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SECURING THE FRONTIER

CHALLENGES AND SOLUTIONS FOR U.S. POLAR MARITIME OPERATIONS

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Cover Graphic: The Coast Guard Cutter Healy breaks ice in the Nome harbor, January 13, 2012. U.S. Coast Guard photo by Petty Officer 2nd Class Charly Hengen.

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CHAPTER 1

Introduction

The Arctic and Antarctic regions are among the most challenging and remote environments on earth. Ice, low temperatures, and moderate to high winds for much of the year make sustained maritime operations difficult to conduct and support. When ships can get underway and remain at sea, they need very long endurance to reach the next port or secure anchorage.

The polar regions are also very different from one another. The Arctic is mostly a maritime region with longstanding shipping, fishing, and oil and gas exploration where temperatures reach 50 degrees Fahrenheit in summer. Antarctica is a 1000-mile-wide continent surrounded by the Southern Ocean where temperatures rarely rise above zero, and activity beyond scientific research is largely precluded by treaty. Despite these differences, both regions remain cold, remote, and sometimes choked by ice. The U.S. Coast Guard (USCG) and U.S. Navy (USN) only have a small fleet of ships, aircraft, and unmanned vehicles that can operate in these conditions to protect U.S. national security interests. Therefore, the maritime services should consider the Arctic and Antarctic together when making decisions regarding polar capabilities and force structure.

The tough weather and distance of polar regions from population centers and infrastructure have limited most expeditions there to researchers or explorers using icebreakers and specialized aircraft, but that is changing. Both areas are becoming more accessible as warming oceans shrink Arctic and Antarctic ice coverage and new technologies such as unmanned vehicles, miniaturized electronics, and nano-engineered materials enable increased polar operations.

Improving access to the poles may facilitate increased exploitation of natural resources. Oil and gas in the Arctic is mostly untapped, whereas resources in the Antarctic are protected by treaty. Although the price of these commodities is relatively low today, establishing claims to polar territory could offer nations future reserves to draw upon when prices rise as predicted during the next decade. The polar regions also offer fisheries that have not been depleted and new sources for minerals such as rare earth metals.

Access to the Arctic and Southern Oceans can enable dramatic reductions in travel time between the Atlantic and Pacific Oceans. Trans-polar routes have been used by aircraft since the mid-twentieth century to move between Europe or Asia and North America. Shipping companies are beginning to use sea routes through the Arctic to save days to weeks on trans-oceanic transits, which can translate into hundreds of thousands of dollars of fuel and personnel costs.

The Arctic and Antarctic regions are also militarily significant. Because polar routes are often the shortest between two nations, such as Russia and the United States, surveillance there is important to homeland defense and missions such as air and missile defense. The remoteness of polar coastlines makes them difficult and expensive to defend, which could be exploited to insert military forces or capabilities into enemy territory. A lesser-known military consideration for the poles is that, unlike satellites in geosynchronous Earth orbit (GEO), satellites in low or medium Earth orbit (LEO and MEO)—such as those in the Global Positioning System (GPS) constellation—rotate the earth several times a day. Without polar ground stations, these satellites would lose radio contact during part of their orbit.

Growing interest in and access to the polar regions comes as the United States finds itself increasingly engaged in great power competition with China and Russia, which are attempting to revise the existing international order to their benefit.[1] Both have invested heavily in their military capabilities in recent years, focused on contesting the regions adjacent to their borders and projecting power abroad. Their efforts extend to the poles; Moscow and Beijing are both pursuing natural resources, access to shipping routes, and the ability to influence Arctic and Antarctic governing bodies.[2]

This study will describe America's national security concerns in the Arctic and Antarctic and assess how they could be affected by changing polar conditions and increased regional activity. It will then explore new concepts and capabilities the United States could implement to better protect its interests and those of its allies and partners in Earth's last frontier.

The Arctic and Antarctic Defined

The remoteness, small indigenous populations,[3] and sparse land borders in the polar regions have driven reliance on international agreements to define territorial boundaries and provide

1 Hal Brands and Eric S. Edelman, *Why is the World So Unsettled? The End of the Post-Cold War Era and the Crisis of Global Order* (Washington, DC: Center for Strategic and Budgetary Assessments, 2017), pp. 11–15.

2 Department of Defense (DoD), Under Secretary of Defense (Policy), *Report to Congress on Strategy to Protect United States National Security Interests in the Arctic Region* (Washington, DC: DoD, December 2016), pp. 7–8, available at https://www.defense.gov/Portals/1/Documents/pubs/2016-Arctic-Strategy-UNCLAS-cleared-for-release.pdf; and Jane Perlez, "China, Pursuing Strategic Interests, Builds Presence in Antarctica," *New York Times*, May 3, 2015, available at https://www.nytimes.com/2015/05/04/world/asia/china-pursuing-strategic-interests-builds-presence-in-antarctica.html?mcubz=0.

3 About 4 million people live across the entire Arctic year-round. Only a few hundred researchers live in Antarctica over winter.

for Arctic and Antarctic governance. As defined in the 1984 Arctic Research and Policy Act, Section 112, the Arctic consists of all regions above the Arctic Circle, or 66.6 degrees north latitude, as well as seas and rivers contiguous with the Arctic.[4] For example, the U.S. definition of the Arctic includes the Bering Sea and the Aleutian Islands. The Antarctic region is defined by the Antarctic Treaty and includes all land and sea areas south of 60 degrees south latitude.[5]

The United Nations Convention on the Law of the Sea (UNCLOS) provides rules for establishing ownership of waters in and around the Arctic and Antarctic. Control of and responsibility for polar areas ashore is established by existing national boundaries in the Arctic and by treaty in the Antarctic.

The Arctic

Due to the Arctic's geography and to agreements between adjoining countries, there are no major territorial disputes in the region today. The Arctic is a largely maritime region surrounded by the six nations with Arctic coastlines, limiting territorial disputes to the location of maritime boundaries that extend 12 nm seaward from their land borders. With the resolution in 2012 of the Norway-Russia maritime boundary, the remaining disputes involve a small area of the Beaufort Sea adjacent to the Alaska-Yukon border and ownership of the uninhabited Han Island between Canada and Greenland. Under UNCLOS, nations have Exclusive Economic Zones (EEZ) extending 200 nm beyond the 12-nm territorial limit where they can exert control over resource extraction. The Arctic Ocean is large enough that the EEZs of the Arctic nations do not overlap. There is, however, the potential for disputes over the expansion of EEZs to encompass the extended continental shelf of Arctic countries, particularly Greenland and Russia. These claims and potential disputes are detailed in Chapter 2.

Coordination of Arctic activities and governance is provided by the Arctic Council, an international group formed in 1996 by the eight countries with territory inside the Arctic Circle: Canada, the Kingdom of Denmark (including Greenland and the Faroe Islands), Finland, Iceland, Norway, Sweden, the Russian Federation, and the United States.[6] Thirteen non-Arctic states, including China, and several non-governmental organizations are observers to the Arctic Council.

The Antarctic

The Antarctic Treaty of 1961 governs territorial claims and activities in the Antarctic region and Antarctica. It recognizes preexisting territorial claims of seven nations that are adjacent to the Antarctic or had longstanding activity there: Australia, New Zealand, Chile, Argentina,

4 Arctic Research and Policy Act, P.L. 98-373, July 31,1984 (amended as P.L. 101-609, November 16, 1990), available at: https://www.nsf.gov/geo/opp/arctic/iarpc/arc_res_pol_act.jsp#104.

5 The Antarctic Treaty, Washington, DC, December 1, 1959, available at http://www.ats.aq/documents/ats/treaty_original.pdf.

6 Arctic Council, Declaration on the Establishment of the Arctic Council, Ottawa, Canada, 1996, available at https://oaarchive.arctic-council.org/handle/11374/85.

France, the United Kingdom, and Norway. The United States and Russia are recognized by the Antarctic Treaty Secretariat as having a "basis for claim" they could exercise in the future. The Antarctic Treaty does not allow any claimant to exert control over their claim or establish new claims. This has precluded territorial disputes in the Antarctic.

The Antarctic Treaty is not permanent, however, and it could eventually change or be abrogated. This has led to efforts by countries such as China to establish a substantial permanent presence in Antarctica that could be the basis for a future claim. And although the treaty prohibits military operations, mining, and oil production in the Antarctic, it does allow scientific research and potential "dual-use" activities such as communications and logistics, which could support future military operations. These allowances have led to increasing efforts by China, the United States, and to a lesser degree Russia to identify potential mineral and petroleum resources, install satellite communication and surveillance systems, and build airfields and port facilities in Antarctica.

A Changing Environment

Temperatures in the Arctic and Antarctic are increasing consistently year over year, reducing sea ice and changing weather patterns. In 2016, Arctic temperatures reached a record high, and sea ice was the thinnest on record.[7] Thin and uneven sea ice coverage, in turn, reduces the amount of reflected solar energy, causing ocean temperatures to rise. This could contribute to thinner ice the following year, continuing a cycle of warming oceans and melting ice. The U.S. government predicts these trends will result in the Arctic being uncovered during the summer by mid-century.[8] This does not mean the Arctic will be completely ice-free. Even when the Arctic Ocean is not covered by ice, ice floes and small icebergs will still be present, having either calved off glaciers on the Arctic coastline or formed in colder areas of water created by eddies or local weather.

The Antarctic is also experiencing warming and loss of sea ice. However, Antarctic temperature increases are not as large as those in the Arctic because the average altitude of Antarctica is more than a mile. Antarctic ice coverage is highly variable, but, on average, ice cover in Antarctica today is 18.2 percent below the 1981–2010 average.[9]

7 National Snow and Ice Data Center, "Arctic Sea Ice Extent," *Arctic Sea Ice News & Analysis*, Daily Image Update, September 5, 2017, available at https://nsidc.org/arcticseaicenews/; and Chris Mooney and James Samenow, "The North Pole is an Insane 36 Degrees Warmer Than Normal as Winter Descends," *Washington Post,* November 17, 2016, available at https://www.washingtonpost.com/news/energy-environment/wp/2016/11/17/the-north-pole-is-an-insane-36-degrees-warmer-than-normal-as-winter-descends/?utm_term=.ce032a816b40.

8 See Jerry Melillo, Terese Richmond, and Gary Yohe, eds., *Climate Change Impacts in the United States: The Third National Climate Assessmen*t (Washington, DC: U.S. Global Change Research Program, 2014), Figure 2.29, "Projected Arctic Sea Ice Decline," available at http://nca2014.globalchange.gov/report/our-changing-climate/melting-ice/graphics/projected-arctic-sea-ice-decline.

9 Scott Waldman, "Climate Change Is Turning Antarctica Green," *Scientific American,* May 19, 2017, available at https://www.scientificamerican.com/article/climate-change-is-turning-antarctica-green/.

In addition to reducing sea ice, higher temperatures melt permafrost. This is especially problematic in Arctic Alaska and Siberia where coastal roads, port infrastructure, and airfields are built upon low-lying permafrost. Today, towns in Alaska are relocating; the land is melting underneath them and rising sea levels cause more frequent flooding.[10] The loss of associated ports and airfields could make Arctic logistics and search and rescue (SAR) more difficult.

The melting of permafrost also contributes to future climate change. Permafrost binds carbon in the cellulose of its mosses and lichens. When it melts and the plant materials decompose, this carbon is released as carbon dioxide and methane, increasing greenhouse gas concentrations in the atmosphere.[11]

Implications of Changing Polar Environments

Receding polar ice will make the Arctic and the Antarctic regions more accessible for longer periods each year. Natural resources such as oil, gas, and fisheries will become easier to find and exploit, which could increase demands on naval and coast guard forces for regulatory enforcement, maritime security, SAR, and environmental response. Warming waters and thinner ice will also enable military operations and shipping to expand in the polar regions. Although the Antarctic Treaty precludes military operations in the region, non-combat activities such as logistics, surveillance, and communications are generally interpreted to lie outside its scope.

