal of Strategic Studies* 34, no. 4 (2011): 557–85.

———. "The Northern Flank and High North Scenarios of the Cold War." Zentrum für Militärgeschichte und Sozialwissenschaften der Bundeswehr, Potsdam, Germany, 2013.

———. "The Rise of the Soviet Navy, a Re-Visited Western View." *Tidsskrift (Kungliga Krigsvetenskapsakademien)*, no. 3 (September 2013).

Egeland Moen, Knut. "Selvpålagte Restriksjoner i Nord, 1945-65." Oslo: Institutt for Forsvarsstudier, 1998.

Elder, Gregory. "Intelligence in War: It Can Be Decisive." *Studies in Intelligence* 50, no. 2 (2006).

Espenes, Øystein, and Gjert Lage Dyndal. "The Changing Focus of NATO-Intelligence - From Southern Scandinavia to the 'High North' at the End of the 1950s." *Tidsskrift (Kungliga Krigsvetenskapsakademien)*, no. 2 (June 2013).

Ferris, John. "Netcentric Warfare, C4ISR, and Information Operations: Towards a Revolution in Military Intelligence?" *Intelligence and National Security* 19, no. 2 (2004): 199–225.

Ferris, John, and Michael I. Handel. "Clausewitz, Intelligence, Uncertainty and the Art of Command in Military Operations." *Intelligence and National Security* 10, no. 1 (1995): 1–58.

Foggo, James, and Alanik Fritz. "The Fourth Battle of the Atlantic." *United States Naval Institute Proceedings* 142, no. 6 (June 2016).

Forden, Geoffrey. "Viewpoint: China and Space War." *Astropolitics* 6, no. 2 (2008): 138–53.

Foust, Jeff. "Current Issues in NewSpace." *The Space Review*. March 5, 2007. http://www.thespacereview.com/article/823/1.

———. "The Evolving Ecosystem of NewSpace." *The Space Review*. August 15, 2011. http://www.thespacereview.com/article/1906/1.

Fowler, Mike. "The Future of Unmanned Aerial Vehicles." *Global Security and Intelligence Studies* 1, no. 1 (Fall 2015).

Frayter, Slava, and Koen Willems. "Increased Efficiency or Beyond Line-of-Sight in Airborne ISR Operations." National Geospatial Agency (NGA), 2013. proceedings.spiedigitallibrary.org/proceeding.aspx?articleid=1688649.

Galeotti, Mark. "I'm Sorry for Creating the 'Gerasimov Doctrine.'" *Foreign Policy*, March 5, 2018. https://foreignpolicy.com/2018/03/05/im-sorry-for-creating-the-gerasimov-doctrine/.

Gao, Charlie. "Russia's New Husky-Class Stealth Submarines: Armed with Hypersonic Missiles?" *The National Interest*, October 1, 2019.

https://nationalinterest.org/blog/buzz/russias-new-husky-class-stealth-submarines-armed-hypersonic-missiles-84626.

Friedman, Norman. "World Naval Developments: The Typhoon Saga Ends." *United States Naval Institute Proceedings* 125, no. 2 (February 1999).

Gerasimov, Valery. "The Value of Science Is in the Foresight." *Military-Industrial Kurier (VPK)*, February 26, 2013. https://www.vpk-news.ru/articles/14632.

Haley, Jaylan M. "An Evolution in Intelligence Doctrine - The Intelligence, Surveillance, and Reconnaissance Mission Type Order." *Air & Space Power Journal* 26, no. 5 (Fall 2012).

Hamilton, Shane P., and Michael P. Kreuzer. "The Big Data Imperative - Air Force Intelligence for the Information Age." *Air & Space Power Journal*, Spring 2018. https://www.airuniversity.af.edu/Portals/10/ASPJ/journals/Volume-32_Issue-1/F-Hamilton_Kreuzer.pdf?mc_cid=a2eed12543&mc_eid=c0b972d50d.

Handel, Michael I. "Intelligence and Military Operations." *Intelligence and National Security* 5, no. 2 (1990): 1–95.

Hanley, John T. jr. "Creating the 1980s Maritime Strategy and Implications for Today." *Naval War College Review* 67, no. 2 (Spring 2014): 11.

Hattendorf, John B. "The Evolution of the U.S. Navy's Maritime Strategy, 1977-1986." *Naval War College Newport Papers*, no. 19 (2004).

———, ed. "U.S. Naval Strategy in the 1990s - Selected Documents." *Naval War College Newport Papers*, no. 27 (2006).

