REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
04/05/2017	Master's Thesis	JUL 2016 - APR 2017

4. TITLE AND SUBTITLE
Arctic Readiness: Changes are Appropriate for 21st Century Naval Expeditionary Warfare

5a. CONTRACT NUMBER
N/A

5b. GRANT NUMBER
N/A

5c. PROGRAM ELEMENT NUMBER
N/A

6. AUTHOR(S)
Oldfield, Nicholas, J., Lieutenant Commander, USN

5d. PROJECT NUMBER
N/A

5e. TASK NUMBER
N/A

5f. WORK UNIT NUMBER
N/A

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
USMC Command and Staff College
Marine Corps University
2076 South Street
Quantico, VA 22134-5068

8. PERFORMING ORGANIZATION REPORT NUMBER
N/A

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)
N/A

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT
There will be a predictable increase in expeditionary warfare involvement within the Arctic region. This paper will discuss the current state of US Navy Arctic readiness with focus on naval expeditionary forces required for rescue missions and advocate future support for upcoming endeavors. The scope of this paper will cover a current assessment of capabilities and capacities, a comparison to other nations, and present recommendations on how to best prepare for future requirements in the harsh Arctic environment.

15. SUBJECT TERMS
Arctic; Rescue; Navy; Expeditionary Warfare; Russia; submarine; conflict; readiness

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			USMC Command and Staff College
					19b. TELEPHONE NUMBER *(Include area code)*
Unclass	Unclass	Unclass	UU	40	(703) 784-3330 (Admin Office)

United States Marine Corps
Command and Staff College
Marine Corps University
2076 South Street
Marine Corps Combat Development Command
Quantico, Virginia 22134-5068

MASTER OF MILITARY STUDIES

TITLE:
Arctic Readiness: Changes are Appropriate for 21st Century Naval Expeditionary Warfare

SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF MILITARY STUDIES

AUTHOR:
LCDR Nicholas J. Oldfield

AY 16-17

Mentor and Oral Defense Committee Member: T.W. Borden
Approved: [signature]
Date: 4/5/17

Oral Defense Committee Member: John Olav Fuglem
Approved: [signature]
Date: 4/5/17

[signature]
S.E. Phillips
4/5/2017

[signature]
Edward T. Nevglaski
LT Col USMC
4-5-17

Executive Summary

Title: Arctic Readiness: Changes are Appropriate for 21st Century Naval Expeditionary Warfare

Author: Lieutenant Commander Nicholas J. Oldfield, United States Navy

Thesis: There will be a predictable increase in expeditionary warfare involvement within the Arctic region. This paper will discuss the current state of US Navy Arctic readiness with focus on naval expeditionary forces required for rescue missions and advocate future support for upcoming endeavors. The scope of this paper will cover a current assessment of capabilities and capacities, a comparison to other nations, and present recommendations on how to best prepare for future requirements in the harsh Arctic environment.

Discussion: The US Navy published the *Arctic Roadmap 2014-2030* in February of 2014 to guide the Fleet on items to address as the Arctic becomes more prevalent to national security concerns. This *Roadmap* is a good start, but it falls short in assessing current Arctic capabilities and responses to catastrophic situations, especially in those where expeditionary forces will be required. To properly prepare for future expeditionary Arctic readiness, the US Navy must address: icebreaker capabilities and capacity; required infrastructure for air, land, and sea forces and equipment; localized Command and Control (C2); train in the environment under all conditions; and expand partnership capacity to deter aggression and provide response for most catastrophic situations that may occur. This discussion is significant to not only to expeditionary warfare personnel, but also the submarine community and any support: US Coast Guard, military aviation, and ground forces that may find themselves operating above the Arctic Circle.

Conclusion: To prepare for Arctic Operations, the US Navy needs to properly self-assess and adequately prepare for contingencies to various degrees, both armed and unarmed. The inability to rescue personnel from a sunken submarine trapped under Arctic ice is the first consideration the US Navy must address. This deficit can be addressed by: developing organizational Command and Control with oversite of the region; investing in infrastructure for sea, air, and land assets; training in the environment under all conditions; and expanding partnership capacity to deter aggression and respond to incidents as needed. Leveraging from friendly and partner nations will help shorten the timeline for such readiness achievements.

DISCLAIMER

THE OPINIONS AND CONCLUSIONS EXPRESSED HEREIN ARE THOSE OF THE INDIVIDUAL STUDENT AUTHOR AND DO NOT NECESSARILY REPRESENT THE VIEWS OF EITHER THE MARINE CORPS COMMAND AND STAFF COLLEGE OR ANY OTHER GOVERNMENTAL AGENCY. REFERENCES TO THIS STUDY SHOULD INCLUDE THE FOREGOING STATEMENT.

Illustrations

Page

Table of Contents

Preface

Prior to Marine Corps University Command and Staff College, I was stationed in Halifax, Canada, as part of the Personnel Exchange Program (PEP). I am a US Navy EOD Officer, a specialty that equates to a Canadian Clearance Diver, and I thus had the unique opportunity to deploy around the world with their Clearance Diver teams to learn from their expertise and share US techniques and procedures when applicable. For five of these trips I found myself in Canada's Arctic. In the summer of 2015 I led a ten-man dive team to the Northwest Passage and participated in Canada's NORTHERN WATCH. The team's task was to clear out underwater piping at a remote listening post and install modern cabling to be laid out to sea. In March/April of 2016 I once again found myself diving in the Arctic, but this time under the ice at the northern-most installation in the world, Canadian Force's Base (CFB) ALERT. The job was to exercise ice diving to facilitate potential submarine rescue or recovery. It was these trips to the region that gave me a passion for the austere environment and how to operate/survive in it. I developed an interest as to how the US would conduct Arctic Operations and made it a personal endeavor to learn as much as I could. It did not take too long to discover that the US has much to learn and is lacking in some capabilities for rescue operations.

Portions of this paper have been gleaned from personal experiences with the personnel I operated with during the Arctic trainings, as well as those skilled individuals I have had the pleasure to discuss this subject with at length. Portions of the paper will include "common knowledge" if one was to live in or visit Canada's High North. These "common knowledge" references will not be sited within the paper as it is difficult to remember individual's names and exact time and date of my encounter.

Without the experience of being stationed with the Royal Canadian Navy I would have never been exposed to the Arctic and operating in such an environment. For this reason, I would like to personally thank the men and women of Fleet Diving Unit (Atlantic) for their amazing leadership and expertise. Realizing this passion was ideal for the MMS process, I met with Dr. J.W. Gordon of Command and Staff College to seek his advice and mentorship. Dr. Gordon introduced me to Lieutenant Colonel John Olav Fuglem, Norwegian Army, who has extensive knowledge of the Arctic and helped expand my views. Both men have been integral to my recent intellectual developments and achievements. This paper is dedicated to those I have had the honor of serving with, LtCol Fulglem, and to Dr. Gordon for providing the insight to best utilize my experiences.

Figure 1: Hard Hat (MK-21) dive APR 2016 CFB ALERT

Figure 2: Gascoyne Inlet, Devon Island, AUG 2015

"We are open for dialogue with our foreign partners and with all neighbors in the Arctic region. But we will naturally defend our own geopolitical interests firmly and consistently."

-Vladimir Putin, Russian President

History's Most Valuable Lesson in Arctic Travel

The Arctic is a geographical area of the world that mankind has attempted to exploit for hundreds of years– seeking its abundant natural resources, mapping its deep currents in attempts to discover shorter inter-coastal passages, and providing a strategic military stronghold. In 1845 Sir John Franklin set sail onboard the *HMS Erebus*, accompanied by the *HMS Terror*, to find the Northwest Passage through the North American Arctic archipelagos. The objective of this voyage was to provide a shorter sea route between Great Britain and Asia, thus saving time and reducing cost while procuring and exchanging goods, namely spices. The voyage was met with harsh cold weather conditions: eventually all personnel and ships were lost after the crew suffered through three gruesome winters. The people who did not develop lead poisoning from the containerized tin rations, or developed scurvy, decided to take their chances in the environment and walk out on the ice in search for an Inuit village to survive and/or be rescued. Those men eventually turned to cannibalism in hopes to live through the austere conditions and those few eventually succumbed to the elements. It was not until fall of 2014 that the *HMS Erebus* was located, and two years later, in the fall of 2016 for the *HMS Terror*, that new discoveries are being found which revealed how the crews lived and died while trapped in the sea ice. One of the lessons learned from this expedition is that no matter how well one plans for harsh conditions, Mother Nature can change this plan for better or for worse, and mankind should anticipate the latter when facing the Arctic.