The current U.S. fleet of ships and aircraft capable of operating in the Arctic and Antarctic is aging and shrinking. The USCG has two heavy icebreakers, one of which is operable, and one medium icebreaker; the National Science Foundation operates a light icebreaker.[12] Although submarines can operate under polar ice and surface through pack ice, the USN has no ice-hardened surface combatants, amphibious ships, or aircraft carriers (CVN) able to operate in regions containing icebergs or ice floes. The U.S. Air Force has ten LC-130 aircraft able to operate from polar bases such as those in Antarctica.[13] Together, these forces will not have sufficient capacity or the right capabilities to address growing demands for polar operations such as maritime security, SAR, surveillance, or disaster response.

10 Robert Ferris, "Thawing Alaska Permafrost Alarms Scientists," *CNBC,* August 23, 2017, available at https://www.cnbc.com/2017/08/23/thawing-alaska-permafrost-alarms-scientists.html.

11 Henry Fountain, "Alaska's Permafrost Is Thawing," *The New York Times,* August 23, 2017, available at https://www.nytimes.com/interactive/2017/08/23/climate/alaska-permafrost-thawing.html?mcubz=0&_r=0.

12 The Coast Guard classifies a heavy icebreaker as one having more than more than 45,000 brake horsepower (BHP) propulsion power; a medium icebreaker as having 20,000 to 45,000 BHP; and a light icebreaker as having less than 20,000 BHP. See U.S. Coast Guard, "U.S. Coast Guard's 2013 Review of Major Icebreakers of the World," *USNI News*, July 23, 2013, available at https://news.usni.org/2013/07/23/u-s-coast-guards-2013-reivew-of-major-ice-breakers-of-the-world.

13 Kerry Jackson, "LC-130 takes off for Operation Deep Freeze," *U.S. Air Force News,* October 21, 2010, available at http://www.af.mil/News/Article-Display/Article/115244/lc-130-takes-off-for-operation-deep-freeze/.

This report assesses likely requirements for USN and USCG operations that will result from the changing nature of Arctic and Antarctic activities. This will include protection and support of commercial ventures such as shipping, tourism, and resource exploitation as well as military operations to protect U.S. and allied territory and EEZs. The report will translate these future needs into recommendations for new operational concepts and capabilities that will improve the ability of USN and USCG forces to protect U.S. interests in these last frontiers.

CHAPTER 2

Arctic Issues

America's national security interests in the Arctic include sustaining maritime access, protecting natural resources, and preventing hostile powers from encroaching on the territory of the United States and its allies and partners. As ice coverage recedes, shipping lanes and resources such as oil, gas, minerals, and fisheries will become more accessible. The Arctic nations and China are increasing the number and frequency of commercial and military operations in the polar regions to begin exploiting these potential benefits. This may also establish a pattern of use to support future territorial claims.

The Arctic Council is "the leading intergovernmental forum promoting cooperation, coordination, and interaction among the Arctic states." It is composed of the eight Arctic states,[13] non-Arctic observer states, and six organizations representing indigenous Arctic natives.[14] While it is not an enforcement body and does not deal with security issues, the Arctic Council does provide a consultative function between nations having territory above the Arctic Circle. Finland, Sweden, and Iceland are all Arctic Council members who do not have any coastline on the Arctic Ocean. They are sometimes referred to as the "Arctic Three" to contrast them with the "Arctic Five" countries that have Arctic coasts.[15]

14 "The Arctic Council: A Backgrounder," Arctic Council, May 26, 2017, available at https://www.arctic-council.org/index.php/en/about-us.

15 Willy Ostreng et al., *Shipping in Arctic Waters* (Heidelberg, Germany: Springer-Verlag Berlin, 2013), p. 67.

Territorial and Sovereignty Disputes

There are no major disputes over territorial waters or EEZs in the Arctic; there are, however, four less-significant unresolved Arctic territorial and sovereignty issues that are being addressed through mid-level diplomatic negotiations:

1. Canada and the United States disagree over the maritime boundary between their EEZs in the Beaufort Sea. In 2016, the United States proposed including the disputed area in its 2017–2022 offshore oil and gas leasing program. In response, Canada alleged that the sale would violate its sovereignty.[16] Both the Chukchi and Beaufort Sea areas were subsequently removed from the 2017–2022 lease program when the Obama Administration placed large portions of the U.S. Arctic off-limits to oil and gas drilling.[17] Current efforts by the U.S. government to restart Arctic oil and gas leasing may resurface this disagreement.

2. The United States maintains that the Northwest Passage and Northern Sea Route Arctic shipping routes should be treated as international straits outside the control of any single country. Canada and Russia maintain that these passages are inland waterways that can be regulated and controlled by the claimant countries.[18]

3. The United States and Russia have a dispute over one area of the Bering Sea. An agreement was signed in 1990 to allow the United States to exercise EEZ jurisdiction over the area, and that agreement has been adhered to in subsequent diplomatic exchanges. Although the agreement was ratified by the U.S. Senate, it has yet to be confirmed by the Russian Duma.[19]

4. Denmark and Canada have an ongoing disagreement concerning the status of Hans Island, an uninhabited island in the strait between Nunavut and Greenland.[20]

16 Chris Windeyer, "Proposed U.S. Beaufort Sea Drilling Leases Infringe on Canada's Sovereignty, Says Yukon," *CBC News*, March 19, 2016.

17 Darryl Fears and Juliet Eilperin, "President Obama Bans Oil Drilling in Large Areas of Atlantic and Arctic Oceans," *Washington Post,* December 20, 2016.

18 Ostreng et al., *Shipping in Arctic Waters*, p. 13.

19 Ronald O'Rourke, *Changes in the Arctic: Background and Issues for Congress* (Washington, DC: Congressional Research Service, December 7, 2016), p. 22.

20 Ibid., p. 22.

A more significant series of disputes may emerge over the next decade regarding extended continental shelves. Article 76 of UNCLOS grants countries rights over natural resources in the seabed of their continental shelves that go beyond the boundaries of their 200 nm EEZ to a maximum of 350 nm from their coasts.[21] Canada, Russia, Norway, and Denmark have submitted, have plans to submit, or intend to carry out revisions to their extended continental shelf (ECS) claims in the Arctic. Many of these ECS claims could overlap one another. And although it is not a signatory to UNCLOS, the United States has established an interagency task force, the U.S. ECS Project, charged with "coordinating the collection and analysis of all relevant data and preparing the necessary documentation to establish the outer limits of the U.S. ECS."[22]

Figure 1 depicts territory claimed in the Arctic, including EEZs and potential extensions of EEZs. It is likely that ECS claims from Denmark, Russia,[23] the United States, and Canada[24] could overlap one another. This is especially problematic regarding Russia, given the importance of the Arctic to Russian national security. The Arctic is the source for most Russian natural gas and some oil. More importantly, the Arctic Ocean is a key operating location for Russia's ballistic missile submarines (SSBN) and it provides a protected bastion within the Barents, Kara, and White Seas in which the Russian Northern Fleet can train and transit to open ocean.

21 United Nations Convention on the Law of the Sea, December 10, 1982, art. 76, "Definition of the Continental Shelf," available at http://www.un.org/depts/los/convention_agreements/texts/unclos/unclos_e.pdf.

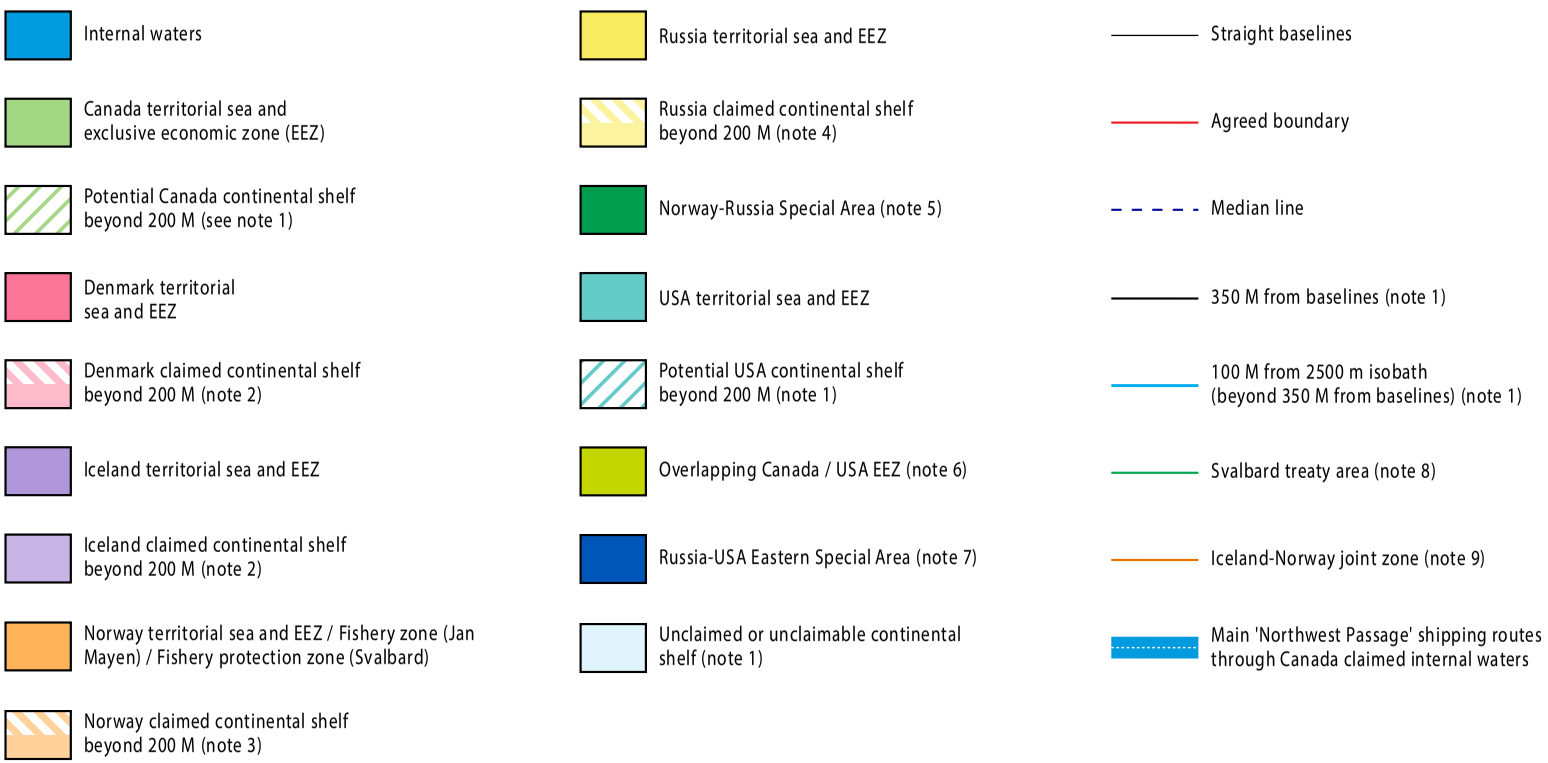
22 "What is the U.S. ECS Project?" U.S. Extended Continental Shelf Project, accessed on August 22, 2017, available at https://www.continentalshelf.gov/about/index.htm.

23 Bob Reiss, "Why Putin's Russia Is Beating the U.S. in the Race to Control the Arctic," *Newsweek*, February 25, 2017, available at http://www.newsweek.com/why-russia-beating-us-race-control-arctic-560670.

24 Levon Sevunts, "Canada to Submit Its Arctic Continental Shelf Claim in 2018," *Radio Canada International*, May 3, 2016, available at http://www.rcinet.ca/en/2016/05/03/canada-to-submit-its-arctic-continental-shelf-claim-in-2018/.

FIGURE 1: ARCTIC TERRITORIAL BOUNDARIES AND EXTENDED EEZ

Map Source: IBRU, Durham University, UK. The original map is available at http://www.durham.ac.uk/ibru/resources/arctic, along with the briefing notes that accompany the map.