Hattendorf, John B., and Peter M. Swartz, eds. "U.S. Naval Strategy in the 1980s - Selected Documents." *Naval War College Newport Papers*, no. 33 (2008).

Håvoll, Harald. "Airborne Maritime Surveillance and ASW - Status and Development: Consequences for Norway." Norsk Utenrikspolitisk Institutt (NUPI), 2015.

Heidenrich, John G. "The State of Strategic Intelligence. The Intelligence Community's Neglect of Strategic Intelligence." *Studies in Intelligence* 51, no. 2 (2007).

Herman, Michael, J. Kenneth McDonald, and Vojtech Mastny. "Did Intelligence Matter in the Cold War?" *Forsvarsstudier*, no. 1/2006 (2006).

Hicks, Kathleen, Andrew Metrick, Lisa Sawyer Samp, and Kathleen Weinberger. "Undersea Warfare in Northern Europe." CSIS International Security Program. Center for Strategic and International Studies, July 2016.

Hinrichs, Jeff S. "Education in Intelligence, Surveillance, and Reconnaissance beyond the 'Green Door.'" *Air & Space Power Journal* 22, no. 2 (Summer 2008).

Holst, Johan J. "Norsk Sikkerhetspolitkk i Strategisk Perspektiv." *Internasjonal Politikk* 24, no. 5 (1966): 463–90.

Holzer, Jenny R., and Franklin L. Moses. "Autonomous Systems in the Intelligence Community: Many Possibilities and Challenges." *Studies in Intelligence* 59, no. 1 (2015).

Hulnick, Arthur S. "What's Wrong with the Intelligence Cycle?" *Intelligence and National Security* 21, no. 6 (2006): 959–79.

Ingebrigtsen, Jan. "En Studie Av Norskehavets Strategiske Betydning Som Funksjon Av Sovjetunionens Nordflåtes Operasjoner (A Study of the Norwegian Sea's Strategic Importance as a Function of the Soviet Union Northern Fleet Operations)." Oslo: NUPI, August 1975.

International Institute for Strategic Studies. "Reviving Russia's Navy." *Strategic Comments* 6, no. 6 (July 2000).

Jasper, Scott. "Does Maritime Patrol Have a Future?" *United States Naval Institute Proceedings* 123, no. 4 (April 1997).

Johnson, Lock. "Bricks and Mortar for a Theory of Intelligence." *Comparative Strategy* 22, no. 1 (2003): 1–28.
Kahn, David. "An Historical Theory of Intelligence." *Intelligence and National Security* 16, no. 3 (2001).
Kobzeva, Mariia. "China's Arctic Policy: Present and Future." *The Polar Journal* 9, no. 1 (2019).
Kremidas-Courtney, Chris. "Countering Hybrid Threats in the Maritime Environment." *The Maritime Executive*, November 6, 2018. https://www.maritime-executive.com/editorials/countering-hybrid-threats-in-the-maritime-environment.
Krepinevich, Andrew, Barry Watts, and Robert Work. "Meeting the Anti-Access and Area-Denial Challenge." Center for Strategic and Budgetary Assessments (CSBA), 2003. http://csbaonline.org/uploads/documents/2003.05.20-Anti-Access-Area-Denial-A2-AD.pdf.
Kriendler, John. "NATO Intelligence and Early Warning." Swindon, England: Conflict Studies Research Centre, Defense Academy of the United Kingdom, March 2006. httpS://www.files.ethz.ch/isn/39988/06_Apr.pdf.
Kristensen, Hans M., and Robert S. Norris. "Russian Nuclear Forces, 2011." *Bulletin of the Atomic Scientists* 67, no. 3 (2011): 67–74.
———. "Russian Nuclear Forces, 2013." *Bulletin of the Atomic Scientists* 69, no. 3 (2013): 71–81.
———. "Russian Nuclear Forces, 2014." *Bulletin of the Atomic Scientists* 70, no. 2 (2014): 75–85.
———. "Russian Nuclear Forces, 2015." *Bulletin of the Atomic Scientists* 71, no. 3 (2015).
Norris, Robert S., and William N. Arkin. "Russian (C.I.S.) Strategic Nuclear Forces End of 1995." *Bulletin of the Atomic Scientists* 52, no. 2 (April 1996): 62–63.
———. "Russian Nuclear Forces, 2000." *Bulletin of the Atomic Scientists* 56, no. 4 (August 2000): 70–71.
Norris, Robert S., William N. Arkin, Hans M. Kristensen, and Joshua Handler. "Russian Nuclear Forces, 2001." *Bulletin of the Atomic Scientists* 57, no. 3 (June 2001): 78–79.
———. "Russian Nuclear Forces, 2002." *Bulletin of the Atomic Scientists* 58, no. 4 (August 2002): 71–73.
Norris, Robert S., and Hans M. Kristensen. "Russian Nuclear Forces, 2004." *Bulletin of the Atomic Scientists* 60, no. 4 (August 2004): 72–74.
———. "Russian Nuclear Forces, 2006." *Bulletin of the Atomic Scientists* 62, no. 2 (April 2006): 64–67.
———. "Russian Nuclear Forces, 2007." *Bulletin of the Atomic Scientists* 63, no. 2 (April 2007): 61–67.
———. "Russian Nuclear Forces, 2008." *Bulletin of the Atomic Scientists* 64, no. 2 (June 2008): 54–62.
———. "Russian Nuclear Forces, 2009." *Bulletin of the Atomic Scientists* 65, no. 3 (June 2009).
———. "Russian Nuclear Forces, 2010." *Bulletin of the Atomic Scientists* 66, no. 1 (February 2010).
Parnemo, Liv Karin. "Russia's Naval Development — Grand Ambitions and Tactical Pragmatism." *The Journal of Slavic Military Studies* 32, no. 1 (2019): 41–69.
Pedlow, Gregory W. "NATO Strategy Documents 1949-1969," October 1997. NATO, online archive. http://www.nato.int/docu/stratdoc/eng/intro.pdf.
Perkins, William. "Alliance Airborne Anti-Submarine Warfare - A Forecast for Maritime Air ASW in the Future Operational Environment." Joint Air Power Competence Centre (JAPCC), June 2016.