Arctic Readiness and the Future of Naval Expeditionary Warfare

This paper will discuss the current state of US Navy Arctic readiness with focus on naval expeditionary forces required for rescue missions and advocate future support for upcoming endeavors. The scope of this paper will cover a current assessment of capabilities and capacities, a comparison to other nations, and present recommendations on how to best prepare for future requirements in the harsh Arctic environment. The US Navy published the *Arctic Roadmap 2014-2030* in February 2014 to guide the Fleet on items to address as the Arctic becomes more prevalent to national security concerns. This *Roadmap* is a good start, but it falls short in assessing current Arctic response to catastrophic situations, both armed and unarmed. The US Navy cannot afford to skip to the future by not addressing the current and short term necessities. There will be a predictable increase in expeditionary warfare involvement within the Arctic region, due to their high technical skills. To properly prepare for future expeditionary Arctic readiness, the US Navy must address: icebreaker capabilities and capacity, required infrastructure for air, land, and sea forces and equipment: localized Command and Control (C2); train in the environment under all conditions; and expand partnership capacity to deter aggression and provide response for most catastrophic situations that may occur.

Arctic Drama

Ice levels are retreating exponentially in the Arctic resulting in additional seagoing passageways and newly accessible resources; something Franklin and his crew had hoped for.[1] These recently available resources are significant to the United States, as well as other Arctic bordering countries. International sea traffic will increase in competition for the revealed treasures, thus increasing the US National Security level, which will in turn involve the US Navy and other maritime forces.

Many nations, not just Arctic Nations, realize that the Arctic can provide an economic boost once its passages and resources become more accessible. China has already explored the possibility of shipping through the Arctic, initiating a dispute with Russia.[2] Russia has recently appealed to the UN for extending its Exclusive Economic Zone (EEZ) further into the Arctic region.[3] Article 55 of the United Nations Convention of the Law of the Sea (UNCLOS) defines the EEZ as, "an area beyond and adjacent to the territorial sea, subject to the specific legal regime established in this Part, under which the rights and jurisdiction of the coastal State and the rights and freedoms of other States are governed by the relevant provisions of this Convention."[4] Article 56 further defines a nation's rights as applied to the EEZ, "sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources, whether living or non-living, of the waters superjacent to the seabed and of the seabed and its subsoil, and with regard to other activities for the economic exploitation and exploration of the zone, such as the production of energy from the water, currents and winds."[5] Any competition over territorial control for resource procurement may generate conflict. The Iraq invasion of Kuwait in 1990 for control of the tiny oil rich land is a recent example of such a conflict. The United States needs to prepare for potential hostilities.

Currently, the US monitors many situations remotely via satellite, but the US also deploys its nuclear-powered submarines to secure and assess the Arctic environment during all months of the year. Ice is present at the High North practically year-round, and its southward reach increases as winter months arrive. Should one of these submarines encounter a condition where they require rescue assistance, the US is extremely limited in its ability to safely rescue the crew of the sub. To plan for impending encounters, either armed or unarmed, the US Navy needs to consider Arctic Operations in its entirety and make serious preparations to defend the

freedom of movement, available resources, and ultimately defend US National Security in the Arctic. A part of it will be to develop more robust capabilities to support current US operations in the environment, thereby posturing a valid deterrent to opposing forces.

The Arctic HOV Lanes with a Russian EZ-Pass

As previously introduced, there is a desire to find the shortest route to cross the ocean dating back hundreds of years. Recently, scientists have made note of the changing Arctic seaways due to global warming. Sea ice is retreating further North during summer months making two passages increasingly passible: the Northwest Passage through the Canadian Archipelago (NWP) and the Northern Sea Route (NSR) over Russia. See Figure 3 below.

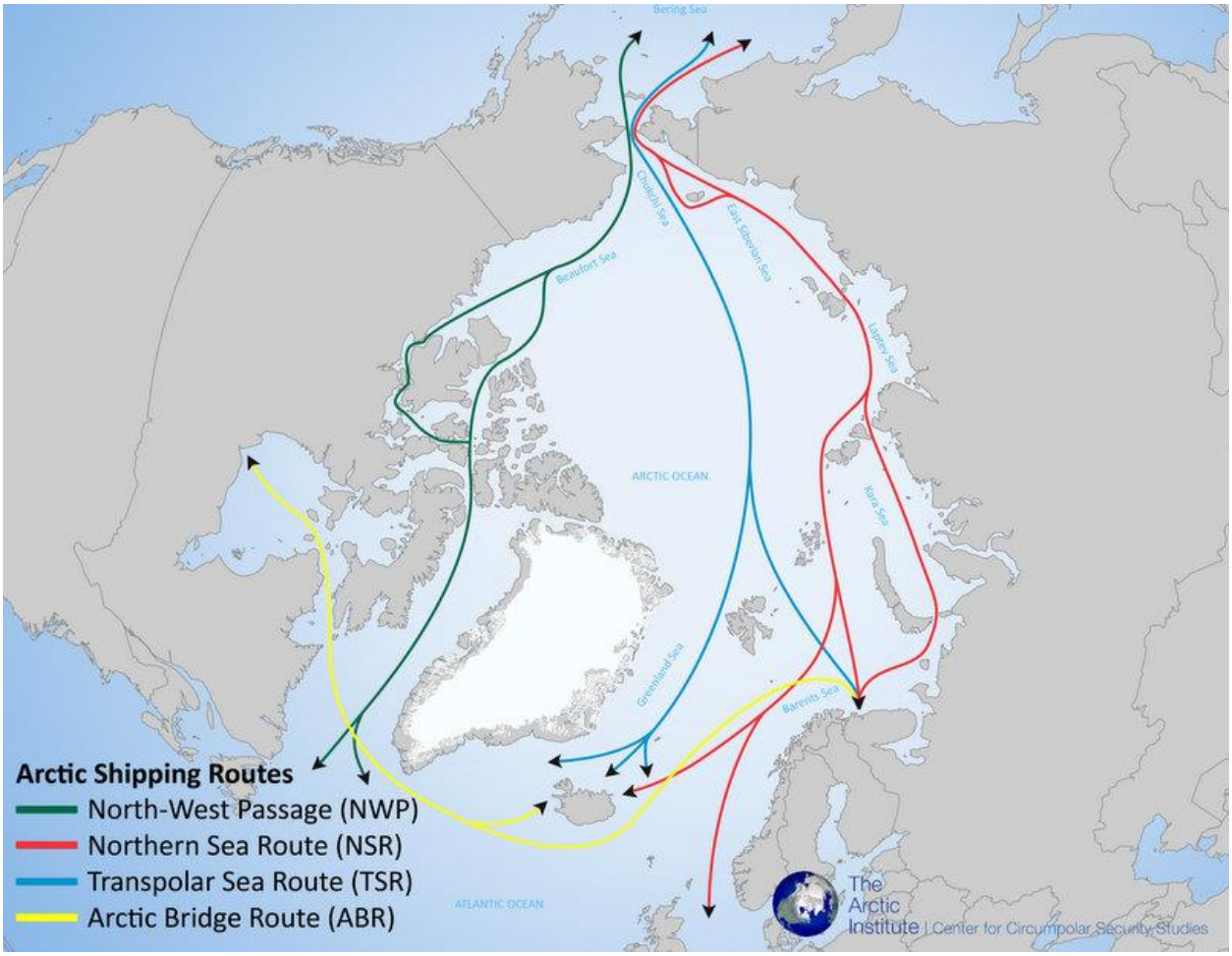

Figure 3. http://www.thearcticinstitute.org/the-future-of-arctic-shipping/

These new passages offer more expedient routes for nations who utilize the Arctic seas. Arctic nations (US, Canada, Russia, Norway, Denmark (Greenland), and Iceland) are not the only ones to make note of the available sea route. China successfully navigated the NSR with the icebreaker ship *Xuelong* (Snow Dragon) in 2012 to verify a safe voyage to the Chinese research station at Svalbard.[6] The following year the Chinese sent the first container ship, the *Yong Sheng*, to see if such a vessel type could safely traverse the same route through the NSR.[7] This ignited conflict with Russia as she does not recognize the NSR as international waters and considers them territorial waters. However, a quicker route to cross the world is not the only reason Russia is concerned with increased presence through the NSR, there are vast resources in the region that could be used to boost Russian economy – or whomever can claim the areas riches first.