Internal waters
Canada territorial sea and exclusive economic zone (EEZ)
Potential Canada continental shelf beyond 200 M (see note 1)
Denmark territorial sea and EEZ
Denmark claimed continental shelf beyond 200 M (note 2)
Iceland territorial sea and EEZ
Iceland claimed continental shelf beyond 200 M (note 2)
Norway territorial sea and EEZ / Fishery zone (Jan Mayen) / Fishery protection zone (Svalbard)
Norway claimed continental shelf beyond 200 M (note 3)
Russia territorial sea and EEZ
Russia claimed continental shelf beyond 200 M (note 4)
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100 M from 2500 m isobath (beyond 350 M from baselines) (note 1)
Svalbard treaty area (note 8)
Iceland-Norway joint zone (note 9)
Main 'Northwest Passage' shipping routes through Canada claimed internal waters

Onshore and Offshore Oil and Gas Extraction

The resolution of competing Arctic ECS claims would have limited economic implications. In 2008, the U.S. Geological Survey (USGS) estimated that 13 percent of the world's undiscovered oil and 30 percent of the world's undiscovered gas lay in the Arctic.[25] The USGS assesses that most of these reserves are within the 200 nm EEZ limit and are concentrated between the shoreline and the 500-meter contour line.[26] While some oil and gas is projected to be in potentially disputed extended EEZs, this oil would be some of the most expensive Arctic oil to extract.

Confrontations over offshore Arctic oil reserves, if they occur, are not likely until the 2020s at the earliest. Drilling in the Arctic is technically challenging and expensive. Low temperatures can cause equipment to fail if it is not specially designed to cope with the climate. The high latitude region offers little infrastructure to support drilling and extraction, forcing companies to build their own or invest in costly work-arounds. Offshore drilling can only occur during summer months and, even then, only with the assistance of ice-hardened ships or icebreakers.

Extraction costs for offshore Arctic oil average about $70 per barrel.[27] Oil prices have been between $48 and $58 per barrel during 2017 and are not projected to reach $70 per barrel until 2020, when current excess stockpiles are depleted.[28] The Russian government, which has aggressively asserted its territorial claims elsewhere, estimates its cost to extract offshore in its portion of the Arctic are between $70 and $100 per barrel. This has constrained Russia's offshore production and could reduce the likelihood of confrontations over disputed extended EEZs.[29]

That is not to say oil and gas production are not economically viable ashore or in more accessible areas of the Arctic. The first Arctic oil and gas discoveries occurred in the 1920s and 1930s in Canada, Alaska, and northern Russia.[30] Sixty-one large hydrocarbon fields have been identified in the Arctic since then, 46 of which are in production. Of those 61 large fields, 42 are in Russia, six in Alaska, 11 in Canada, and one in Norway.[31]

25 Donald L. Gautier et al., "Assessment of Undiscovered Oil and Gas in the Arctic," *Science* 324, no. 5931, May 29, 2009.

26 Ostreng et al., *Shipping in Arctic Waters*, p. 102.

27 James Henderson, "How Saudi Arabia's Grip on Oil Prices Could Bring Russia to Its Knees," *War in Context,* February 2, 2016, available at http://warincontext.org/2016/02/02/how-saudi-arabias-grip-on-oil-prices-could-bring-russia-to-its-knees/.

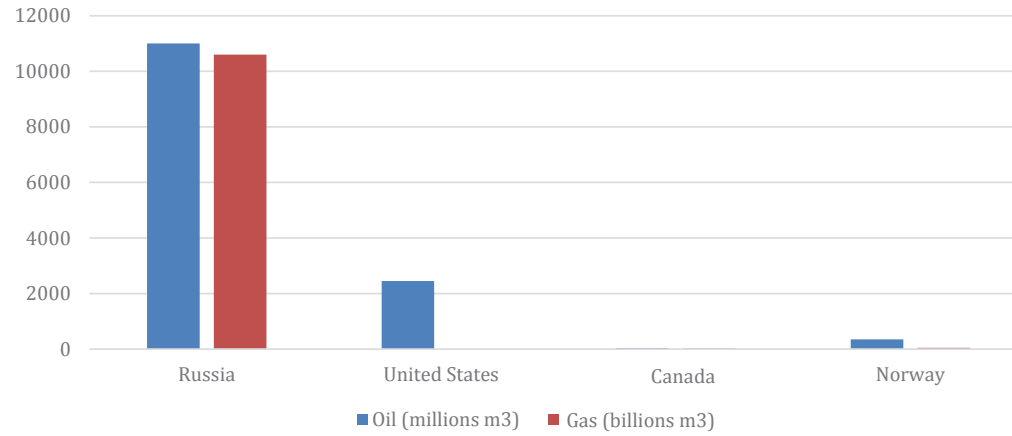
28 "End of day Commodity Futures Price Quotes for Crude Oil WTI (NYMEX)," *NASDAQ*, August 23, 2017, available at http://www.nasdaq.com/markets/crude-oil.aspx?timeframe=1y; and International Energy Agency, "Global Oil Supply to Lag Demand after 2020 Unless New Investments are Approved Soon," *IEA Newsroom,* March 6, 2017, available at https://www.iea.org/newsroom/news/2017/march/global-oil-supply-to-lag-demand-after-2020-unless-new-investments-are-approved-so.html.

29 Elena Mazneva and Dina Khrennikova, "Russia Can Wait for $70 Oil Before Re-Entering Arctic Waters," *Bloomberg*, updated March 29, 2017, available at https://www.bloomberg.com/news/articles/2017-03-28/russia-can-wait-for-70-oil-before-returning-to-arctic-waters.

30 Arctic Monitoring and Assessment Program (AMAP), *Arctic Oil and Gas 2007* (Oslo, Norway: AMAP, 2007), p. 14.

31 Ostreng et al., *Shipping in Arctic Waters*, p. 99.

FIGURE 2: CUMULATIVE ARCTIC OIL AND GAS PRODUCTION, 1960–2004



Data from *Arctic Oil and Gas 2007*, pp. 16–17.

Of all the states currently undertaking Arctic oil and gas extraction, Russia has the most mature high latitude production apparatus and is responsible for roughly 80 percent of all Arctic oil and 99 percent of all Arctic gas production. Within Russia, Arctic fields supplied 81 percent of natural gas output and 17 percent of crude output in 2016, making the region critical to Russia's economic wellbeing.[32] Existing Russian Arctic hydrocarbon fields are mostly located in Western Siberia, and their output is expected to fall abruptly over the next two decades.[33] Russia hopes to offset this decline by developing new offshore fields in the Barents and Kara Seas. However, Russia has so far avoided expanding its exploration of the offshore Arctic fields while oil remains below $70 a barrel.[34]

Most Norwegian oil production has come from large fields in the North Sea. Norway's oil output reached its peak in 2001 and has declined ever since. Consequently, exploration in the comparatively under-examined Barents Sea is critical to the country's future as a major oil exporter.[35] In contrast to Russia, Norway is drilling new wells in the Barents Sea because its oil companies are confident they can break even despite low oil prices. One factor contributing to Norway's bullishness is the lack of sea ice in the portion of the Barents just north of Norway, which reduces the costs of extraction operations relative to other Arctic locations.[36]

Like Russia and Norway, Alaska faces declining oil production from its existing onshore fields. An additional variable for Alaska is the minimum level of throughput required to keep

32 Mazneva and Khrennikova, "Russia Can Wait for $70 Oil."

33 Barry Scott Zellen, ed., *The Fast-Changing Arctic: Rethinking Arctic Security for a Warmer World* [Kindle version] (Calgary, Alberta: University of Calgary Press, 2013), loc. 5816.

34 Mazneva and Khrennikova, "Russia Can Wait for $70 Oil."

35 Mikael Hook and Kjell Aleklett, "A Decline Rate Study of Norwegian Oil Production," *Energy Policy* 36, no. 11, November 2008.

36 Mikael Holter, "What Oil Crisis? Arctic Drilling Off Norway Set for Record," *Bloomberg*, February 15, 2017.

the Trans-Alaska Pipeline System (TAPS) economically viable. TAPS was completed in 1977 and runs between Prudhoe Bay and Valdez, Alaska, after which oil is transferred to tankers for shipment to the lower 48 states. The pipeline is crucial to the success of North Shore oil production in Alaska because it obviates the need to send tankers around the Aleutian Islands into the challenging North Alaskan seas. TAPS has also allowed Alaska to develop North Shore energy projects without a nearby deep draft port.

Without significant new sources of northern Alaska oil, the rate of production decline at existing North Shore oil fields could make oil too expensive to ship via TAPS by the mid-2020s.[37] The pipeline may continue to operate at low throughput levels thanks to its importance for the Northern Alaskan region, but the increasingly high costs of operation will dissuade oil companies from investing in new North Shore oil projects.

The late 2000s were a period of great optimism for oil development along the Alaskan North Shore. However, the declining oil prices of the past few years and the technical challenges of operating in the Arctic have reduced oil companies' appetite for Alaskan oil development. In 2015, Shell elected to discontinue exploration following a collection of disappointing results from a test well in the Chukchi Sea after spending seven years and $8 billion. In 2016, Royal Dutch Shell, ConocoPhillips, and others gave up drilling rights in Alaska that had been purchased for a total of $2.5 billion.[38] In June 2017, the U.S. oil company Caelus declared that it would delay drilling a test well at its discovery in Alaska's Smith Bay due to low oil prices, challenging local conditions, and a tax dispute with the Alaskan government.[39]

Despite these setbacks, the U.S. government continues to promote oil exploration in Alaska by seeking a reversal of the current ban on oil exploration in the Arctic National Wildlife Refuge (ANWR).[40] New onshore discoveries may allow oil companies to avoid the costly technical complications of offshore drilling in the Arctic. In March of 2017, a partnership between the Spanish oil company Repsol and the U.S. company Armstrong Oil and Gas announced that it had discovered a 1.2 billion-barrel onshore field adjacent to the National Petroleum Reserve-Alaska (NPR-A) that could be ready for production by 2021.[41] If those projections are accurate, then the Repsol-Armstrong field would be the largest onshore discovery in Alaska of the past three decades. A second large field was discovered by ConocoPhillips in the NPR-A in March 2017 that could yield as much as 100,000 barrels of oil daily.[42]

37 Tim Bradner, "Infrastructure Investment Climate for Oil and Gas Industry," *Alaska Business*, April 2017, p. 100.

38 Jennifer A. Dlouhy, "Big Oil Abandons $2.5 Billion in U.S. Arctic Drilling Rights," *Bloomberg*, May 10, 2016.

39 Alex DeMarban, "Caelus Delays Drilling at Smith Bay, Leaving a Big Alaska Energy Prospect Unconfirmed," *Alaska Dispatch News*, June 12, 2017.

40 Matt Egan, "Trump Wants to Drill for Oil in Alaska's Fragile Wildlife Refuge," *CNN,* May 25, 2017.

41 Matt Egan, "Massive Oil Discovery in Alaska is Biggest Onshore Find in 30 Years," *CNN*, March 10, 2017.

42 Alex DeMarban, "ConocoPhillips Announces Alaska Discovery with Daily Production Potential of 100,000 Barrels," *Alaska Dispatch News,* March 9, 2017.

Drilling in the Arctic creates environmental risks due to the volume of oil or gas being extracted and transported. The most catastrophic consequence of greater drilling would be an oil well blow-out or a tanker spill. There is considerable uncertainty in the scientific community about the interaction between oil and the unique characteristics of the Arctic environment, such as sea ice.[43] However, it is well understood that oil undergoes biological degradation more slowly at cold temperatures than at warm temperatures, potentially allowing an Arctic oil spill to linger for 50 years or more.[44]

The negative impact of an oil spill in the Arctic would likely be exacerbated by a slow response time. There is little emergency infrastructure in the Arctic, and the emergency services that do exist lack specialized spill response equipment or training. Responders moving from the Continental United States (CONUS) or other southern locations to the Arctic region have a long distance to travel, leading some experts to fear there would be a "response gap" in the case of a high latitude oil accident. After arrival, the responders' operations would be hindered by the limited port infrastructure throughout the Arctic.