Polmar, Norman. “The Russian Navy - Beneath the Waves.” *United States Naval Institute Proceedings* 138, no. 6 (June 2012).
Reade, David. “NAS Keflavik, Iceland - The ASW Training Capital of the World.” *Maritime Patrol Aviation* 3, no. 2 (March 1995).
Reade, David. “Worldwide P-3 Status Report.” *Maritime Patrol Aviation*, September 1992, 62–68.
Reade, David, and Bob Harper. “Naval Air Station Keflavik, Iceland.” *Airborne LOG*, no. Fall 1994 (1994): 8–11.
Rhodes, Carl, Jeff Hagen, and Mark Westergren. “A Strategies-to-Tasks Framework for Planning and Executing Intelligence, Surveillance, and Reconnaissance (ISR) Operations.” RAND, Project Air Force, 2007.
Robideau, Larry. “Third Battle for the North Atlantic 1962-1991.” *Cold War Times* 6, no. 1 (February 2006). http://www.coldwar.org/text_files/coldwartimesfeb2006.pdf.
Savolainen, Jukka, Terry Gill, Valentin Schatz, Lauri O Jala, Tadas Jakstas, and Pirjo Kleemola-Juntunen. “Handbook on Maritime Hybrid Threats - 10 Scenarios and Legal Scans.” Helsinki, Finland: The European Centre of Excellence for Countering Hybrid Threats, November 2019.
Seagle, Adriana N. “Intelligence Sharing Practices within NATO: AN Englisg School Perspectvie.” *International Journal of Intelligence and Counterintelligence* 28, no. 3 (2015).
Sergunin, Alexander, and Valery Konyshev. “Russia in Search of Its Arctic Strategy: Between Hard and Soft Power?” *The Polar Journal* 4, no. 1 (2014).
Sherman, Kenneth B. “Feet Dry: Maritime Patrol Goes Ashore - New Roles and Missions Mean No Safe Harbor for Land Forces.” *The Journal of Electronic Defense (JED)*, no. March 2001 (2001): 37–43.
Shibilski, Daniel P. “Future of Air Force Intelligence.” *United States Naval Institute Proceedings* 132, no. 2 (February 2006).
Simon, Luis. “The ‘Third’ US Offset Strategy and Europe’s ‘Antiaccess’ Challenge.” *Journal of Strategic Studies* 39, no. 3 (2016): 417–45.
Singh, Jasjit. “Aerial Surveillance for Maritime Security.” *Strategic Analysis* 7, no. 12 (1984).
Smith, Clyde A. “The Mearning and Significance of the Gorshkov Articles.” *Naval War College Review* 26, no. 5 (April 1974): 18–37.
Smith, R. Jeffrey. “Hypersonic Missiles Are Unstoppable. And They’re Starting a New Global Arms Race.” *New York Times Magazine*. June 19, 2019. https://www.nytimes.com/2019/06/19/magazine/hypersonic-missiles.html.
Staar, Richard. “Russia’s Navy Remains in Decline.” *United States Naval Institute Proceedings* 124, no. 8 (August 1998).
Skogrand, Kjetil, Olav Njølstad, and Rolf Tamnes. “Hot Spot - Cold War, the High North, and Grand Strategy.” *Institutt For Forsvarsstudier (IFS) Info* 5/1998 (1998).
Stavridis, James. “Maritime Hybrid Warfare Is Coming.” *United States Naval Institute Proceedings* 142, no. 12 (December 2016).
Tamnes, Rolf. “Integration and Screening - The Two Faces of Norwegian Alliance Policy.” *Forsvarsstudier*, no. 6 (1987).
Tamnes, Rolf, Kate Hansen Bundt, Trond Grytting, Alf Håkon Hoel, Janne Haaland Matlary, Asle Toje, and Julie Wilhelmsen. “A Unified Effort to Strengthen the Defence of Norway.” Norwegian Ministry of Defense, April 28, 2015.
Tice, Brian P. “Unmanned Aerial Vehicles - The Force Multiplier of the 1990s.” *Air & Space Power Journal* 5, no. 1 (1991).