Russia's need to maintain and establish Arctic control, and dominance, is mostly driven by its economic needs. Per the *Circum-Arctic Resource Appraisal (CARA)*, published in 2008, approximately thirteen percent of the world's hydrocarbon reserve may be found in the Arctic along with 1,700 cubic feet of natural gas and 44 billion barrels of natural gas liquids.[8] These resources are distributed in pockets around the region, with Russia estimated to control of most of the natural gas and the US having most of the oil off Alaska within the countries' respective EEZ.[9] Article 57 of the UNCLOS limits the EEZ boundary stating it, "shall not extend beyond 200 nautical miles from the baselines from which the breadth of the territorial sea is measured.[10] All natural resources are claimable by the country of the EEZ, and trespassers are considered poaching. Russia has been trying to expand its EEZ by appealing to the international community. In 2001, and again further refined in 2015, Russia submitted its claim to expand its Arctic territory by over 463,000 square miles to the Commission on the Limits to the Outer Continental Shelf (CLCS).[11] They claim that the country's continental shelf expands beyond the standard 200

nautical miles, thus their EEZ must be adjusted. The CLCS does not decide the outcomes of countries claims, but they are considered an authority on assigning country ownership with regards to the Law of the Sea.[12] Now that Russia has made its case known of its desire to increase its Arctic reach, the security of such resources and EEZ expansion must be taken into consideration.

Over the past few years Russia has been increasing its military presence in the Arctic. In 2014 Russia held the largest post-Soviet military exercise, named VOSTOK, that involved over 100,000 personnel and thousands of military assets across all services.[13] This exercise was Russia's way of demonstrating to the world its technical and operational capabilities to mobilize and amass its military to respond to Arctic hostilities or threats. In an additional demonstration of further strategic significance, Russia has re-established Soviet-era airfields in the High North, totaling 14 operational bases since the end of 2015.[14] All this military power, plus command and control exercises, has shown Russia's refusal to play the waiting game for international rulings to determine which countries control what parts of the Arctic. This has caused the US, Canada, and partner nations to re-assess their own Arctic posture and capabilities to counter or deter further Russian dominance. Until those international boundary determinations are ratified, the current boundaries remain in effect but with conflicts in of themselves.

International Lines and Law

In 1982, the United Nations (UN) updated and signed into effect the current Law of the Sea (UNCLOS or simply LOS) which detailed various international laws from freedom of maneuver to the requirement for response as part of the Safety of Life at Sea (SOLAS). Russia and China ratified the UNCLOS, but the United States did not. The US government, at the objection to its Naval leadership, did not want the most powerful naval power to potentially be

governed by an international entity or law if there was an objection on the US's part. The US does follow the faith of the UNCLOS guidelines, but retains the autonomy to choose an alternative option if disagreeing with the situation. As Fairhall references in his book *Cold Front*, "Increased realization that the oceans contain all kinds of valuable resources has recently prompted new kinds of UN regulation to control not only surface activity but also economic exploitation of the seabed."[15] This is precisely why the US did not ratify the UNCLOS, in that they wished to remain free to maintain freedom to maneuver and potential resource procurement. Russia continues to remind the international governing body that the US remains independent. This ongoing dispute translates into territory or boundary claim disturbances in various parts of the world, not just the Arctic.

Freedom of navigation is the vanguard for all surface and subsurface vessels in the NSR and NWP. Russia claims that the NSR goes through parts of her territorial waters, likewise Canada claims the NWP as her own[16]. In both cases, those respective nations would then hold the ability and right to charge a fee and control who may or may not transit through the passages; a northern Panama Canal by comparison. The US would like to see the NWP declared an international strait so the US Navy can move freely between the Atlantic and Pacific Oceans.[17] The US considers a body of water that connects two high seas that is used for international shipping as part of pre-UNCLOS laws, falling under the 1958 Territorial Seas Convention for innocent passage.[18] Currently, the UN would be the designator of the NWP under the LOS provisions. Canada continues to hold firm that parts of the NWP are indisputably within territorial waters so the Canadian Government can protect the area from potential pollution.[19] Since the US has not ratified the UNCLOS, the dispute remains a friendly topic of contention between the two nations.

While this is just one example of amicable passageway disputes, there are also additional conflicts between the US and Canada with regards to territorial waters versus EEZ rulings.

The territorial waters boundary between the US and its Northern neighbor are still not completely resolved today. The boundary where Alaska meets the Yukon Territory is a tenuous, unofficial "agree to disagree" arrangement that is reviewed constantly by both governments as more resources in the area become available. The US believes that the maritime boundary in the Beaufort Sea should be at a 90-degree angle from the coastline boundary, while Canada mandates the boundary created by the Anglo-Russian Treaty of 1825 should be followed.[20] This difference of this boundary has a significant impact to resource ownership: vast amounts of oil, fishing grounds, and pollution rights are all up for contention. While this dispute remains on amicable terms, Russia, on the other hand, has not come to such an agreement with the US. Initially proposed in 1990, Russia and the United States have still not ratified an agreement settling disputed waters over part of the Bering Sea.[21] Reasons for this dispute are a matter of understanding geometry and how it is applied to maps and charts. Cartographers typically use two types of lines to map such boundaries. Rhumb lines and great circle lines are used on two common map projections, Mercator and Conical. Depending on the type of line and map projection used, lines will either appear straight or curved. For example, a rhumb line will be a straight line on a Mercator projection, whereas a great circle line is curved. Because each country interpreted the boundary line described in the treaty for the sale of Alaska (in 1867) as a straight line, the Soviet Union depicted the Bering Sea marine boundary as a rhomb line on a Mercator projection whereas the United States used a great circle line on a conical projection. Therefore, each country's claim maximized the amount of ocean area and seafloor under their respective territorial control. Because the Soviet Union had disbanded prior to the 1990 boundary

settlement being sanctioned, Russia now maintains the old Soviet views thus keeping the conflict in a disturbed state.[22] The US holds to that settled Soviet maritime boundary, and patrols the waters as such, because it gives more territorial control and benefit to the United States.

To shorten the list of maritime boundary disputes in the Arctic region, a summary is depicted in Figure 4 below. With all these unsettled boundaries, there lies a potential for conflict escalation, both armed and unarmed, which brings about addressing regional securities.

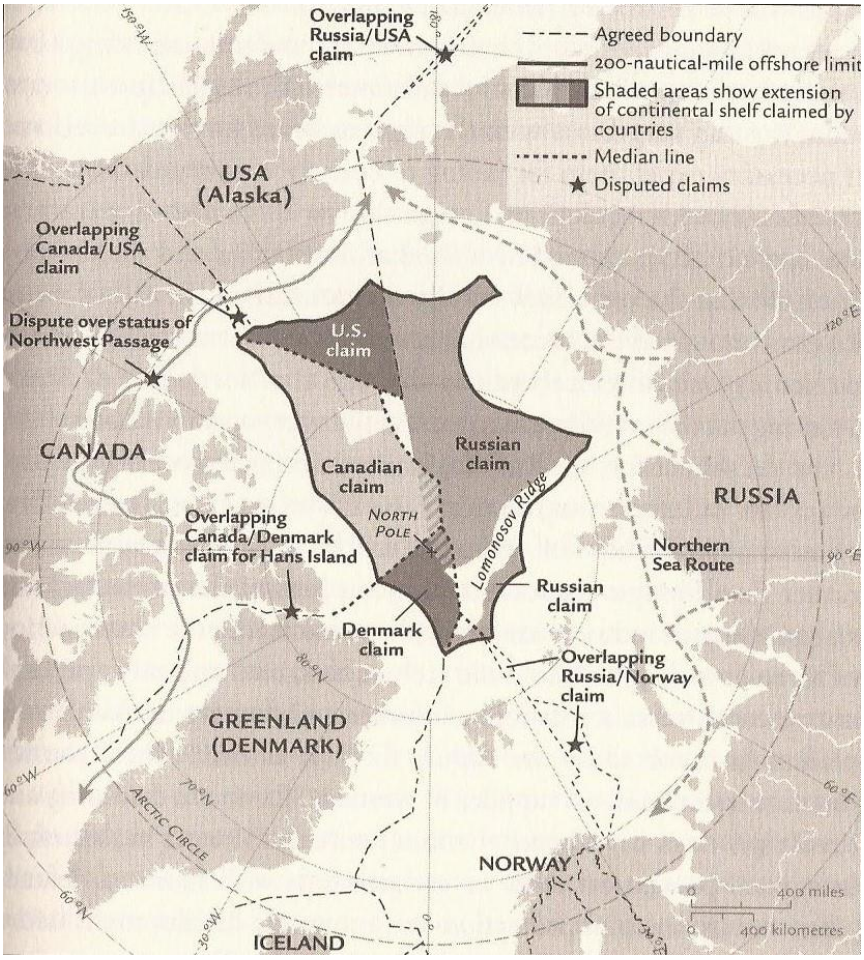

Figure 4: Polar Imperative pg 453

NOTE: The northern section of the Norway/Russia Arctic boundary dispute in the Barents Sea was resolved September 2010.[23]