Onshore Mineral Resources

The Arctic is home to considerable mineral reserves; many have remained untapped due to the difficulty of accessing them. The diminishing Arctic sea ice may open new routes to these existing reserves, making it easier to sustain mining operations and transport extracted minerals. In addition, receding glaciers may expose previously hidden mineral deposits that are suitable for extraction.[45]

As with oil and gas, Russia possesses the largest amount of Arctic mineral resources of any Arctic nation. Russia has explored some 20,000 deposits and mined approximately 30 percent of them.[46] In the United States, Alaska is the fifth largest state producer by value of minerals, with most of its revenues coming from zinc, gold, and silver.[47] Canada and Norway also carry out Arctic mining, with their Arctic reserves accounting for 5 percent and 50 percent of their total national mineral production by value, respectively.[48]

Arctic Shipping and Cruise Sailing

Territorial disagreements could also emerge over international transit lanes. For example, the United States has ongoing disagreements with Russia and Canada over the three main routes

43 O'Rourke, *Changes in the Arctic* (2016), p. 36.

44 Ostreng et al., *Shipping in Arctic Waters*, p. 159.

45 O'Rourke, *Changes in the Arctic* (2016), p. 33.

46 Ostreng et al., *Shipping in Arctic Waters*, p. 106.

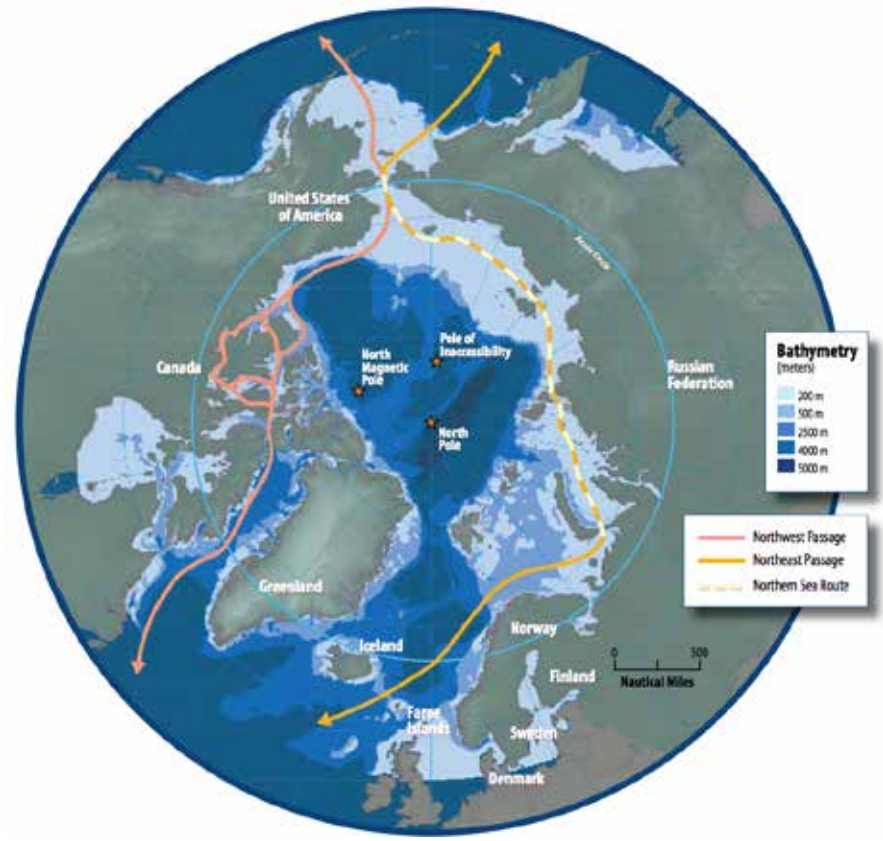
47 Ibid., p. 107.

48 Ibid., p. 107.

that connect the Pacific and Atlantic Oceans via the Arctic: The Northern Sea Route along the Russian coast, the Northwest Passage along the Canadian coast, and a third route across the North Pole (see Figure 3). Of these, the continued presence of ice floes in the mid-Arctic Ocean and along the Northwest Passage will likely make them less reliable than the Northern Sea Route. The Northwest Passage will likely be affected by ice even after the mid-Arctic becomes ice-free in summer because it consists of a series of narrow channels.[49]

Arctic traffic falls into one of two categories: transit traffic or destination traffic. Transit traffic refers to ships that pass through the Arctic on their way from a non-Arctic embarkation point to a non-Arctic destination.[50] Destination traffic refers to ships whose destination is an Arctic port and whose point of origin may either have originated in the Arctic or outside the Arctic. Historically, most Arctic shipping has constituted destination traffic.

FIGURE 3: ARCTIC SHIPPING ROUTES



Map Source: Protection of the Arctic Marine Environment (PAME), *Arctic Marine Shipping Assessment*, 2009 Report (Iceland and Norway: The Arctic Council, 2009), available at https://www.pmel.noaa.gov/arctic-zone/detect/documents/AMSA_2009_Report_2nd_print.pdf.

49 Ibid., p. 13.

50 Frederic Lasserre et al, "Polar Seaways? Maritime Transport in the Arctic: An Analysis of Shipowners' Intentions II," *Journal of Transport Geography* 57, December 2016, p. 107.

The Northern Sea Route is between 2,200 and 2,900 nm long and skirts Russia's northern coast between Murmansk in the west and Provideniya in the east. First navigated by the Swedish scientist A.E. Nordenskjold in 1879, the Northern Sea Route has been vital to the sustainment of Russia's many northern Siberian communities and the resource extraction industries that they support. At the height of economic activity on the Northern Sea Route in the 1980s, the Soviet Union operated an Arctic fleet of almost 700 ice-hardened vessels and 38 icebreakers, including six nuclear icebreakers.[51] However, the economic collapse Russia experienced following the dissolution of the Soviet Union dramatically reduced the amount of investment in Northern Sea Route communities and businesses, and the volume of Northern Sea Route shipping fell by 77 percent between 1987 and 1998.[52]

The last several years have seen a steady, but not dramatic, uptick in Northern Sea Route shipping as Russia has sought to reinvigorate its Arctic economic program. Transit and destination shipping traffic there are constrained by recent sanctions, the route's shallow depth, and weather. Nevertheless, shipping traffic grew by 35 percent between 2015 and 2016 and is predicted to reach 75 million tons a year by 2025.[53] By comparison, the Panama Canal moved 330.7 million tons of transit shipping in 2016.[54] Of the 7.33 million tons of cargo moved via the Northern Sea Route in 2016, 3.5 million tons were oil and oil products; 3.4 million tons were other dry cargo; 114,000 tons were related to liquefied natural gas (LNG) extraction; 220,000 tons were coal; and 55,000 tons were ore concentrate.[55]

The Northwest Passage runs through the Canadian Archipelago between Baffin Bay in the east and the Beaufort Sea in the west. Northwest Passage routes that pass north of Banks or Victoria Islands can generally be thought of as the northern routes and are shorter than the more circuitous southern route passing through Amundsen or Coronation Gulfs. However, the northern routes are also more prone to blockages by ice. They first opened to unaided navigation as recently as 1998.[56] The southern routes have been intermittently open since the 1970s, but they are narrower, shallower, and longer than the northern routes and therefore less appealing for trans-Arctic shipping.[57] Less resource extraction occurs at Northwest Passage ports than along the Northern Sea Route. Therefore, the Canadian government has never prioritized Arctic infrastructure development in the same way as the Soviet and Russian

51 Ostreng et al., *Shipping in Arctic Waters*, p. 19.

52 Ibid., p. 19.

53 "Traffic Volume on the Northern Sea Route Increased in 2016," Centre for High North Logistics (CHNL), Information Office, February 2, 2017, available at http://www.arctic-lio.com/node/264. The source of CHNL's information is the Russian news repository site PortNews, available at http://portnews.ru/news/.

54 See "Panama Canal Records Third Highest Annual Cargo Tonnage in Fiscal Year 2016," Panama Canal Authority press release, October 20, 2016, available at http://www.pancanal.com/eng/pr/press-releases/2016/10/20/pr610.html.

55 "Traffic Volume on the Northern Sea Route Increased in 2016," CHNL.

56 Anne Casselman, "Will the Opening of the Northwest Passage Transform Global Shipping Anytime Soon?" *Scientific American*, November 10, 2008.

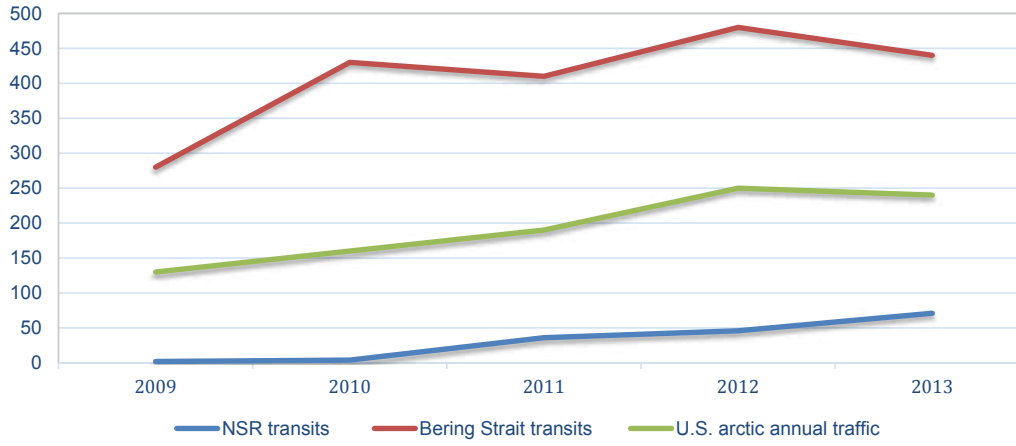
57 Tom Di Liberto, "Northwest Passage Clear of Ice Again in 2016," *ClimateWatch Magazine*, September 16, 2016.

governments. Consequently, the Northwest Passage has lower traffic levels than the Northern Sea Route and is considered less viable as a future trans-Arctic shipping route.[58]

The Transpolar Route goes directly across the Central Arctic Ocean. As such, the majority of the route does not fall within the territorial bounds of any of the Arctic states. At present, only icebreakers are able to navigate to the North Pole and, with one exception, only during summer months.[59] Some predictions assess that ocean warming could allow unaided navigation in ice-diminished conditions on the Transpolar Route by the middle of this century.[60]

The navigable season for Arctic sea lanes is generally from June to October, when the ice melts sufficiently to allow passage of conventional or ice-hardened vessels at lower latitudes and icebreakers at higher latitudes. The changes to Arctic sea ice mass and volume described in Chapter 1 have resulted in an expanded season in many parts of the Arctic, which has subsequently increased shipping traffic (see Figure 4).

FIGURE 4: ARCTIC SHIPPING ACTIVITY



Data from Alyson J. Azzara et al., *A 10-Year Projection of Maritime Activity in the Arctic Region* (Washington, DC: The International Council on Clean Transportation, January 1, 2015), p. 23.

The savings from shipping via the Arctic could be substantial. Using the Northwest Passage or Northern Sea Route can reduce the travel time from the Atlantic to Pacific by four to ten days, saving hundreds of thousands of dollars in fuel and personnel costs.[61] However, cost savings—and interest in Arctic shipping routes—are affected by the same oil prices that affect petroleum

58 Ostreng et al., *Shipping in Arctic Waters*, p. 30. Fraunhofer Gesellschaft (FhG), "Safe Navigation Through the Northwest Passage," *Phys.org News*, November 3, 2016, available at https://phys.org/news/2016-11-safe-northwest-passage.html.

59 Ostreng et al., *Shipping in Arctic Waters*, p. 34.

60 Jugal K. Patel and Henry Fountain, "As Arctic Ice Vanishes, New Shipping Routes Open," *The New York Times*, May 3, 2017.

61 Ed Struzik, "Shipping Plans Grow as Arctic Ice Fades," *Yale Environment 360*, November 17, 2016, available at http://e360.yale.edu/features/cargo_shipping_in_the_arctic_declining_sea_ice.

exploration in the Arctic. The savings from using Arctic routes decreased as oil prices dropped over the last several years.[62] When oil prices rebound over the next five to ten years, interest in these routes is likely to increase again.

The Arctic is also becoming more popular with tourists who will travel on these same routes. In 2005, only 11 cruises travelled through the Arctic. In 2015, 45 cruises made an Arctic voyage.[63] Oil price fluctuations are unlikely to significantly affect cruise traffic, which is expected to increase in volume and reach to include expeditions to northern Greenland, Norway's island of Svalbard, and Russia's Arctic national park.