White, Jonathan, and Sean Filipowski. "Know the Environment, Know the Enemy, Know the Target." *United States Naval Institute Proceedings* 140, no. 7 (July 2014).
Whitman, Edward. "SOSUS - The 'Secret Weapon' of Underseea Surveillance." *Undersea Warfare* 7, no. 2 (Winter 2015).
Wicken, Olav. "Stille Propell i Storpolitisk Storm - KV/Toshiba-Saken Og Dens Bakgrunn." Institutt for Forsvarsstudier, 1988.
Vengstad, K. "Fleksibilitet Og Slagkraft. Luftforsvaret Og NATOs Infrastrukturprogram 1950-1957." *Forsvarsstudier* 3 (2006).
Warden, John A. III. "The Enemy as a System." *Airpower Journal* 9, no. 1 (1995): 40–55.
Yegorova, Natalia. "Stalin's Conception of Maritime Power: Revelation from the Russian Archives." *Journal of Strategic Studies* 28, no. 2 (2005): 157–86.
Yeh, Puong F. "The Case for Using Robots in Intelligence Analysis." *Studies in Intelligence* 59, no. 4 (2015).
Young, Adam B. "Employing Intelligence, Surveillance, and Reconnaissance - Organizing, Training, and Equipping to Get It Right." *Air & Space Power Journal* 28, no. 1 (February 2014).
Zeytoonian, Dan, Laura Geldhof, Maureen Green, Remi Hajjar, Chris Litwhliler, Christine Locke, James Myers, David Perrine, and Cameron Weathers. "Intelligence Design: COIN Operations and Intelligence Collection and Analysis." *Military Review*, October 2006.

Books

Aid, Matthew M., and Cees Wiebes, eds. *Secret of Signals Intelligence During the Cold War and Beyond*. London: Frank Cass, 2001.
Aldrich, Richard J. *GCHQ - The Uncensored Story of Britain's Most Secret Intelligence Agency*. London: Harper Press, 2011.
Berkowitz, Bruce. *The National Reconnaissance Office at 50 Years: A Brief History*. Chantilly, Virginia: Center for the study of national reconnaissance, 2011.
Birkeland, John O., and Gjert Lage Dyndal. "Fremtidig Autonom Droneteknologi Og - Konsepter." In *Når Dronene Våkner*, edited by Tor Arne Berntsen, Gjert Lage Dyndal, and Sigrid Redse Johansen. Oslo: Cappelen Damm Akademiske, 2016.
Blackman, Tony. *Nimrod - Rise and Fall*. London: Grub Street Publishing, 2011.
Breemer, Jan S. *Soviet Submarines - Design, Development and Tactics*. Surrey, UK: Jane's Information Group Ltd, 1989.
Brodie, Bernard. *Strategy in the Missile Age*. 8th ed. Princeton, NJ: Princeton University Press, 1991.
Chamayou, Gregoire. *Drone Theory*. New York: Penguin Random House, 2015.
Børresen, Jacob, Gullow Gjeseth, and Rolf Tamnes. *Allianseforsvar i Endring, 1970-2000*. Norsk Forsvarshistorie 5. Bergen: Eide Forlag, 2004.
Cole, Paul, and Douglas Hart, eds. *Northern Europe: Security Issues for the 1990s*. London: London Westview Press, 1986.
Crickmore, Paul F. *Lockheed Blackbird - Beyond the Secret Missions*. Revised edition. Oxford: Osprey Publishing, 2016.
Donald, David. *The Encyclopedia of World Aircraft*. Etobicoke, Ontario: Prospero Books, 1997.
DUPI. "Grønland under Den Kolde Krig. Dansk Og Amerikansk Sikkerhedspolitik 1945-68." Copenhagen: Dansk Udenrigspolitisk Institut, 1997.