Security in the Arctic

Due to the boundary disputes, passage way control, and territorial water/EEZ considerations and developments, every Arctic country is reviewing security concerns and increasing awareness; evaluating what measures possibly to take as Russia increases its rhetoric and military buildup. US, Canada and Denmark have been addressing this concern since the end of World War II.[24] The US initially assumed the majority of defense responsibilities for the region due to its military capacity; but the roles have changed since the end of the Cold War in that the threat of a nuclear submarine carrying nuclear warheads has decreased.[25] However, the possibility of a foreign submarine operating in Arctic waters is still present, explaining why the US has continued submarine deployments; to track and deter other countries' submarines from operating in or around North American waters and waters of disputed territory. In addition, maintain freedom of navigation for its own submarines. Since the Cold War, new technologies have been and are now being developed which increase surveillance capacity. Thus, Canada and the US have collaborated to update their strategies for Arctic surveillance.

US submarines have been at the forefront of Arctic surveillance as Canadian submarines are limited in numbers and are not nuclear powered. Since physical patrolling has its limits to submarines or airplanes, alternative methods needed to be employed. To increase the capacity of Arctic monitorization, Canada has adopted its "Northern Strategy" with the start by launching Radarsat II satellite system to monitor shipping and pollution in the region.[26] The US/Canada alliance of North America Aerospace Defense Command (NORAD) has also been the lead for the early warning air surveillance for both countries. Remote listening and radar stations can be found all over the North American High North. Those outposts, which are maned and operated by Canadian Armed Forces (CAF), are in communication with NORAD as one of the senior

security commands; as well as Canadian Maritime Forces Atlantic (MARLANT), the Naval command overseeing Arctic waterways, and Joint Task Force North (JTFN) controlling CAF and reporting to Canadian Joint Operational Command (CJOC). These improvements to alternate methods of surveillance have been substantial. However, all the monitoring is for nothing unless there is a physical means to enforce the boundaries and defend against threats. To further increase Artic physical security/patrolling/defense abilities, both the US and Canada are looking to invest in additional surface vessels with improved ice breaking capabilities.

At the time of this paper, Russia has the greatest number of Arctic capable surface ships. Their public inventory boasts 40 plus icebreakers, including 4 heavy nuclear powered ones. China's numbers and inventory are unknown entities but as their previously mentioned exploration of the NSR passageway demonstrated they are considering pursuit of increased Arctic travel, potentially resource acquisition, and possibly annexation. In comparison, the combined inventory of US and Canada is 8 vessels in all, with none of them under nuclear power. Since recognizing the deficiency of capable vessels, Canada has laid the keel for its first of six Arctic Offshore Patrol Ships (AOPS), targeting commissioning year of 2018.[27] The United States is also planning to beef up the Coast Guards surface capability with the addition of 4 icebreakers. As noted on the USCG website, "The operational polar icebreaking fleet currently includes one 399-foot heavy icebreaker (Coast Guard Cutter Polar Star, commissioned in 1976) and one 420-foot medium icebreaker (Coast Guard Cutter Healy, commissioned in 2000)."[28] In January of 2016, the Coast Guard published requirements to the acquisitions section to solicit industry for bids on the future icebreakers procurement. The goal is to have the contract awarded by 2020 and begin construction shortly after. This aligns a couple of years behind the Canadian AOPS. Once completed, the two nations will have bolstered their physical support by having

ships able to navigate thick winter sea ice and provide the much-needed support to current submarine patrols. The increase in icebreaker capacity will add a dimension to the current surveillance aircraft and the satellite and remote radars as a defense in depth system. These contracts are a positive step in correcting the Canadian and US inventory deficiency, but still fall short in inventory and capacity comparison to Russia.

The US Navy is Designated as the Lead for Arctic Security

In February 2014, CNO Admiral Greenert published *The US Navy Arctic Roadmap: 2013 – 2030*. The *Roadmap* discusses the plan for future developments ranging from current posture, which is assessed as appropriate, to far term considerations and requirements.[29] It is interesting to note that the analysis encourages naval training to occur primarily in the summer months when the Arctic ice has receded and does not specifically mention any training recommendations during the winter months. By limiting training windows, the Navy is hindering the true understanding of the Arctic environment as during most the year the Arctic is under thick ice; un-navigable to most surface vessels. As previously stated, submarines currently patrol the Arctic waters daily due to the ice limitations on current sea-going vessels. The *Roadmap* does not address the support required for submarines in this environment. Therefore, the *Roadmap* is lacking the logistical considerations to maintain the safety of the crew and operability of the submarines themselves.

If a submarine were to become distressed under thick winter ice, the US Navy cannot perform any type of rescue. The physical number of ships in the US and Canada icebreaker inventory poses a problem in of itself. Coupled with that limited number of icebreakers is the capability of the icebreakers themselves – neither country is outfitted with a vessel that can match Russia's heavy ice breaking capability. Therefore, a stranded sub in an inaccessible

location to the US or Canada would be at the mercy of Russia. As the LOS states, if a vessel has the means and capability to save the life at sea you are obligated to do so, even if the ship must navigate into territorial waters of another nation. Given the nature and secrecy of any US nuclear submarines, it would be a hard pill to swallow to allow Russia to attempt such access and recovery, but it would be expected of Russia to attempt it as under the LOS obligations. In August of 2000 the *Kursk,* a nuclear powered Russian Oscar II submarine, sunk in a little over 100 meters depth in the Barents Sea, taking 118 souls with her. Russia was conducting a large scale naval exercise at the time. Norwegian seismic listening stations in the area logged and reported two separate explosions at the time the submarine was lost.[30] Survivors onboard had moved to an escape compartment but the escape capsule and emergency buoy failed to work, trapping 23 men on the bottom of the sea with oxygen levels falling and unable to support life. NATO nations offered their assistance but Russia was reluctant to accept, wanting to preserve the secrecy of its nuclear submarine's operating capability. Thus, all lives were lost. The *Kursk*'s 15-year anniversary article states, "according to experts, lives could have been saved if rescue operations had begun sooner."[31] Had Russia acted sooner and allowed NATO assistance, those 23 lives could have been saved. President Putin has declined to share further reasoning for delaying foreign rescue assistance. The survivors' families and Russian public are still resentful over his actions, or lack thereof. US, Canada, Russia, or any other nation operating submarines in the Arctic may find themselves in a situation like the *Kursk* but with additional complications to rescue attempts due to the thickness of sea ice and remoteness of the region. To properly plan for such a catastrophe, there are many considerations that the US must address to mount an appropriate and successful response.

Rescue capabilities

Between World War I and World War II (WWII), the use of the submarine as part of naval warfare increased and its role expanded, thus prompting the undertaking of various tests. The increasing number of submarines created an associated increase in number of experimentation and personnel qualifications, as well as an equitable loss of life during such experimentations. One visionary submarine (and diving) officer assessed the potential for catastrophic situations with these new boats. Lieutenant Commander Momsen foresaw a need to develop advanced rescue techniques due to his observations made as a Lieutenant during his submarine tours. He witnessed events that lead to multiple deaths that could have been prevented if the appropriate tools had been invented and were made available. His vision was to adapt the use of a diving bell to allow for personnel rescue. The diving bell was reconfigured to allow divers to access sunken boat and rescue personnel trapped in the hull where they still had breathable air. The *US Navy Dive Manual* references the historical concept of submarine rescue: "The Navy pushed for development of a rescue chamber that was essentially a diving bell with special fittings for connection to a submarine deck hatch. The apparatus, called the McCann-Erickson Rescue Chamber, was proven in 1939 when the USS Squalus, carrying a crew of 50, sank in 243 fsw [feet of sea water]. The rescue chamber made four trips and safely brought 33 men to the surface."[32] Divers that accompanied and operated the bell used helium mixed-gas, which allowed them to conduct the rescue safely. The use of mixed gases was another innovation spearheaded by Momsen. The fact that such a rescue was successful has created a counterbalance point; if more submarines are going to be traveling under the ice due to increased Arctic surveillance, then more submarine support needs to be accessible and functional under all conditions, including friendly nations ability to assist with support and rescue.