The number of Arctic cruise passengers originating in Svalbard, Jan Mayen, Greenland, Canada, and Russia climbed from just over 50,000 in 2005 to over 70,000 in 2015.[64] Most Arctic passenger ships have remained in the high latitudes of the North Atlantic rather than undertaking a trans-Arctic passage. However, some vessels do operate further north. In 2016, the cruise liner *Crystal Serenity* became the largest cruise ship to navigate the Northwest Passage. A second Arctic voyage has been scheduled for the ship in August 2017, and there are currently between 15 and 20 ice-strengthened cruise vessels on order by various cruise operators.[65] In addition to dedicated cruise ships, Russian polar icebreakers also host passengers on Arctic sightseeing tours.

In short, the quantity of Arctic shipping traffic is likely to grow in the future as the volume of Arctic sea ice diminishes. A reduction in sea ice would open Arctic routes to navigation for longer periods than they are open today, potentially allowing shipping companies to make use of Arctic routes that could reduce cargo transit times. Increased natural resource exploration and extraction and overall growth in the global economy could also lead to additional shipping traffic.

A study conducted by the U.S. Committee on the Marine Transportation System in 2015 projected vessel activity growth in the U.S. Arctic region (comprising the northern Bering Sea, the Bering Strait, and the Chukchi and Beaufort Seas to the Canadian boundary). The study evaluated current Arctic shipping trends and examined different scenarios for global economic growth and Arctic development, then derived three estimates for vessel traffic increases (see Figure 5). The projections ranged from a 120 percent to 430 percent increase in the number of vessels using the Arctic in 2025 compared to 2013 and a 150 percent to 500 percent increase in the number of Arctic transits in 2025 compared to 2013.[66]

62 Malte Humpert, "Is Northern Sea Route Shipping in a Deep Freeze?" *Arctic Deeply,* News Deeply, June 6, 2016, available at https://www.newsdeeply.com/arctic/articles/2016/06/06/is-northern-sea-route-shipping-in-a-deep-freeze.

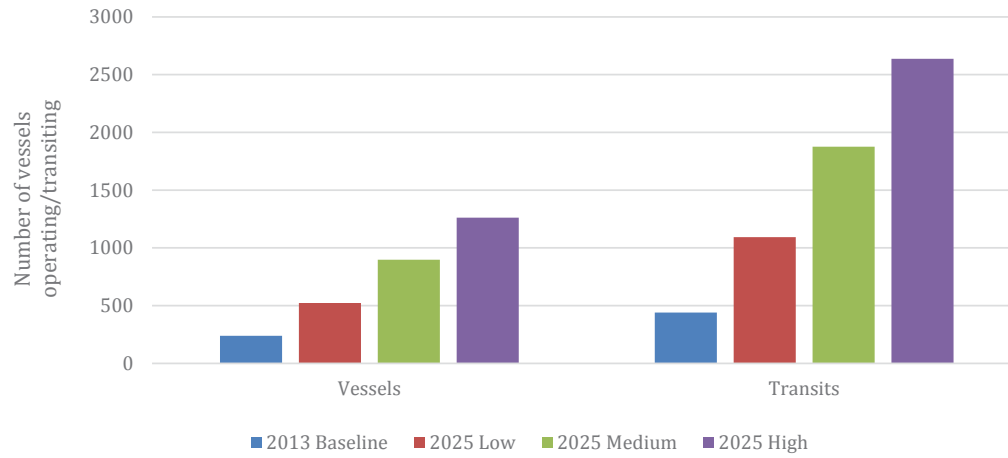
63 Struzik, "Shipping Plans Grow as Arctic Ice Fades."

64 Aaron Lawton, "Cruise Tourism in the Arctic," Presentation at the 7th Symposium on the Impacts of an Ice-Diminishing Arctic on Naval and Marine Operations, Washington, DC, July 18, 2017.

65 Lawton, "Cruise Tourism in the Arctic."

66 Alyson J. Azzara et al., *A 10-Year Projection of Maritime Activity in the Arctic Region* (Washington, DC: The International Council on Clean Transportation, January 1, 2015), p. 57.

FIGURE 5: PROJECTED FUTURE ACTIVITY IN THE U.S. ARCTIC REGION



Data from Azzara et al., *A 10-Year Projection of Maritime Activity in the Arctic Region*, p. 57.

Although the volume of Arctic shipping is likely to grow, the most optimistic predictions, which envision Arctic transit routes challenging existing major sea lanes, seem unlikely to materialize. Arctic shipping is currently hindered by environmental and technical challenges that will persist for several decades into the future—even as periods of ice-diminished conditions lengthen. Ice conditions are unpredictable and, even during ice-diminished summer months, present mariners with icebergs and other navigation hazards that could damage or sink an unprotected vessel. Future reductions in Arctic sea ice will likely increase the variability and unpredictability of ice conditions rather than diminish them. Thick multi-year ice that is typically bounded by one-year ice may be allowed to float further south than it has the past. Unpredictable and variable ice conditions present a challenge for shipping companies, which incur significant financial costs if they are unable to stick to a precise schedule.[67]

The Arctic region also suffers from a lack of both fixed infrastructure and navigation support for maritime traffic. The Northern Sea Route and the Northwest Passage are essentially shallow water coastal routes with draft restrictions and limited port capacity, which would prevent the operation of existing large commercial shipping vessels. For example, some sections of the Northern Sea Route are between 12 and 13 meters deep, far shallower than is permissible for a typical large containership with a draft of more than 14 meters.[68] In shallow draft areas, shippers could opt to use smaller ships, but such a step would likely raise the cost per container of goods shipped along Arctic routes above the cost of goods transported on today's existing deep-draft sea lines of communication (SLOC), even accounting for the reduced distance of the Arctic routes.

67 O'Rourke, *Changes in the Arctic* (2016), p. 24.

68 Ostreng et al., *Shipping in Arctic Waters*, p. 320.

In addition to draft restrictions, all three polar routes lack high-quality communications infrastructure, navigation charts, navigation aids, and other elements of the global maritime trade architecture that are ubiquitous at lower latitudes. Moreover, the global shipping industry has already invested heavily in infrastructure to support trade along today's busiest sea routes—the recent expansion of the Panama Canal, for example—and may be reluctant to make similar improvements in Arctic infrastructure.

Fisheries

The Arctic and adjacent waters are home to several active fisheries that are expected to move in time and location with rising ocean temperatures and associated changes in water chemistry.[69] These changes will be significant given the importance of Arctic fisheries. Three of the six Arctic countries—the United States, Russia, and Norway—are the world's third, fourth, and tenth largest captured fish producers.[70] China, a country that does not border the Arctic but is pursuing Arctic research and has a declared interest in the region, is the leading fish products producer and accounts for 16 percent of the globe's captured fish production by itself.[71] Overall, global fish production has increased annually at an average rate of 3.2 percent between 1961 and 2013, twice the rate of population growth during that period.[72]

Global climate change and warming oceans are altering the behavior and habitats of marine life in uncertain ways that will likely impact the global fishing trade. Arnfinn Jorgensen-Dahl, an Arctic expert at Norway's Ocean Futures research institute, has described these possible changes:

> Under the influence of climate change some fish stocks, such as cod and herring, may be more plentiful in Arctic waters in the future. Moderate warming could improve conditions for these fish stocks as higher temperatures and reduced ice cover might lead to higher productivity. . . . Some other species, such as northern shrimp, may be negatively affected. Species whose principal habitat was in Sub-Arctic waters might also move north, further complicating the situation. What the consequences of climate change will be for marine fish stocks in the Arctic is highly uncertain.[73]

As the type and location of stocks change, fishing activities may increase in locations where it had not previously been prevalent. Climate change may create incentives for illegal fishing activity if fishermen find that the fish they have traditionally pursued have moved to new areas inside other countries' EEZs. If warming oceans reduce the populations of certain fish and

69 As water temperature rises, it can absorb more carbon dioxide, which lowers the pH of the water and changes the solubility of other ions, like salts, in water. Fish species have different affinities and tolerance for these water chemistry changes.

70 "Captured" refers to fish caught in the wild as opposed to fish that are farmed for food.

71 Ostreng et al., *Shipping in Arctic Waters*, pp. 110–111.

72 Food and Agriculture Organization of the United Nations, *The State of World Fisheries and Aquaculture: 2016* (Rome: United Nations, 2016), p. 2.

73 Ibid., p. 111.

marine life species, their fisheries could become increasingly fragile. Communities that were supported by fishing for specific species may find themselves in economic decline.

In the face of growing uncertainty regarding the location, size, and resiliency of fisheries, some nations have prohibited Arctic fishing in areas where fish stocks may be at risk. For example, the United States banned industrial fishing within its EEZ north of the Bering Strait.[74] In 2015, the Arctic coastal countries signed a moratorium on fishing in the Central Arctic Ocean until further research could be undertaken and a fisheries management system is implemented.[75]

Military Competition

The Arctic region's geographic remoteness, harsh climate, sparsely distributed population, and short open navigation season have prevented a major military conflict from occurring in the high latitudes. However, for much of the Cold War the United States and the Soviet Union viewed the Arctic as critical terrain in the nuclear competition because it was the shortest route between the two countries. During the 1950s, both sides planned to route strategic bombers, and later intercontinental ballistic missiles, over the Arctic Ocean for homeland attacks. Elaborate Arctic early warning networks were established as a counter to such strikes. Components of these surveillance systems remain in place today and have been improved to address growing ballistic missile threats from Iran, China, and North Korea.

Starting in the 1970s, the undersea competition in the Arctic Ocean accelerated as the Soviets adopted tactics and platforms designed to allow them to fire submarine-launched ballistic missiles at the United States from under the polar ice. The United States began deploying nuclear attack submarines (SSN) to the Arctic Ocean to track Soviet SSBNs, which eventually became an explicit strategy designed to pull Soviet SSNs away from U.S. carrier battle groups in the Atlantic Ocean and Mediterranean Sea.[76]

Russian military activity in the Arctic peaked during the Cold War before declining substantially during the 1990s. Over the past decade, however, Russia has rebuilt some of its Arctic military presence as part of its overall armed forces modernization effort. The following chapters will describe how Russia, the United States, and the other Arctic countries are adapting their militaries for a future where the Arctic is both more accessible and more heavily trafficked.

74 Allison Winter, "U.S. Bans Commercial Fishing in Warming Arctic," *The New York Times*, August 21, 2008.

75 O'Rourke, *Changes in the Arctic* (2016), p. 39.

76 Bryan Clark, *The Emerging Era in Undersea Warfare* (Washington, DC: Center for Strategic and Budgetary Assessments, 2015), p. 7, available at http://csbaonline.org/research/publications/undersea-warfare/publication.

Summary

Warming oceans and receding ice will make the Arctic more accessible, particularly during the summer. Economics and unpredictability, however, may constrain increases in Arctic activity. Except for oil, gas, or mineral production on shore or in the Barents Sea, the Arctic's weather, remoteness, and lack of infrastructure will make resource extraction and shipping more expensive and less reliable than non-polar alternatives. Tourism and research are likely to increase modestly with greater Arctic access, which will raise requirements for SAR operations, maritime safety and security enforcement, and environmental response efforts. These missions, however, will largely occur in ice-free areas and seasons, allowing them to be addressed with standard, rather than ice-capable, ships, aircraft, and systems.

Military activity is likely to increase in the Arctic as part of the increasing great power competition between the United States, China, and Russia. The United States may be in the better position for this competition because it has a shorter Arctic coastline than Russia, yet it maintains a military presence in the Arctic that enables surveillance and communications. Nevertheless, it is likely U.S. military forces will face increasing requirements in the High North to protect U.S. interests and support civilian security and safety.