Efjestad, Svein. “Norway and the North Atlantic: Defence of the Northern Flank.” In *NATO and the North Atlantic - Revitalizing Collective Defence*, by John A. Olsen. Whitehall Paper 87. London: Royal United Services Institute (RUSI), 2017.
Eriksen, Knut E., and Helge Ø. Pharo. “Kald Krig Og Internasjonalisering, 1945-1965.” In *Norsk Utenrikspolitisk Historie, Bd.5*. Oslo: Universitetsforlaget, 1997.
Ford, Christopher, and David Rosenberg. *The Admiral’s Advantage - U.S. Navy Operational Intelligence in World War II and the Cold War*. Annapolis, MD: Naval Institute Press, 2005.
Friedman, Norman. *Seapower and Space*. Annapolis, MD: Naval Institute Press, 2000.
Friedman, Norman. *Submarine Design and Development*. London: Conway Maritime, 1984.
Furquhar, John T. *A Need to Know: The Role of Air Force Reconnaissance in War Planning, 1945-1953*. Maxwell AFB, Montgomery, Alabama: Air University Press, 2005.
Gaddis, J.L. *Strategies of Containment. A Critical Appraisal of Postwar American National Security Policy*. Oxford: Oxford University Press, 1982.
Gibson, Chris. *Nimrod’s Genesis - RAF Maritime Patrol Projects and Weapons since 1945*. Manchester: Hikoki Publications, 2015.
Goldstein, Walter, ed. *Clash in the North*. Washington, D.C.: Pergamon-Brassey’s International Defense Publishers, 1988.
Gordon, Doug. *Tactical Reconnaissance in the Cold War*. Barnsley: Pen & Sword Aviation, 2006.
Green, Michael. *United States Naval Aviation 1911-2014*. Barnsley: Pen & Sword Aviation, 2015.
Grove, Eric, ed. *NATO’s Defence of the North*. London: Brassey’s, 1989.
Grove, Eric, and Graham Thomson. *Battle for the Fjords*. Annapolis, MD: Naval Institute Press, 1991.
Herman, Michael. *Intelligence Power in Peace and War*. Cambridge: Cambridge University Press, 1996.
Herrick, Robert W. *Soviet Naval Strategy: Fifty Years of Theory and Practice*. Annapolis, MD: Naval Institute Press, 1968.
Hopkins, Robert S. III. *Spyflights and Overflights - US Strategic Aerial Reconnaissance - Volume I 1945-1960*. Manchester: Hikoki Publications, 2016.
———. *U.S. Strategic Aerial Reconnsaissance and the Cold War, 1945-1961*. University of Virginia, 1998.
Hudson, Peter, and Peter Roberts. “The UK and the North Atlantic: A British Military Perspective.” In *NATO and the North Atlantic - Revitalizing Collective Defence*, by John A. Olsen. Whitehall Paper 87. London: Royal United Services Institute (RUSI), n.d.
Jervell, Sverre, and Kare Nyblom. *The Military Buildup in the High North. American and Nordic Perspectives*. London: UP of America, 1986.
Jones, Barry. *Avro Shackleton*. Ramsbury, UK: Crowood Press, 2002.
Jordan, John. *Soviet Submarines - 1945 to the Present*. London: Arms & Armour Press, 1989.
Lashmar, Paul. *Spy Flights of the Cold War*. Phoenix Mill: Sutton Publishing Limited, 1996.
Lehman, John. *Oceans Ventured: Winning the Cold War at Sea*. New York: W.W. Norton & Company, Inc, 2018.
Leighton, Marion K. *The Soviet Threat to NATO’s Northern Flank*. New York: National Strategy Information Centre Inc, 1979.
Luddy, John. “The Challenge and Promise of Network-Centric Warfare.” Arlington, VA: Lexington Institute, February 2005.
Mason, R.A. *Air Power - An Overview of Roles*. London: Brassey’s Defence Publishers, 1987.