The sinking of the *Kursk* was tragic but something that could have been addressed in time if Russian leadership had allowed the international partners the opportunity to save life at sea. The US Navy and Norwegian Navy have capabilities for diving at the depth of the *Kursk* as well as a submarine rescue system designed for such a situation. This next generation of the Deep Submergence Rescue Vehicle (DSRV) was designed in response to the US's loss of its nuclear-powered submarine, the USS THRASHER in the 1960s. Like the *Kursk*, the THRASHER had lost all crew members but the sinking was more catastrophic due to significant construction flaws and depth of water. Aside from the safety measures implemented during construction, procedures were also updated and trained to following the THRASHER's sinking. More so was the requirement for the DSRV to be developed as the modified diving bell has its depth limitations and still requires a lot of additional personnel to be in the water for operation. Today the US Navy's Submarine Rescue Diving and Recompression System's (SRDRS) is the primary rescue method, but it must be deployed from a ship with substantial deck space and a crane strong enough to lift the tethered hybrid ROV/compression chamber.[33] Commander Christy Hagen, a spokesperson for the U.S. Navy's Submarine Force, gives details of the rescue system, "The SRDRS consists of the Atmospheric Dive Suit 2000 (ADS2000) – manned, one-atmosphere dive suit that is used to inspect bottomed submarines and clear away debris that could cover an escape hatch, associated topside equipment and systems, and the PRM Falcon. [The] Falcon is a

tethered, remotely-operated submersible that is launched and controlled from the deck of a surface ship and transfers up to 16 submariners from a disabled submarine per dive."[34]

Figure 5: SRDRS http://www.navy.mil/navydata/fact_display.asp?cid=4100&tid=400&ct=4

This highly capable system is what the US Navy developed and deploys as its primary means for submarine rescue around the world. CDR Hagen references its availability, "The U.S. SRDRS is kept in a fly-away status, ready to deploy on a moment's notice. Based at the Deep Submergence Unit at the Naval Air Station in San Diego, Calif., SRDRS can deploy and be ready to mate with a disabled submarine anywhere in the world within 72 hours."[35] The problem with the system being kept in a fly away status means there has to be a lot of logistical coordination with the movement and deployment. Aircraft will be coordinated and a vessel with ample deck space and equipment to support and operate the SRDRS must be made available in the rescue location. That therein lies a prominent issue with using the SRDRS in the Arctic for submarine rescue. Currently, there is an extremely limited icebreaker capacity in the US and Canadian inventory with the required deck space or equipment that would be able to traverse heavy ice water conditions. These requirements must be applied to the latest icebreakers being forged in Canadian shipyards and written into the USCG contracts to correct this deficiency.

Working as a Team

The United States realizes that it is not the sole military enforcer in the world and needs to strengthen ties to friendly nations that would be able to provide expertise in areas where the US was lacking. With regards to seeking Artic Warfare experts, the *Arctic Roadmap* give some guidance when discussing future considerations and challenges while working with our allies:

> These challenges provide opportunities to cooperate with interagency partners and international allies, sharing limited resources to improve situational awareness and develop a Common Maritime Picture (CMP) of the Arctic Ocean. In conjunction with interagency and international partners, the Navy will seek to improve Maritime Domain Awareness (MDA), information sharing, and communications. Currently, Arctic MDA is assessed as adequate. However, as traffic and Regional activity rise in the coming decades, the Navy will seek to improve overall MDA capability. To build the ties of trust and confidence that underpin strong alliances and partnerships, it is essential to operate and train together. Multilateral training, operations, and exercises in the Arctic Ocean such as NORTHERN EAGLE and NANOOK will improve knowledge of the Region and provide a positive foundation for future missions.[36]

It is important to note that the 2014 published *Roadmap* states that right now the level of MDA in the Arctic is currently "adequate." The *Roadmap* assessed as such because up until recently the surface traffic has increased minimally due to sea ice, but the subsurface element has not changed. However, there should be a predictive increase in surveillance subsurface traffic as surface traffic will increase due to the increased number of available traversable sea passageways. Through bilateral exercises and information sharing, the US will gain a better level of understanding in how the respective forces operate in the environment, which in turn will give the US a more accurate assessment of appropriate Arctic Warfare.

The two exercises that the *Roadmap* refers, specifically, take place in the summer months when sea ice is at its lowest. The US's geographical closest ally, Canada, understands the need for year-round training in the Arctic and demonstrates this competence on an annual basis through exercises such as OP NANOOK, OP NUNALIVUT, OP NORTHERN WATCH, and so on. These multi-force expeditionary exercises take place during different seasons to provide

varied Arctic environments. This past winter (as part of OP NUNALIVUT16) the Canadian Navy sent a dive team to CFB ALERT, the northernmost installation in the world, to conduct diving operations under the ice. The design of the exercise was to practice Arctic Expeditionary Skills as well as show the world that Canada is serious about its sovereignty[37]. Aside from conducting inspection on freshwater pipes that supply the base, the dive team exercised cutting holes through eight feet of ice to be able to access the sea for Submarine Search and Rescue (SUBSAR).[38] The US Navy needs to mirror the skills of our northern neighbors and can do so at a relatively inexpensive cost with information sharing and exercise participation. The US Air Force, through the 109th Air National Guard (ANG) out of New York, participates in OP NUNALIVUT by flying North America's only C-130 capable of landing on sea ice. Canada is willing to open winter exercises to the US and other partner nations, as they see the benefit of information sharing.

When considering that the Canadian Clearance Divers exercise submarine rescue under Arctic sea ice, the means and capability need to be fully understood. If required, submarine rescue in the High North is an agreement that the US has with Canada that should the need to save life at sea, to include underwater, that Canada will be fully capable to respond and lend their assistance.[39] It is a mandatory requirement that Canadian divers maintain the SUBSAR mission as part of their core competencies. Canada understands that the US is the primary patroller of North America and welcomes the support. The interesting item of note is that Canada Coast Guard does have an icebreaker fleet, but limit their High North reach to just the summer months.[40] Canada also has a limitation on the number and type of aircraft that are capable of landing on the sea ice. Furthermore, Canada does not have a submarine rescue chamber like that of the US. The question then becomes how would Canada fulfill the rescue of a submarine? This

is more of a play on words as in reality, it would be a recovery mission vice a rescue mission should Canada be asked to dive on the submarine. Even if the SRDRS were to be flown by the 109th NY ANG out on the ice, there would be no crane or support vessel from which the chamber must be operated from. This needs to be understood as practicing with the SRDRS under ideal conditions is not adequately preparing the forces for the most common experienced conditions.

The SRDRS has been used in joint exercise with partner nations. Not only has the SRDRS been successful in design and demonstrations for US submarines, but the international community also has benefited from such a capability. "As part of BOLD MONARCH 2011, the U.S. Navy's Submarine Rescue Diving and Recompression System's (SRDRS) Pressurized Rescue Module (PRM) Falcon successfully mated with the Russian Federation Navy's Kilo-Class submarine *Alrosa* (B-781). As a result, Falcon is now certified to mate with a submerged Russian submarine and be able to rescue submariners."[41] If this chamber had been around during the loss of the *Kursk*, lives could have been saved, with Russia's permission. But had the *Kursk*, or any submarine for that matter, been in the Arctic and trapped under the ice, the outcome would have been the same as if the SRDS was not in existence. The best international submarine rescue capability is only useable in ideal circumstances, and those circumstances would only then be applicable to the summer Arctic months, which are three out of the twelve of the year. As stated earlier, subsurface patrols are due to increase and are certainly not hindered by the harsher winter conditions. It would stand to reason that rescue capabilities should mirror the same limitations and expectations.

The *US Navy Arctic Roadmap* does consider operating with allied forces who currently exercise in the region. However, the only mention to such an expeditionary reference may be found within the Implementation Plan, the final appendix of the *Roadmap*. Naval Expeditionary

Combat Command (NECC) is tasked to "develop a plan to be prepared to execute Arctic expeditionary operations in the near term," and to determine the strategy for acquiring the equipment needed for Arctic operations.[42] Recently the US Navy participated in a multinational Arctic exercise in March (ICEX 2016) and dove Self-Contained-Underwater-Breathing-Apparatus (SCUBA) under Arctic ice to test and evaluate authorized US Navy equipment limitations. While this is a promising start, the exercise was still primarily submarine centric.[43] Even though NECC forces participated in ICEX 2016, they were more on a trial to see what logistic support would be required for future deployments to the region. The US Navy needs to address these same capabilities and become proficient in expeditionary warfare in the hostile Arctic environment. At one point, the US was proficient and even advantageous in this planning. The prime example is the post WWII – Cold War collaboration between Norway and the US.