CHAPTER 3

Antarctic Issues

Antarctica presents a very different set of challenges and opportunities from the Arctic. For example, whereas the Arctic is predominantly a maritime region that is becoming more accessible, the Antarctic region is mostly continental. And, whereas the Arctic's national boundaries are largely resolved because of geography and UNCLOS, Antarctica's territorial claims are not established or recognized (see Figure 6). These claims reflect those asserted when the Antarctic Treaty was negotiated in 1959, and they have been frozen in place since. The treaty precludes parties from asserting new claims, but some non-claimants, including China, argue they have a basis for claims they could assert in the future.[77]

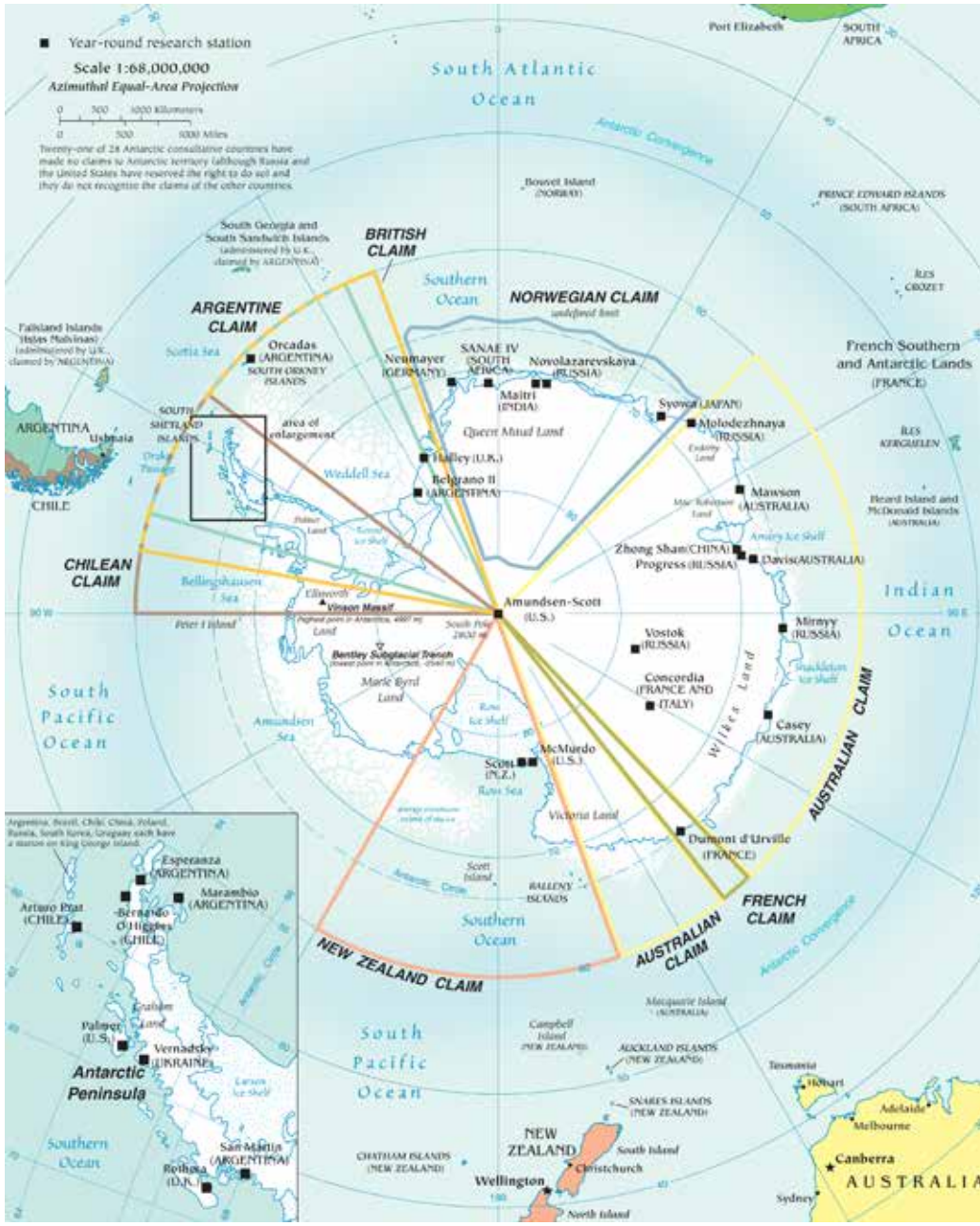
Although the United States does not claim a sector in Antarctica, the Antarctic Treaty Secretariat recognizes the right of the United States and Russia to make future claims.[78] The United States maintains five facilities there for research, which are supported by U.S. military forces. USCG icebreakers clear passages to resupply McMurdo Station in the New Zealand sector, and ski-equipped LC-130 aircraft support inland facilities such as Scott-Amundson at the South Pole. Russia also has a substantial presence in the Antarctic and a fleet of more than 40 icebreakers, although most of them are dedicated to sustaining access to Russia's 12,000 nm Arctic coastline.[79]

77 Australian Associated Press, "China's Secret Threat to Australia's Antarctic Claim, Report Reveals," *News.com.au,* August 18, 2017, available at http://www.news.com.au/world/chinas-secret-threat-to-australias-antarctic-claim-report-reveals/news-story/d88ca4389f7d621f5b50d529954de68d.

78 The Antarctic Treaty, 1959; "The Antarctic Treaty," Secretariat of the Antarctic Treaty website, available at http://www.ats.aq/e/ats.htm; and "Antarctic Treaty: Narrative," U.S. Department of State website, available at https://www.state.gov/t/avc/trty/193967.htm#narrative.

79 Simon Romero, "Countries Rush for Upper Hand in Antarctica," *The New York Times,* December 29, 2015, available at https://www.nytimes.com/interactive/2015/12/29/world/countries-rush-for-upper-hand-antarctica.html?_r=0.

FIGURE 6: ANTARCTIC TERRITORIAL CLAIMS



Map Source: CIA Factbook 2009.

Several U.S. allies are claimants to Antarctic territory. The Antarctic Treaty does not allow claimants to deny access for other states' research and scientific activities, but claimants could establish a permanent presence in their sectors to undermine future competing claims from other countries. Budget constraints, however, have reduced the ability of U.S. allies to sustain an Antarctic

presence and monitor activities in their claimed sectors.[80] This is especially challenging for Australia, whose claims under the Antarctic Treaty covers about 42 percent of the continent. China may be exploiting Australia's situation to build or expand its facilities in Antarctica and now has four bases there, three of which are in the Australian Antarctic Territory (AAT).[81] Figure 7 is a Chinese depiction of its East Antarctica facilities in the AAT, which suggests China's intent to maintain a contiguous permanent presence on the continent. This presence could be the basis for a future claim by China if the Antarctic Treaty is modified or dissolved.

FIGURE 7: CHINESE FACILITIES IN EAST ANTARCTICA

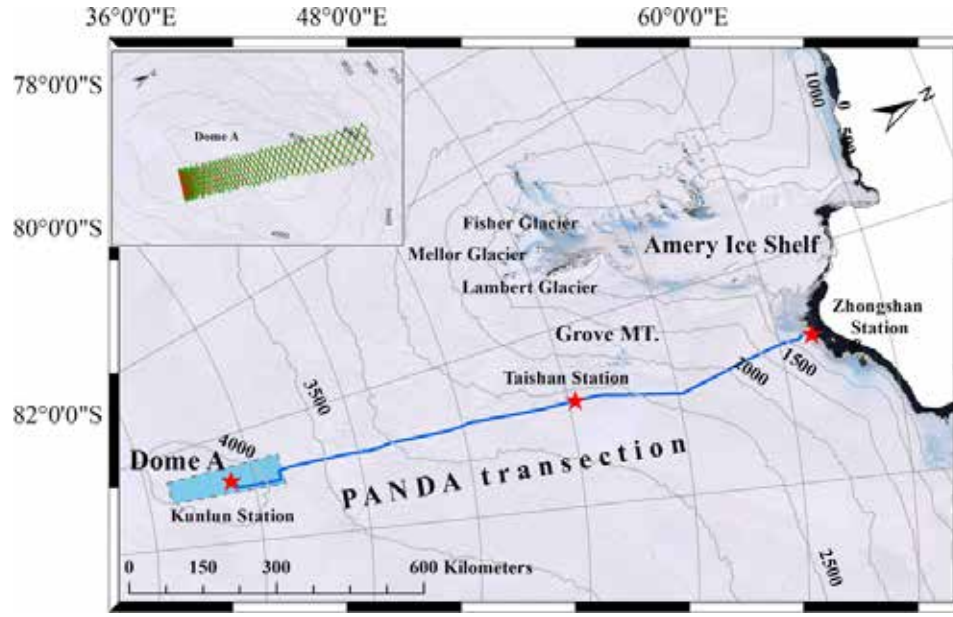


Image from Qiang Qiang, Chunxia Zhou, Mingsheng Liao, Qiuyang Zhao, and Zemin Wang, "Elevation Change Around Dome A Region of Antarctica from EnviSat Satellite Radar Altimetry During 2002–2012," *Geo-spatial Information Science* 18, no. 4, 2015. This article is a product of the Chinese Antarctic Center of Surveying and Mapping, Wuhan University.

The Antarctic Treaty and its protocols restrict fishing and prohibit mining and oil or gas extraction. The treaty further requires that all activities in Antarctica be for peaceful purposes and prohibits the construction of military bases, military maneuvers, and the testing of military weapons.[82] The treaty does, however, allow for research and investigation into future resource extraction and dual-use activities such as communications, surveillance, navigation, and resupply that could extend a nation's military capability and reach. If these dual-use

80 Anthony Bergin, "Cold Calculations: Our Antarctic Choices," *ASPI Strategist,* May 28, 2013, available at https://www.aspistrategist.org.au/cold-calculations-our-antarctic-choices/.

81 Agence France-Presse (AFP), "China Opens Fourth Antarctic Research Station," *Phys.org News,* February 10, 2014, available at https://phys.org/news/2014-02-china-fourth-antarctic-station.html.

82 Protocol on Environmental Protection to the Antarctic Treaty, October 4, 1991, available at http://www.ats.aq/documents/keydocs/vol_1/vol1_4_AT_Protocol_on_EP_e.pdf.

activities become purely military in the future, there are few enforcement mechanisms under the treaty. If a party to the treaty believes another party nation is violating the treaty's provisions, it must attempt to resolve the dispute directly with the other party. Failing that, the dispute is brought to the International Court of Justice.

The ability to emplace dual-use facilities in Antarctica has been used by the United States, Russia, and China to support military communications, navigation, and surveillance. Each has ground stations in Antarctica to increase the accuracy of satellite navigation systems by providing additional geographically-dispersed reference points.[83] Several nations, including the United States, Russia, China, India, and Germany, have Antarctic stations to communicate with polar orbiting surveillance, visual, radar, and infrared satellites. And China recently installed a high-frequency radar at its coastal Zhongshan station, which could detect ships and aircraft hundreds of miles away, as well as jam U.S. radars and long-range communications.[84]

In addition to military operations, China uses its growing footprint in Antarctica to assess the amount and types of natural resources in the region. Although there is no mechanism in the Antarctic Treaty to assert a new claim, China may plan to establish one based on its historical operations and contemporary presence. Chinese expeditions, many of them in the AAT, have explored for mineral deposits, especially mercury, coal, and rare earth metals used in modern electronics. At sea, five Chinese boats catch small phytoplankton called krill, the most numerous type of marine life in the Southern Ocean. China's krill fleet is the largest of its kind in the Southern Ocean.[85]

Tourism, however, is the fastest growing activity in Antarctica. In the summer of 2016–2017, more than 45,000 visitors came to Antarctica. About a third were American, with the rest coming predominantly from China, the United Kingdom, Germany, and Australia.[86] Most tourists are on cruises that do not disembark in Antarctica; those that go ashore usually do so in the Antarctic Peninsula, which is closest point in Antarctica to South America.

Whereas Arctic shipping routes potentially offer a faster way to connect large ports in the Northern Hemisphere, the smaller ports of the Southern Hemisphere result in less demand for Antarctic shipping routes. Moreover, the existing route around Africa's Cape of Good Hope is regularly used by the largest Aframax container ships of more than 300,000 tons without having to enter Antarctic waters. The other Antarctic Route around South America's Cape Horn or Tierra Del Fuego is, like the Northwest Passage, shallow, constrained, and often too rough to transit reliably.

83 Jenna Higgins, "The Delineation of Militarisation in Antarctica," *The Strategy Bridge,* January 31, 2017, available at https://thestrategybridge.org/the-bridge/2017/1/31/the-delineation-of-militarisation-in-antarctica.