McCGwire, Michael. "Current Soviet Warship Construction and Naval Weapons Development." In *Soviet Naval Policy: Objectives and Constraints*, edited by Michael MccGwire, Ken Booth, and John McDonnell. New York: Praeger, 1975.
———. "Soviet Strategic Weapons Policy - 1955-70." In *Soviet Naval POlicy: Objectives and Constraints*, edited by Michael MccGwire, Ken Booth, and John McDonnell. New York: Praeger, 1974.
MccGwire, Michael, James M. McConnell, and Robert G. Weinland. "Admiral Gorshkov on 'Navies in War and Peace.'" Arlington, VA: Center for Naval Analysis, September 1974.
Mutza, Wayne. *Lockheed P2V Neptune - An Illustrated History*. Atglen, PA: Schiffer Publishing, Ltd., 1996.
Nordenman, Magnus. *The New Battle for the Atlantic - Emerging Naval Competition with Russia in the Far North*. Annapolis, MD: Naval Institute Press, 2019.
Norris, Pat. *Spies in the Sky - Surveillance Satellites in War and Peace*. Chichester, UK: Praxis Publishing Ltd, 2008.
Olsen, John A., ed. *Future NATO: Adapting to New Realities*. Whitehall Paper 95. London: Royal United Services Institute (RUSI), 2019.
———, ed. *NATO and the North Atlantic - Revitalizing Collective Defence*. Whitehall Paper 87. London: Royal United Services Institute (RUSI), 2017.
———, ed. *Security in Northern Europe: Deterrence, Defence and Dialogue*. Whitehall Paper 93. London: Royal United Services Institute (RUSI), 2018.
Owen, David. *Anti-Submarine Warfare - An Illustrated History*. Annapolis, MD: Naval Institute Press, 2007.
Oxlee, Geoffrey. *Aerospace Reconnaissance*. London: Brassey's, 1997.
Palmer, Michael A. *Origins of the Maritime Strategy - The Development of American Naval Strategy, 1945-1955*. Reissue edition. Annapolis, MD: Naval Institute Press, 1990.
Podvig, Pavel, ed. *Russian Strategic Nuclear Forces*. 2004 paperback edition. Cambridge, MA: MIT Press, 2001.
Polmar, Norman, and John F. Bessette. *Spyplanes - The Illustrated Guide To Manned Reconnaissance And Surveillance Aircraft From World War I To Today*. Minneapolis, USA: Quarto Publishing Group Inc, 2016.
Reade, David. *The Age of Orion - The Lockheed P-3 Story*. Atglen, PA: Schiffer Publishing, Ltd., 1998.
Richelson, Jeffrey T. *The US Intelligence Community*. Seventh edition. Boulder, CO: Westview Press, 2016.
Riste, Olav, and Arnfinn Moland. *Strengt Hemmelig - Norsk Etterretningstjeneste 1945-1975*. Oslo: Universitetsforlaget, 1997.
Roberts, Michael D. *Dictionary of American Naval Aviation Squadrons - Volume 2*. Vol. 2. Washington, D.C.: Naval Historical Center, 2000.
Schelling, Thomas C. *Strategy of Conflict*. London: Oxford University Press, 1970.
Skogan, John, and Arne Brundtland, eds. *Soviet Sea Power in the Northern Waters*. New York: St.Martin's Press, 1990.
Skogrand, Kjetil. *Alliert i Krig Og Fred*. Norsk Forsvarshistorie 4. Bergen: Eide Forlag, 2004.
Sontag, Sherry, and Christopher Drew. *Blind Man's Bluff - The Untold Story of American Submarine Espionage*. New York: HarperPaperbacks, 1999.
Tamnes, Rolf.*Oljealder, 1965-1995*. Norsk Utenrikspolitikks Historie 6. Oslo: Universitetsforlaget, 1997.

Tamnes, Rolf. "The Significance of the North Atlantic and the Norwegian Contribution." In *NATO and the North Atlantic - Revitalizing Collective Defense*, edited by John A. Olsen. Whitehall Paper 87. London: Royal United Services Institute (RUSI), 2017.

Tamnes, Rolf.*The United States and the Cold War in the High North*. Oslo: Ad Notam, 1991.

Tart, Larry, and Robert Keefe. *The Price of Vigilance - Attacks on American Surveillance Flights*. New York: Ballantine Books, 2001.

Thetford, Owen. *British Naval Aircraft Since 1912*. London: Putnam, 1978.

Thomas, Rick. *Global Hawk - The Story and Shadow of America's Controversial Drone*. Great Britain: Amazon, 2015.

Tunander, Ola. *Cold Water Politics - The Maritime Strategy and Geopolitics of the Northern Front*. London: SAGE Publications, 1989.

Weir, Gary E., and Walter J. Boyne. *Rising Tide - The Untold Story of The Russian Submarines That Fought The Cold War*. New York: Basic Books, 2003.

Wilkes, Owen, and Nils Petter Gledistch. *Onkel Sams Kaniner - Teknisk Etterretning i Norge*. Oslo: Pax Forlag, 1981.