After the completion of WWII and at the beginning of the Cold War, Norway and the United States identified common interests in the Arctic with regards to security and resources management. Norway, an Arctic nation, occupies a strategic geographic position that allows a military strength to patrol and enforce Russia's Northeastern boarder. Since the Cold War, Russia has had its northern nuclear submarine fleet operating out of the Kola Peninsula, as well as its nuclear missile silos.[44] Norway understands that in a war of attrition, they could not hold up to Russia, so they need to rely heavily on a strong NATO coalition and bilateral trust with the United States. The US provided heavy artillery (relevant to the time) to be stored in isolated caves in Norway to be easily accessible in the event of northern European conflict. This equipment was enough stockpile for a Marine Expeditionary Brigade (MEB) in size. Norway would safeguard the equipment, as well as provide for half of the monetary compensation required to keep the equipment in good working order. The equipment was utilized for combined

nation winter warfare proficiency training. The practice did get phased out when the Global War on Terrorism took precedence**.** The final physical use of these artillery stores was its physical relocation to Afghanistan to be used in ENDURING FREEDOM. Since the withdrawal from OIF and OEF, the US is returning to training with NATO partners and re-engaging in European security.

The Marine Corps realized that the equipment stored in Norway and used in OIF and OEF needed to be modernized to meet the equipment upgrades of the Marine-Air-Ground-Task-Force (MAGTF). So, in 2012 the USMC addressed this shortfall with a completion date set for 2016.[45] To start preparing a force to operate the upgraded equipment in winter environments, thirty US Marines participated in NORTHERN RESPONSE, a Norwegian led exercise, in 2015. The goal was collaboration and expansion upon expeditionary winter warfare, under the guidance of subject matter experts. The success of the exercise empowered a standing agreement of 300 US Marines on a six-month rotation to be stationed back in the re-equipped caves to provide equipment maintenance and continue their winter warfare training.[46] Major General Niel Nelson, Commander of Marine Corps Forces Europe and Africa, said this new deployment will be known as "Marine Rotational Force Europe -- and the first troops arriving as part of the rotation will be a reinforced infantry company from Lejeune's 1st Battalion, 2nd Marines."[47] The greatest benefit will be the impartation of winter warfare knowledge to more US ground troops. Another is improved gear maintenance and revision of applicable materials needed to continue the Arctic standby. This is an excellent beginning to "winterizing" a US Force. The US Navy needs to involve their expeditionary forces: SEALs, SEABEEs, Navy Divers, and Explosive Ordnance Disposal (EOD) technicians in similar training due to the nature of the environment and the likely classifications of future encounters in the Arctic Theater.

NECC Forces are seeking opportunities to broaden their operating environment. For the first time, Navy Explosive Ordnance Disposal (EOD) divers/technicians deployed to train under winter conditions. In early February 2017, a team of eight Navy EOD technicians participated in EXERCISE ARCTIC SPECIALIST (EX AS17). The purpose of this exercise was to familiarize EOD technicians of the operating conditions in land and maritime conditions of the High North.[48] This exercise allowed divers to expose themselves to extremely cold conditions and gain familiarity in the vary shallow water (VSW) and shallow water (SW) mine-counter-measure (MCM) zones in cold weather conditions. Aside from divers learning what dive gear and equipment they need to use in the environment, autonomous unmanned underwater vehicles (UUV) were also deployed for testing and evaluation.[49] The team further participated in cardio conditioning for the rugged terrain by hiking mountains and conducting land navigation. The team also conducted small arms training to see how reaction times and target acquisition are different when geared for the cold. The Norwegian EOD teams were enthusiastic to host their US allies and share their expertise. Although this is a good start for exposing NECC Forces to Arctic conditions, but it still does not address diving operations in deeper depths nor the potential rescue of personnel from a sunken submarine under thick ice. Ice diving, regardless of thickness is very technical in nature; and fits into the strategic sense of national security in that submarines are a strategic asset and therefore any means to keep submarines operating fits into the requirements for strategic national security.

Figure 6. Arctic Specialist Dive 13FEB2017

Figure 7. Artic Specialist Ruck 05FEB2017

Both Figures Taken from EOD GROUP TWO Public Affairs FaceBook Blog

Recommendations

To strengthen national security and maintain a state of readiness for future Arctic endeavors, the US needs to first acquire means to maneuver at sea; beginning with icebreaking capabilities. US House Representative Duncan Hunter (California), who is the chairman of the House Transportation and Infrastructure subcommittee, believes that the US is lacking in capability and capacity regarding US icebreaking ships when compared to Russia. "Russia is working overtime to strengthen its Arctic presence while the U.S. is acting like a bystander and a nation without any similar strategic interests. With new icebreaking capability, we can exponentially strengthen our presence and guarantee year-round access for reasons of national security, commerce, and research."[50] These icebreakers will allow for further access to the areas not reachable during the ice-covered months with our current aged inventory of 2 icebreakers. The new icebreakers will require a deck space large enough to carry the SRDRS for submarine rescue response as discussed. However, the six planned icebreakers that the USCG is developing are not expected to first be in service in 2023. The USCG is still trying to obtain funding and has reached out to industry to design and develop medium and heavy icebreakers.[51] Representative Hunter must make his point apparent to the Secretary of Homeland Defense and the White

House administration. But even with these icebreakers in US inventory, there is still the tyranny of distance as there are no US Arctic ports or bases.

The *Arctic Roadmap* briefly considers what the requirements are for basing and sea ports in the Arctic. Currently there is little to no infrastructure that is of proximity to the passages to allow for quick rescue and or safe harbor in the event of a ships mechanical or structural damages to those seagoing vessels. Therefore, it would be in the best interests of Canada and the US to establish such infrastructure in the region. A better understanding of the engineering requirements unique to this infrastructure could provide detailed methods in which to accomplish this build. For example, builds will have to take into account permafrost and how to work around the hardened layer. As defined by Webster's Dictionary, Permafrost is "a permanently frozen layer at variable depth below the surface in frigid regions [polar] of a planet." However, expanding on current infrastructure in the region one will note some of the requirements. Infrastructure needs to have large heated warehouses and docking stations so that any vessels that may transit the Northwest Passage or the Bearing Strait may be able to port for repairs. Should those repairs be of a lengthy requirement, a heated and enclosed dry docking may be required to prevent further damage to the ships from incoming ice or winter storms. In addition to more facilities to house and repair surface vessels, the region needs to construct more aviation facilities and airfields.

NORAD utilizes the early warning system of airborne assets to patrol the skies of the Arctic. Both Canada and the US have the capabilities to put man or unmanned systems in the air, but those assets need to come from afar. For the US, the major air installations come out of Alaska and Thule, Greenland. Thule is the most northern and capable base; Canada uses it as a staging and replenishment area for its northern-most installation/listening post in ALERT. The

transit time is lengthy as Thule Base is not centrally located. Having a localized C2 would be cost effective as well as provide timely decisions. Since NORAD is already an established, well operating combined command, this C2 can be a localized detachment of NORAD, with a similar bi-nation manning and reporting. Creating a military installation and merging it into CAN-US would take some coordination and understanding between the two countries. Canada does not want to give up its Arctic sovereignty, but the Canadian government also realizes that without US patrols in its territorial waters that she is at a security disadvantage. Building a North American Arctic security partnership will be vital to deterring aggression as well as provide timely responses to catastrophic situations. Cornwallis Island, located on the northern side of the Northwest Passage should be considered as a potential location to establish an Arctic Center hub. On Cornwallis Island, it is the town of Resolute that holds the most promise for such a multi-national installation.

The Arctic town of Resolute has a civilian airport that the CAF also utilizes, but currently there are not enough facilities and infrastructure to house large amounts of aircraft. Canada's Arctic Training Centre (ATC) consists of three buildings that are owned and operated by the CAF but are not part of a base. Arctic survival and Arctic warfare courses are held here for CAF and exercises are hosted on an annual basis. At the ATC, various gear is staged year-round for use in the region. There are limited numbers of snow mobiles and ATVs as required for Arctic training and exercises. There are also a limited number of BV-200's, a two-cabin tracked vehicle holding up to eleven passengers for traveling on snow and ice. The ATC and the town of Resolute is centrally located along the Northwest Passage and free of sea ice in the summer months, meaning shipping will have access to and from the bay in the town of Resolute. This location has the potential to provide greater opportunities if it were to undergo an upgrade of

technology and infrastructure. In addition to airframe and ground forces support in the Arctic, medical facilities should be invested for those persons requiring care, as they are currently minimal.