84 Anne-Marie Brady, *China's Expanding Antarctic Interests: Implications for Australia* (Canberra, Australia: The Australian Strategy and Policy Institute, 2017), p. 14.

85 Ibid., p. 19.

86 "2016–2017 Tourists by Nationality (Total)," *Tourism Statistics*, International Association of Antarctic Tourism Operators (IAATO), available at https://iaato.org/tourism-statistics.

Overall, America continues to sustain the largest presence in Antarctica among nations active in the polar regions. It sends the most researchers and tourists; authors the most scientific publications; and, behind Australia, supports the second-most scientific projects in Antarctica.[87] China, however, is close behind. China now spends more than the United States on research, polar stations, logistics, and ice-capable vessels and aircraft. China has two military icebreakers that are devoted to keeping the Yellow Sea clear and one research icebreaker. It has a third military icebreaker under construction, which is intended for polar operations.[88] Australia has one icebreaker, the *Aurora Australis,* and has another under construction. The United States has one heavy and one medium USCG icebreaker and one light research icebreaker. The heavy icebreaker, *Polar Star*, is devoted to resupplying U.S. and allied Antarctic stations since weather conditions could preclude flight operations and some equipment is too large to be flown in.

Summary

Like the Arctic, economics and remoteness reduce the viability of commercial efforts in the Antarctic. More importantly, the Antarctic Treaty limits activity there to scientific research, closely managed fishing, tourism, potential dual-use communication and surveillance operations, and the safety and logistics efforts to support these activities. This may eventually change if the Antarctic Treaty falls out of use or is abrogated, but that does not appear likely for the next decade or more.

It is likely, however, that dual-use military activities and tourism will continue to grow. This will sustain a requirement for icebreakers to resupply Antarctic stations and, potentially, improved capabilities for SAR or environmental response activities during the Antarctic summer. Today, the capacity for these operations from Antarctica is small and would need to be augmented from South America or Tasmania.

87 Brady, *China's Expanding Antarctic Interests*, p. 20.

88 Franz-Stefan Gady, "China Begins Construction of Polar Icebreaker," *The Diplomat,* December 22, 2016, available at http://thediplomat.com/2016/12/china-begins-construction-of-polar-icebreaker/.

CHAPTER 4

International Polar Plans

Each country with territory or claims in the polar regions generally seeks to maximize the economic benefits from its claims and maintain its sovereignty over them. As ice coverage diminishes and the economic potential of these regions becomes more accessible, polar countries are accelerating efforts to better understand, protect, and exploit their Arctic and Antarctic resources. These efforts have also been accelerated by non-polar countries, such as China, as they pursue access and resources in the polar regions.

One indication of the increasing concern of polar countries regarding their Arctic and Antarctic territory is the growing fleets of ice-capable naval ships and military icebreakers, some of which are illustrated in Figure 8. In contrast to the scientific and research vessels that have operated for decades in the high latitudes, these armed ships are able to both sustain access to polar areas and defend them.

Most countries with polar interests focus on either the Arctic or Antarctic due to funding constraints and geography, which may make one region or the other more strategically important. Great powers such as the United States, China, and Russia are able and willing to maintain a presence and conduct operations in both regions. The United Kingdom and Norway also sustain a presence in the Arctic and Antarctic.[89] The following discussion highlights some of the main elements of major foreign countries' interests and plans for the polar regions, which is used to inform the recommendations in Chapter 6 on U.S. and allied actions to improve polar access, response, and defense. Smaller nations with less impact on U.S. and allied plans are not included in this discussion for the sake of brevity.

89 The United Kingdom has scientific stations on Svalbard in the Arctic and in the UK sector of Antarctica. See the British Antarctic Survey website, available at https://www.bas.ac.uk/about/the-arctic/britain-in-the-arctic/.

FIGURE 8: ICE-CAPABLE ARMED NAVAL SHIPS

Otago
Nationality: New Zealand
Draft: 12 ft
Displacement: 1900 tonnes
Ice thickness: 0.4 m
Ships in class: 2

DeWolf-*In Development*
Nationality: Canada
Draft: 19 ft
Displacement: 6400 tonnes
Ice thickness: 2 m
Ships in class: 5 (projected)

Knud Rasmussen
Nationality: Denmark
Draft: 16 ft
Displacement: 2050 tonnes
Ice thickness: 1.2 m
Ships in class: 3

23550-*In Development*
Nationality: Russia
Draft: 20 ft
Displacement: 8500 tonnes
Ice thickness: 1.7 m
Ships in class: 2 (projected)

Thetis
Nationality: Denmark
Draft: 20 ft draft
Displacement: 3556 tonnes
Ice thickness: 1 m
Ships in class: 4

Svalbard
Nationality: Norway
Draft: 21 ft draft
Displacement: 6375 tonnes
Ice thickness: 2 m
Ships in class: 1

Photos: U.S. Navy, the Royal Canadian Navy, IHS Janes, and Creative Commons and GNU FDL sources. Information from R.C. Braithwaite and D. Khan, "Implications of Ice Class for an Offshore Patrol Vessel," *Journal of Marine Engineering & Technology* 13, no. 3, 2014; and IHS Jane's.

Russia

The Arctic occupies a central place in the Russian economy and in the country's cultural heritage. More than 20 percent of Russia's landmass and 80 percent of Russia's natural gas resources lie in the Arctic. Russia's ability to carry out economic development in the harsh environment of the High North has long been an important component of Russia's national identity. The Antarctic is less prominent in Russian plans; they focus on maintaining capabilities there to support military communications, surveillance, and navigation, as well as sustaining an Antarctic presence to support future claims if the Antarctic Treaty is modified or abrogated.

In 2009, the Russian Federation's Security Council published *Fundamentals of the Russian Federation's Policy in the Arctic for the Period up to 2020 and Beyond*. The document established an overarching goal of turning the Arctic into "Russia's foremost strategic base for natural resources" by 2020.[90] Russian interests in the Arctic were described by the following activities: using the region as a resource base; maintaining the region as a "zone of peace"; protecting the environment; and developing the Northern Sea Route.[91] These goals are broadly consistent with previous Russian Arctic policy, which emphasized resource extraction and power projection via the Arctic SLOCs.

90 Zellen, *The Fast-Changing Arctic*, loc. 5813.

91 Sergey Sevastyanov and Alexey Kravchuk, "The Russian Approach to National Security in the Arctic," *The Korean Journal of Defense Analysis* 29, no. 1, March 2017, p. 140.

One of Russia's most important Arctic military missions is nuclear deterrence. All six of Russia's third-generation Delta IV nuclear SSBNs—two thirds of Russia's entire SSBN fleet—belong to the Kola Peninsula-based Northern Fleet. These SSBNs can venture into the Arctic Ocean from the port of Gadzhiyevo to carry out patrols under the Arctic ice. Defending those platforms and their communication and support infrastructure from attack is critical to the survivability of Russia's nuclear triad. Therefore, Russia is upgrading the defenses at some of its Arctic bases by stationing additional fighter aircraft and moving S-400 surface-to-air missiles (SAM) to Novaya Zemlya and Tiksi.[92]

Russia is in the process of fielding a Delta IV replacement, the Borei-class (Project 955/A) SSBN, the first of which was assigned to the Northern Fleet in 2015. The Russian submarine force has been ramping up its level of activity over the past few years to levels that are allegedly on par with those seen during the Cold War.[93]

The Russian Navy also seeks to preserve its ability to project power into the Atlantic, Pacific, and Arctic Oceans from its Northern Fleet. The Northern Fleet, the most powerful in the Russian Navy, is reliant on Arctic passages to reach the Atlantic Ocean. Although Russia has demonstrated its ability to move Northern Fleet vessels to the Pacific Ocean via the Northern Sea Route, such as the 2013 Northern Sea Route transit of the *Pyotr Velky* nuclear-powered cruiser to Kotelny, the practice is rare.[94] As navigation along the Northern Sea Route becomes easier, the strategic mobility of the Northern Fleet is likely to increase, and more transfers between the Northern and Pacific fleets may occur.

Russia has also taken several steps to improve its Arctic force posture. In December 2014, Russia created an Arctic Joint Strategic Command to facilitate command and control of its various Arctic military elements. Russia has established or reconstituted several new Arctic bases, including Temp airfield on Kotelny Island in 2013, a permanent base on the Novosibirsky Islands in 2014, and a temporary naval base at Novaya Zemlya in 2015. In addition, Moscow has opened or re-opened airbases on Novaya Zemlya, Chukotka, Franz Josef Land, Naryan-Mar, Norilsk, and Tiksi.[95]

The Russian military has stepped up its Arctic operations since 2009, when it conducted its largest Arctic exercise since 1991.[96] In 2013 Russia resumed patrols in the Arctic, deploying

92 Stephanie Pizard et al., *Maintaining Arctic Cooperation with Russia: Planning for Regional Change in the Far North* (Santa Monica, CA: RAND Corporation, 2017), p. 12.

93 Hans M. Kristensen and Robert S. Norris, "Russian Nuclear Forces, 2017," *Bulletin of the Atomic Scientists* 73, no. 2, 2017, p.121.

94 Andrew E. Kramer, "Russia Preparing Patrols of Arctic Shipping Lanes," *The New York Times*, September 14, 2013.

95 Jeffrey MazoLee Willett, "Ice Melt Opens Increased Arctic Maritime and Military Activity," *Jane's Intelligence Review*, IHS Janes, July 28, 2017.

96 Pizard et al., *Maintaining Arctic Cooperation with Russia*, p. 13.

ten surface vessels to the Novosibirsky Islands. More recently, a surface flotilla that included nuclear-powered icebreakers transited the Northern Sea Route in 2016.[97]

The Russian icebreaker fleet is composed of 46 nuclear and conventional vessels with a further 11 under construction (three nuclear) and four planned (two nuclear); 32 of these are operated by the government, and the rest are commercially-operated. Russia is the only country that operates nuclear icebreakers.[98] It is also the only country building or with plans to develop several new types of civilian icebreakers, including three nuclear-powered icebreakers, intended for use on the Northern Sea Route.[99]

In April 2017, Russia laid down the keel of *Ivan Papanin*, lead vessel of the Project 25330 ice-class patrol ship class. The 25330 is capable of breaking ice with a thickness of up to 1.7 meters, giving it the ability to break first-year ice year-round. The only currently operational warship with a similar icebreaking capability is Norway's *Svalbard*. The 25330 will be equipped with an aft section optimized for equipping modular weapons, possibly including containerized anti-ship cruise missiles (ASCM).[100] If Russia elects to deploy its 25330 vessels with ASCMs, the ships will be first icebreakers to be armed with long-range precision weapons.

Canada

Forty percent of the Canadian landmass is in the Arctic, and Canada claims the Northwest Passage lies entirely in its waters. Canada's most recent Arctic strategy document, *Exercising Sovereignty and Promoting Canada's Northern Strategy Abroad*, states, "Exercising sovereignty over Canada's north . . . is our number one Arctic foreign policy priority."[101] In addition to sovereignty, the report outlined three other goals of Canadian Arctic policy: promoting economic and social development; protecting the environment; and improving and devolving Northern governance.[102] Canada is a non-consultative party to the Antarctic Treaty and supports some Antarctic research, but it does not have facilities or a continuous presence in the Antarctic.[103]

97 Willett, "Ice Melt Opens Increased Arctic Maritime and Military Activity."

98 The National Academies of Science, Engineering, and Medicine (NAS), *Acquisition and Operation of Polar Icebreakers: Fulfilling the Nation's Needs* (Washington, DC: NAS, 2017), p. 136.

99 U.S. Coast Guard, Office of Waterways and Ocean Policy (CG-WWM), "Major Icebreakers of the World," chart, May 1, 2017, available at http://www.dco.uscg.mil/Portals/9/DCO%20Documents/Office%20of%20Waterways%20and%20Ocean%20Policy/20170501%20major%20icebreaker%20chart.pdf?ver=2017-06-08-091723-907.

100 Nikolai Novichikov, "Russian Project 23550 Arctic Patrol Ship Laid Down," *Jane's Defence Weekly*, IHS Janes, April 25, 2017.

101 "Statement on Canada's Arctic Foreign Policy: Exercising Sovereignty and Promoting Canada's Northern Strategy Abroad," Government of Canada, 2010, p. 2.