Wilson, Stewart. *Combat Aircraft since 1945*. Fyshwick, Australia: Aerospace Publications Pty Ltd, 2000.

Wood, John. *Russia, the Asymmetric Threat to the United States - A Potent Mixture of Energy and Missiles*. Santa Barbara, California: Praeger Security International, 2009.

Presentations

ADM Lewis, Andrew. "One Arctic: Maintaining Stability and Propserity in the High North." Presented at the Henry Bacon seminar, Washington, D.C., May 8, 2019.

Gressel, Gustav. "Russia's Quiet Military Revolution, and What It Means for Europe." Policy Brief. European Council on Foreign Relations, October 2015.

Johnstone, Clive. "NATO's Maritime Moment: A Watershed Year in Alliance Sea Power." Speech presented at the Allied Ambassador's Lunch, Residence of Belgian Ambassador to the United Kingdom, London, January 17, 2017. https://mc.nato.int/media-centre/news/2017/nato-maritime-moment-a-watershed-year-in-alliance-sea-power.aspx.

Nordenman, Magnus. "NATO's next Consortium: Maritime Patrol Aircraft." Issue Brief. Washington, D.C.: Atlantic Council, Brent Scowcroft Center on International Security, May 2016.

Rear Admiral Thomas Ernst. "Agile Command and Control in a Degraded Environment." In *Preparing NATO for Joint Air Operations in a Degraded Environment.* Joint Air & Space Power Conference 2016. Kalkar, Germany: Joint Air Power Competence Centre, 2016.

Unpublished theses

Ambrose, Gary. "Transforming Maritime Patrol Aviation." Master's Thesis, USMC Command & Staff College, 2003.

Bergstrøm, Øyvind. "NATOs Maritime Strategi Etter 1990 - Fra Sjømakt Til Ordensmakt?" Master's Thesis, Norwegian Armed Forces Staff College, 2009.

Birkeland, John O. "The Potential of LIDAR as an Anti-Submarine Warfare Sensor." M.Phil (R), War Studies, University of Glasgow, 2009. http://theses.gla.ac.uk/1252/1/2009birkelandmphil.pdf.

———. “The Unsinkable Aircraft Carrier - An American Response to the Chinese Anti-Access/Area Denial (A2/AD) Challenge.” Master of Military Operational Art and Science, Air Command & Staff College, USAF, 2013. file:///C:/Users/JohnO/Downloads/ADA603131.pdf.

Breemer, Jan S. “Estimating the Soviet Submarine Missile Threat: A Critical Examination of the Soviet Navy’s SSBN Bastion Strategy.” PhD, International Relations, University of Southern California, 1987.

Dyndal, Gjert Lage. “Land Based Air Power or Aircraft Carriers? The British Debate about Maritime Air Power in the 1960s.” PhD, History, University of Glasgow, 2009.

Klevberg, Håvard. “Maritime Surveillance in the North: 333 Squadron in Norwegian Security Politics.” PhD, History, University of Oslo, 2011.

Marshall, James P. “Near-Real Time Intelligence on the Tactical Battlefield.” Research Report. Maxwell AFB, Montgomery, Alabama: Air University, January 1994.

Morton, Tyler. “Ears and Eyes in the Sky: The Evolution of Manned Airborne ISR.” Master’s Thesis, School of Advanced Air and Space Studies, 2012. www.dtic.mil/get-tr-doc/pdf?AD=AD1019401.

———. “From Kites through Cold War: The Evolution of United States Air Force Manned Airborne ISR.” PhD, Air University, 2016.

Rekstad, Jan Egil. “P-8 and the Trilateral Partnership - The Operational Significance and Influence on Norwegian Security Policy.” Master’s Thesis, The Norwegian Drfence University College, 2018.

Simensen, Thor A. “Link-11 Communication.” Master’s Thesis, Naval Postgraduate School (NPS), 1992.

Trefz, John L. “From Persistent ISR to Precision Strike - The Expanding Role of UAVs.” Master’s Thesis, Naval War College, 2003.

Winkler, Robert P. “The Evolution of the Joint ATO Cycle.” Master of Science in Joint Campaign Planning and Strategy, Joint Advanced Warfighting School, 2006. dtic.mil/cgi-bin/GetTRDoc?AD=ADA451239.

Smith-Windsor, Brooke A. “NATO’s Maritime Strategy and the Libya Crisis as Seen from the Sea.” Research Paper. Rome: NATO Defense College, March 2013.