The medical facilities in the High North are lacking to say the least. Locals from Resolute fly eight hours to Iqaluit, Baffin Island, for routine medical care. The medical system of the Government of Canada covers the transportation and treatment of personnel; however, it demonstrates the overall lack of medical care availability in the Arctic. The town of Resolute would be an ideal location to establish a medical center that could tend to community and military patients throughout the year, with appropriate medical staff support. The staff do not have to be permanently stationed there, but instead they could be "deployed" to the area comparatively to how both military forces do in support of combat operations in remote areas. The medical facility would also be able to offer more immediate medical support for locals and military alike, providing an alternative to medevac to Alaska, Thule, or Trenton. Proper infrastructure considerations must also be addressed when expanding medical facilities as previously discussed. The facility should be large enough and have appropriate recompression abilities to properly treat those rescued from sea. Any recompression chamber attached to one of the newly commissioned icebreakers would be fixed to the deck and only able to treat small numbers.

Arctic medical facilities need to be readily available across the region to allow for those needing recompression treatment, due to dive or flight decompression requirements. Per the US Navy Dive manual, a recompression treatment must begin as soon as possible, but must begin within six hours of reaching the surface (for omitted decompression).[52] This six-hour window from the diver's location means medical facility locations and manning need to be considered.

The SRDRS is a recompression chamber in of itself but does have a limited physical capacity. Having an additional, separate chamber would provide treatment in massive casualties' scenarios, as well as a potential back up due to SRDRS equipment failure. Another reason for having a recompression chamber in the Arctic is for divers. Divers are used for not only submarine rescue or recovery, but facility upkeep to underwater infrastructure. The ATC would like to have an Arctic Diving School as part of its training curriculum per Maj Chris White[53], the Commanding Office of the ATC at the time. He understands that it is a requirement for all diving to have a recompression chamber and certified diving medical doctor on site. Currently there is no such chamber in the area and divers assume the risk or bring their own chamber if logistics allow. Canada Clearance Divers do have a small, two-person chamber, that they bring with for all diving expeditionary deployments. The chamber can be broken down to portable components, as it has been demonstrated on numerous OP NUNALIVUT exercises, but requires multiple carries by the Twin-Otter planes that primarily run in the region. Furthermore, this system is not all inclusive and must be assembled in a heated and controlled environment. While it is invaluable to smaller operations and exercises, its limited treatment space does not make it ideal for larger operations or rescues. Training in the Arctic environment will be key to sustaining and defending any national security interests with these new command elements, infrastructure, and capacity increases.

Training does not need to be done by the US Forces alone. Through bilateral exercises and information sharing, the US will gain a better level of understanding in how the respective forces operate in the environment, which in turn will give the US a more accurate assessment of appropriate Arctic Warfare. Multinational training has been previously addressed, with Canada and Norway being the two major partners for building an American Arctic Force. However,

when adding up the capacity of US, Canada, and Norwegian assets, they still come short when compared to Russia. Therefore, it is essential to build and maintain relations not only with Arctic countries, but NATO countries along Russia's borders. If there were to be an incident (armed or unarmed), Russia would find itself facing a multi-national coalition in the Arctic, spearheaded by US, the Dutch (Greenland), Norway, and Canada; while facing allied NATO nations in the south. The *Arctic Roadmap* does a good job of stressing that the US must build such relations in order to augment relations specifically in the Arctic.

Conclusion

The United States, as an Arctic Nation, needs to understand the region in its entirety. Mankind has altered nature's equilibrium with its carbon footprint leading to global warming. This has altered the Arctic environment, making it more traversable and easier to obtain Earth's regional resources. These two occurrences will increase mankind's further intrusiveness into the Arctic region, causing a greater impact overall on the region's temperature and surroundings. This increase of multiple nations' presence in the region will lead to an exponential increase in sovereignty and security concerns. To prepare for Arctic Operations, the US Navy needs to properly self-assess and adequately prepare for contingencies to various degrees. The *Arctic Roadmap* is a good start, but it falls short in assessing current Arctic responses to catastrophic situations, both armed and unarmed. The inability to rescue personnel from a sunken submarine trapped under Arctic ice is the first consideration the US Navy must address. This deficit can be addressed by: icebreaker capabilities and capacity; required infrastructure for sea, air, and land assets; localized Command and Control; train in the environment under all conditions; and expanding partnership capacity to deter aggression and provide response for most catastrophic

situations that may occur. Leveraging from friendly and partner nations will help shorten the timeline for such readiness achievements.

The conditions of the Arctic are harsh and unpredictable. If a human life hangs in the balance, be it military or civilian, all means and abilities should be made to save it. As a country, the US has passed "the planning window" for future Arctic plans and defense, and now must address the lack of responsiveness, compared to our greatest Arctic competitor, Russia, and provide the Title 10 needs to US Naval Expeditionary Forces. By addressing US policies regarding the Arctic region, strategies can be developed to strengthen national security while preparing for the Arctic's future endeavors.

---

[1] Heather A. Conley, and Caroline Rohloff, The New Ice Curtain (New York: Center for Strategic International Studies, 2015), I.
[2] *Ibid*.
[3] *Ibid*, XII.
[4] "United Nations Convention of the Law of the Sea," Geneva,1958, *United Nation Convention* (1982), Article 55.
[5] *Ibid*, Article 56.
[6] *Heather A. Conley, and Caroline Rohloff, The New Ice Curtain (New York: Center for Strategic International Studies, 2015),* XI.
[7] *Ibid*.
[8] David Fairhall, *Cold Front*, Counter Piont, Berkeley, CA, 2010, 21.
[9] *Ibid*, 22.
[10] "United Nations Convention of the Law of the Sea," Geneva, 1958, United Nations Convention (1982), Article 57.
[11] Conley and Rohloff, XII.
[12] *Ibid.*
[13] *Ibid*, XIII.
[14] *Ibid.*
[15] David Fairhall, *Cold Front*, 29.
[16] *Ibid*, 147.
[17] *Ibid*.
[18] Shelagh Grant, *Polar Imperative*, Douglas and McIntyre, Quebec, Canada, 2011, pg 451
[19] David Fairhall, *Cold Front*, 30.
[20] Shelagh Grant, *Polar Imperative*, 454.
[21] *Ibid*, 458.
[22] *Ibid*, 458.
[23] Luke Harding, "Russia and Norway Resolve Arctic Border Dispute," *The Guardian*, September 15, 2010. https://www.theguardian.com/world/2010/sep/15/russia-norway-arctic-border-dispute
[24] Shelagh Grant, *Polar Imperative*, 458.
[25] *Ibid*, 459.
[26] *Ibid*, 459.
[27] Department of National Defence, *AOPS Fact Sheet*, Royal Canadian Navy, Ottawa, Canada, January 2015.
[28] Department of Homeland Security, *Polar Icebreaker*, US Coast Guard website accessed 13 January 2017, https://www.uscg.mil/acquisition/icebreaker/