Online resources

Boeing. “P-8A Poseidon.” Accessed November 28, 2019. https://www.boeing.com/defense/maritime-surveillance/p-8-poseidon/index.page.

Bosbotinis, James. “The SDSR and the Future of British Airborne ISTAR.” *DefenseIQ* (blog), June 12, 2015. http://www.defenceiq.com/air-forces-and-military-aircraft/articles/the-sdsr-and-the-future-of-british-airborne-istar.

Dassault Aviation. “Atlantic - Origins and Context.” Dassault Aviation. Accessed March 23, 2017. http://www.dassault-aviation.com/fr/passion/avions/dassault-militaires/atlantic/.

Devereaux, Ryan. “The Drone Papers - Manhunting in the Hindu Kush.” *The Intercept*, October 15, 2015. https://theintercept.com/drone-papers/manhunting-in-the-hindu-kush/.

GE Aviation. “Boeing Team Wins $3 Billion Multi-Mission Maritime Aircraft Program.” *GE Aviation Online*. June 14, 2004. https://www.geaviation.com/press-release/jv-archive/boeing-team-wins-3-billion-multi-mission-maritime-aircraft-program.

GlobalSecurity.org. “AA-13 ARROW / K-37/R-37 / RVV-BD,” February 6, 2018. https://www.globalsecurity.org/military/world/russia/aa-13.htm.

Human Rights Watch. “Heed the Call - A Moral and Legal Imperative to Ban Killer Robots.” Human Rights Watch, August 21, 2018.

https://www.hrw.org/report/2018/08/21/heed-call/moral-and-legal-imperative-ban-killer-robots.

Kimball, Daryl. "The Presidential Nuclear Initiatives (PNIs) on Tactical Nuclear Weapons at a Glance." Arms Control Association, July 2017. https://www.armscontrol.org/printpdf/111.

Natalucci, Matteo. "Top 5 Ports in Northern Europe." *Port Technology*, August 30, 2019. https://www.porttechnology.org/news/top-5-ports-in-northern-europe/.

Naval Air Museum Barbers Point. "Lockheed P-3C Orion - BuNo 160770." Accessed September 6, 2018. http://nambp.org/lockheed-p-3c-orion.

Naval History and Heritage Command. "P-3 Orion," May 29, 2014. https://www.history.navy.mil/research/histories/naval-aviation-history/naval-aircraft/current-aircraft-inventory/p-3-orion.html.

nti.org. "U.S. Senate Ratifies New START in 71-26 Vote, Despite Top GOP Opposition." *NTI Online*, December 22, 2010. https://www.nti.org/gsn/article/us-senate-ratifies-new-start-in-71-26-vote-despite-top-gop-opposition/.

Nuclear Threat Initiative (NTI). "Russia Submarine Capabilities." NTI, June 10, 2014. https://www.nti.org/analysis/articles/russia-submarine-capabilities/.

Oliker, Olga. "Unpacking Russia's New National Security Strategy." *Csis.Org*. January 7, 2016. https://www.csis.org/analysis/unpacking-russias-new-national-security-strategy.

PAX. "Killer Robots - What Are They and What Are the Concerns?" PAX, 2018. https://www.paxforpeace.nl/media/files/pax-booklet-killer-robots-what-are-they-and-what-are-the-concerns.pdf.

Proc, Jerry. "CS2F TRACKER." *RADIO COMMUNICATIONS AND SIGNALS INTELLIGENCE IN THE ROYAL CANADIAN NAVY* (blog), February 18, 2019. http://jproc.ca/rrp/rrp3/tracker.html.

Sadiq, Sheraz. "Silicon Valley Goes to Space." *Kqed.Org*, November 18, 2013. https://www.kqed.org/science/11135/silicon-valley-goes-to-space-2.

Sutton, H I. "Husky_SSN." *Covert Shores* (blog), December 30, 2019. http://www.hisutton.com/Husky_SSN.html.

TeleGeography. "Submarine Cable Map." TeleGeography. Accessed October 23, 2019. https://www.submarinecablemap.com/.

US Navy. "Fact File - P-3C Orion and EP-3 Aries." US Navy, December 3, 2018. https://www.navy.mil/navydata/fact_display.asp?cid=1100&tid=1400&ct=1.

———. "Fact File - P-8A Posdeidon Multi-Mission Maritime Aircraft (MMA)." US Navy, December 3, 2018. https://www.navy.mil/navydata/fact_display.asp?cid=1100&tid=1300&ct=1.

Williams, Ian. "The Russia - NATO A2AD Environment." *Missile Threat Project (CSIS)*, January 3, 2017. https://missilethreat.csis.org/russia-nato-a2ad-environment/.