[29] Department of the Navy, *U.S. Navy Arctic Roadmap 2014-2030* (Washington, DC: Chief of Naval Operations Task Force Climate Change, 2014), 7.
[30] RT Question More, *The day the Kursk sank: 15 years on, Russia remembers one of worst-ever submarine tragedies*, rt.com, 12 Aug 2015, https://www.rt.com/news/312234-kursk-submarine-tragedy-anniversary/
[31] *Ibid.*
[32] Naval Sea Systems Command, *US Navy Dive Manual Rev6*, Washington, DC: Department of the Navy, 15 APR 2008, 1-28.
[33] Department of the Navy, *New Submarine Rescue Asset Joins Fleet* (Washington, DC: Team Submarine Public Affairs, 2008), http://www.navy.mil/submit/display.asp?story_id=40147 Accessed 27 SEP 2016.
[34] Edward Lundquist, U.S. Navy Submarine Rescue Diving and Recompression System (SRDRS) Mates With Russian Sub, Defense Media Network, 10 June 2011, http://www.defensemedianetwork.com/stories/u-s-navy-submarine-rescue-system-mates-with-russian-sub/
[35] Edward Lundquist, U.S. Navy Submarine Rescue Diving and Recompression System (SRDRS) Mates With Russian Sub, Defense Media Network, 10 June 2011, http://www.defensemedianetwork.com/stories/u-s-navy-submarine-rescue-system-mates-with-russian-sub/
[36] Department of the Navy, *U.S. Navy Arctic Roadmap 2014-2030* (Washington, DC: Chief of Naval Operations Task Force Climate Change, 2014), 16.
[37] LCDR Nicholas Oldfield, Trip Report OP NUNALIVUT 2016 Initial Planning Conference, Canadian Maritime Operations Group Five, MOG5: 3350-10, October 26, 2015.
[38] LT Adrian Lalancette, RCN, UTM 03-16 Operation Nunalivut 2016, Fleet Diving Unit (Atlantic), Shearwater, Nova Scotia, Canada, 3 February 2016.
[39] LCDR Stephan Julian (Commanding Officer of Canada's Fleet Diving Unit-Atlantic), discussion with, 5 February 2014.
[40] Canada Coast Guard, *Icebreaker Initiative Directive* (Ottawa, Canada: Government of Canada, APR 2015).
[41] Edward Lundquist, U.S. Navy Submarine Rescue Diving and Recompression System (SRDRS) Mates With Russian Sub, Defense Media Network, 10 June 2011, http://www.defensemedianetwork.com/stories/u-s-navy-submarine-rescue-system-mates-with-russian-sub/
[42] Department of the Navy, *U.S. Navy Arctic Roadmap 2014-2030* (Washington, DC: Chief of Naval Operations Task Force Climate Change, 2014), 32.
[43] CNN, "US Military Tests Arctic Operations," *CNN.com*, March 20, 2016, http://www.cnn.com/2016/03/20/politics/gallery/u-s-military-arctic-exercise-icex/.
[44] Major General Odin Johannessen, "Norway's High North Strategy," (lecture, Marine Coprs University, Quantico, VA, January 26, 2017).
[45] Christopher P. Cavas, "Cave-Dwellers: Inside the US Marine Corps Prepositioning Program-Norway," *DefenseNews.com*, published September 20, 2015. http://www.defensenews.com/story/defense/show-daily/modern-day-marine/2015/09/20/inside-us-marine-corps-prepositioning-program-norway/32511065/
[46] Major General Odin Johannessen, "Norway's High North Strategy," (lecture, Marine Coprs University, Quantico, VA, January 26, 2017).
[47] Hope Hodge Seck, "US Marines to Arrive in Norway in First for New Unit", of *Military.com*, published January 9, 2017. http://www.military.com/daily-news/2017/01/09/us-marines-to-arrive-in-norway-in-first-for-new-unit.html
[48] Commodore Ole Morten Sandquist, Exercise Arctic Specialist 2017 Specifications, to Explosive Ordnance Disposal Mobile Unit EIGHT, MCM Detachment, memorandum, May 09,2016.
[49] *Ibid*.
[50] World Tribune, "Geostrategy: Russia takes the Arctic seriously, U.S. has only two icebreakers", *World Tribune Online*, February 20, 2017, http://www.worldtribune.com/geostrategy-russia-takes-arctic-seriously-u-s-has-only-two-icebreakers/
[51] *Ibid.*
[52] US Naval Sea Systems Command, *US Navy Dive Manual Revision 7*, SS521-AG-PRO-010 (Washington, DC: USNAVSEA Systems Command, December 1, 2016), 6-20.
[53] Maj Chris White (Commanding Officer of Canada's Arctic Training Centre), discussion with, 09 January 2016.

Bibliography

Boot, Max. War. *War Made New: Technology, Warfare, and the Course of History, 1500 to Today*. New York: Gotham Books, 2006.

Byers, Michael. *Who Owns the Arctic? Understanding Sovereignty Disputes in the North.* Madeira Park, British Colombia, Canada: 2009.

Canadian Coast Guard. *Icebreaker Initiative Directive*. Ottawa, Canada: Government of Canada, April 2015.

Conley, Heather A. and Caroline Rohloff. "The New Ice Curtain: Russia's Strategic Reach to the Arctic." Center for Strategic & International Studies, Washington, DC: Rowman & Littlefield, August 2015.

CNN, "US Military Tests Arctic Operations," *CNN.com*, March 20, 2016, http://www.cnn.com/2016/03/20/politics/gallery/u-s-military-arctic-exercise-icex/.

Canadian Department of National Defence. *AOPS Fact Sheet*. Ottawa, Canada: Royal Canadian Navy, January 2015.

Fairhall, David. *Cold Front*. Berkeley, CA: Counter Piont, 2010.

Fuglem, John Olav, LCOL, Norwegian Army. "Russian and NATO Future Strategy in the Arctic: The Arctic Security Dilemma; a Russian Escalation without a NATO Counter-Strategy." Master's thesis, Marine Corps University, 2016.

Grant, Shelagh. *Polar Imperative*. Quebec, Canada: Douglas and McIntyre, 2011.

Gray, Colin. *The Future of Strategy*. Malden, MA: Polity Press, 2015.

Haass, Richard. *Foreign Policy Begins at Home: The Case for Putting America's House in Order*. New York: Basic Books, 2013.

Haass, Richard. *A World in Disarray: American Foreign Policy and the Crisis of the Old Order.* New York: Penguin Books, 2017.

Hambling, David. "Russia Built a Big Bad Nuclear Powered Icebreaker to Win the Arctic," *Popular Mechanics*, last modified June 23, 2016, http://www.popularmechanics.com/military/navy-ships/a21484/russia-nuclear-powered-icebreaker/.

Harding, Luke. "Russia and Norway Resolve Arctic Border Dispute." The Guardian, September 15, 2010. https://www.theguardian.com/world/2010/sep/15/russia-norway-arctic-border-dispute

Johannessen, Major General Odin. “Norway’s High North Strategy.” Lecture. Marine Coprs University, Quantico, VA, January 26, 2017.

Kraska, James. *Arctic Security in an Age of Climate Change.* New York: Cambridge University Press: 2011.

Lalancette, LT Adrian, RCN. Unit Temporary Memorandum 03-16 Operation Nunalivut 2016. Fleet Diving Unit (Atlantic), Shearwater, Nova Scotia, Canada. 03 February 2016.

Lansing, LCDR Shawn, USGC. “The Coast Guard Needs More Than Another Icebreaker.” *Proceedings,* February 2017.

Lundquist, Edward. *U.S. Navy Submarine Rescue Diving and Recompression System (SRDRS) Mates with Russian Sub*. Defense Media Network, 10 June 2011, http://www.defensemedianetwork.com/stories/u-s-navy-submarine-rescue-system-mates-with-russian-sub/

Oldfield, LCDR Nicholas J, Trip Report Operation Nunalivut 2016 Initial Planning Conference. Canadian Maritime Operations Group Five, Halifax, Nova Scotia. MOG5: 3350-10, 26 October 2017.

Papp, Admiral Robert J., USCG Ret. “America’s Arctic Imperative.” *Proceedings Magazine,* February 2017.

Sandquist, Commodore Ole Morten. Exercise Arctic Specialist 2017 Specifications to Explosive Ordnance Disposal Mobile Unit EIGHT, MCM Detachment. May 09,2016.

US Coast Guard. “Major Icebreakers of the World”. June 26, 2015. http://www.uscg.mil/hq/cg5/cg552/images/20140626%20Major%20Icebreaker%20chart.pdf

US Department of Homeland Security. *Polar Icebreaker*. Washington, DC: US Coast Guard. August 9, 2016. http://www.uscg.mil/hq/cg9/icebreaker/.

US Department of the Navy. *Arctic Roadmap: 2014-2030*. Washington, DC: Chief of Naval Operations, February 2014.

US Department of the Navy. *New Submarine Rescue Asset Joins Fleet*. Washington, DC: Team Submarine Public Affairs, 2008, http://www.navy.mil/submit/display.asp?story_id=40147 Accessed 27 SEP 2016.

US Department of the Navy. “Submarine Rescue Diving and Recompression System (SRDRS)”. *Navy.mil Fact Sheet*, last modified October 19, 2015. http://www.navy.mil/navydata/fact_display.asp?cid=4100&tid=400&ct=4

US Naval Sea Systems Command. *US Navy Diving Manual Revision 7*. SS521-AG-PRO-010. Washington, DC: USNAVSEA Systems Command. December 1, 2016.

Zellen, Barry Scott. *The Fast-Changing Arctic: Rethinking Arctic Security for a Warmer World.* Calgary, Alberta, Canada: University of Calgary Press, 2013.