102 "Statement on Canada's Arctic Foreign Policy," 2010, pp. 5–6.

103 Ann Balasubramaniam, "A Review of the Importance of Antarctic Research in Canada," *publications*, Government of Canada, February 13, 2017, available at https://www.canada.ca/en/polar-knowledge/publications/polarleads/vol1-n03-2016.html.

Canada and the United States have cooperated on Arctic security issues since World War II, when Canadian naval vessels assisted with the escort of convoys transiting to Arctic Russian ports. During the Cold War, Canada and the United States collaborated on the construction of three linear radar networks that ran across the North American continent: the Pinetree Line, the Mid-Canada Line, and the Distant Early Warning (DEW) Line. Subsequently, the two countries jointly formed the North American Air Defense Command (NORAD—subsequently renamed North American Aerospace Defense Command) in order to provide homeland defense against the Soviet Union.[104]

Canada has a long history of undersea operations in the Arctic, many of which were undertaken jointly with the USN. During the 1970s, Canada and the United States collaborated on the development of an Arctic sound surveillance systems (SOSUS) network, and between 1977 and 1986, U.S. SSNs transited through Canadian Arctic waters at least nine times.[105]

As part of its plan to strengthen its Arctic sovereignty, Canada has been increasing its visible military presence in the high latitudes. In 2002, the Canadian military resumed Arctic operations when it carried out *Operation Narwhal 2002*, an exercise that consisted of sovereignty patrols near Resolution Island in southern Baffin Bay.[106] *Operation Narwhal 2004* featured a frigate—the first Canadian warship to sail in Arctic waters since 1982. Subsequent exercises have included both Canadian and foreign naval vessels.[107] The Canadian military has also conducted *Operation Nanook* each year since 2007, including U.S. and other NATO armed force units in some years.[108]

The Canadian Coast Guard currently operates seven icebreakers, which are nearing the end of their service lives. Canada plans to acquire a new icebreaker, CGCS *John G. Diefenbaker*, that will be able to operate in the Arctic year-round in the early 2020s. By then, it will be the country's only icebreaker.[109] Canada is in the process of developing an ice-strengthened warship, the *Harry DeWolf*-class Arctic Offshore Patrol Ship (AOPS). The AOPS will be constructed to conduct operations year-round in first-year ice. Once the first vessel in the *DeWolf*-class enters service in 2018, Canada will join Norway as one of two countries operating a warship with year-round icebreaking capability.

104 "A Brief History of NORAD," North American Aerospace Defense Command Office of History, December 31, 2013, available at http://www.norad.mil/Portals/29/Documents/A%20Brief%20History%20of%20NORAD%20%28current%20as%20of%20March%202014%29.pdf.

105 Adam Lajeunesse, *Lock, Stock, and Icebergs: A History of Canada's Arctic Maritime Sovereignty* [Kindle edition] (Vancouver, Canada: UBCPress, 2016), loc. 4172.

106 Rob Huebert, "Canadian Arctic Maritime Security: The Return to Canada's Third Ocean," *Canadian Military Journal* 8, no. 2, Summer 2007.

107 Huebert, "Canadian Arctic Maritime Security."

108 "Operation NANOOK," National Defence and the Canadian Armed Forces, updated September 18, 2017, available at http://www.forces.gc.ca/en/operations-canada-north-america-recurring/op-nanook.page.

109 "Are Canada's Coast Guard Icebreakers Ready?" *Maritime Executive,* February 21, 2017, available at http://www.maritime-executive.com/article/are-canadas-coast-guard-icebreakers-ready.

Norway

Norway is the only nation with territory in the Arctic and claims in the Antarctic. Nearly 10 percent of Norway's population lives above the Arctic Circle, and more than 30 percent of its landmass lies in the Arctic—the most of any country. The Arctic oil and gas industry is the largest component of the Norwegian economy, and 33 percent of Norway's mining occurs in the Arctic. Not surprisingly, Norway's government has declared that "The Arctic is Norway's most important foreign policy priority."[110]

Norway's Arctic policy emphasizes international cooperation, business development, knowledge development, infrastructure, and emergency preparedness.[111] Because its oil and gas production and fisheries lie outside ice-covered regions of the Arctic, Norway only operates one medium icebreaker—the *Svalbard*-class Arctic-class patrol vessel—and it is currently building an Arctic research ship.[112] The *Svalbard* is equipped with a 57mm deck gun, making it the world's only operational armed icebreaking warship.

Norway is also an Antarctic claimant and has sent explorers, researchers, and fishermen to Antarctica for more than a century. Norway's early interest in the region derived from whaling, which was a large contributor to the Norwegian economy during the early 20th century. Today, however, Norway's priorities there are scientific research, protecting the environment, sustaining its claim, and maintaining its fisheries.[113] Unlike other Antarctic claimants, Norway's claim is not a sector radiating out from the South Pole. Norway's territory of Dronning Maud Land consists of areas ashore where Norwegian expeditions have done most of their mapping and research, supported by the Troll research station (see Figure 6). The north and south limits of Donning Maud Land are not defined, although other Antarctic claimants consider it to extend from the South Pole to the coast.[114]

Greenland (Denmark)

Greenland is an autonomous country within the Kingdom of Denmark. While Greenland's 50,000 citizens have had home rule since 1979, Greenland's foreign policy is set by Denmark. Denmark's Arctic strategy was last affirmed in a 2011 policy document that laid out four

110 *Norway's Arctic Policy* (Oslo, Norway: Norwegian Ministry of Foreign Affairs, November 2014), p. 7, available at https://www.regjeringen.no/globalassets/departementene/ud/vedlegg/nord/nordkloden_en.pdf.

111 Ibid., p. 3.

112 Ibid., p. 16.

113 *Norwegian Interests and Policy in the Antarctic*, white paper (Oslo, Norway: Norwegian Ministry of Foreign Affairs, June 12, 2015), pp. 8–9, available at https://www.regjeringen.no/contentassets/cef2a67e958849689aa7e89341159f29/en-gb/pdfs/stm201420150032000engpdfs.pdf.

114 Ibid., p. 17.

goals: a peaceful, secure, and safe Arctic; Denmark's self-sustaining growth and development; respect for the Arctic climate; and close cooperation with international partners.[115]

Denmark has been an Arctic military partner of the United States since the early Cold War. Thule Air Base was established in northern Greenland in the early 1950s to host U.S. strategic bombers. Although the base still exists today, it no longer hosts aircraft and instead functions primarily for space situational awareness and ballistic missile early warning.[116]

Denmark plans to spend some $18 million annually over the next decade to fund Arctic-specific defense investments, including patrol vessels, unmanned aircraft, and commercial satellite coverage.[117] Four commercial icebreakers are currently operated in Denmark's Arctic territory, none of which are government owned or operated.[118]

Greenland's citizens have considered independence, largely to take advantage of oil exploration in Greenland and its EEZ. With falling oil prices, independence has become less of an issue.[119] When oil prices begin to rise again in the 2020s, Greenland could again move toward separation from Denmark. This could significantly change relationships in the High North, especially if Greenland aligns itself with commercial interests from non-Arctic countries like China.

Finland

Although it does not have any Arctic coastline, Finland considers itself a global leader in Arctic technology and expertise, including icebreaker and ice-capable ship construction. As such, Finland's Arctic strategy notes that Finland can harness its long Arctic history and knowledge-base to "[seize] new business opportunities opening the Arctic." It states that Finnish companies should "get involved in new projects or those that are already underway in the Arctic region."[120]

There are eight government owned or operated icebreakers and two privately owned icebreakers in Finland.[121] Finland is also acquiring four offshore patrol vessels (OPV) with "ice navigation capability."[122]

115 *Strategy for the Arctic 2011–2020* (Copenhagen, Denmark: Ministry of Foreign Affairs, 2011), pp. 10–11.

116 "Arctic Air Base Gets $40 Million Upgrade in Face of Increasing Missile Threats," *CBS News,* May 30, 2017, available at https://www.cbsnews.com/news/inside-thule-air-base-arctic/.

117 DoD, *Report to Congress on Strategy to Protect United States National Security Interests in the Arctic Region* (Washington, DC: DoD, 2016), p. 8.

118 NAS, *Acquisition and Operation of Polar Icebreakers*, p. 136.

119 "Independence on Ice," *The Economist,* January 21, 2015, available at https://www.economist.com/news/europe/21640224-falling-crude-prices-are-forcing-greenland-put-plans-split-denmark-independence-ice.

120 Prime Minister's Office, Finland, *Finland's Strategy for the Arctic Region 2013* (Helsinki, Finland: Prime Minister's Office Publications, 2013), p. 26.

121 CG-WWM, "Major Icebreakers of the World."

122 Gerrard Cowan, "Inside the Circle: Adapting to the Arctic," *Jane's Defence Weekly*, IHS Janes, April 26, 2017, p. 3.

Sweden

Sweden's 2011 Arctic strategy emphasizes "efficient, multilateral coordination on the Arctic" because "The challenges facing the Arctic are far too multifaceted and broad for any single individual state to successfully deal with them on its own."[123] Sweden has identified some areas where Swedish companies may be able to benefit from increased economic activity in the Arctic. These include the pursuit of joint ventures for the Swedish oil and gas industry or the growth in the demand for Arctic vehicle tests.[124]

Like Finland, Sweden is not a coastal Arctic country. To support its shipping and other commercial interests, the Swedish government currently owns or operates four icebreakers, and a further three are operated privately. Sweden plans to purchase an additional three icebreakers in the early 2020s.[125]

Iceland

Iceland's Arctic claim rests on its possession of the island of Grimsey. Grimsey lies off the northern coast of Iceland and has a population of some 100 people.[126] Iceland is seeking to be recognized as a coastal Arctic state to increase its influence in the Arctic Council.

During the Cold War and for more than a decade afterwards, the United States operated aircraft, including anti-submarine warfare (ASW) and fighter platforms, out of Naval Air Station Keflavik in Iceland. The United States turned over ownership of the base to the Icelandic Coast Guard (Iceland has no military) in 2006, but it has continued to operate aircraft out of the installation since then. In 2016 DoD began upgrading some of Keflavik's facilities and initiated temporary deployments of P-8 Poseidon ASW aircraft to the base to patrol the Greenland-Iceland-United Kingdom (GIUK) gap.[127]

Australia

Australia's polar interests are focused on the Antarctic region, where it has been involved for more than a century and holds claim under the Antarctic Treaty to 42 percent of the continent. As described in the *Australian Antarctic Strategy and 20 Year Action Plan*, Australia's national interests in Antarctica include protecting its territory, keeping Antarctica free from

123 Government Offices of Sweden, *Sweden's Strategy for the Arctic Region* (Stockholm, Sweden: Ministry of Foreign Affairs, 2011), p. 19.

124 Ibid., pp. 33–34.

125 CG-WWM, "Major Icebreakers of the World."

126 DoD, Under Secretary of Defense (Policy), *Report to Congress on Strategy to Protect United States National Security Interests in the Arctic Region*, p. 8.

127 Gareth Jennings, "US Navy Deploys Poseidon to Plug GIUK Gap," *IHS Jane's Navy International*, IHS Janes, November 2, 2016.

conflict, promoting scientific research, and fostering economic development within the limits of the Antarctic Treaty.[128] Consistent with its interests, Australia has more science projects underway in Antarctica than any other nation; the Heard and MacDonald Island fisheries around the Antarctic Circle are among Australia's largest; and Hobart in Tasmania provides regular jet airline flights and shipping to Antarctica.[129]

Australia plans several logistics initiatives to support its Antarctic program. It is building a multi-mission icebreaker to replace its one existing icebreaker, *Aurora Australis*, which is used to support resupply, research, and improving ports in Antarctica and Tasmania to increase their throughput and make them available to other Antarctic visitors.[130] To improve air connectivity to Antarctica, Australia is upgrading the Hobart International Airport and other AAT airfields such as Wilkins. These airfields can be used by conventional wheeled aircraft, including C-17A military cargo aircraft and A319 passenger jets. Australia is also restoring its road network to enable researchers to traverse the AAT.[131]

Australia faces competing priorities in the Antarctic. Its interest in protecting Australia's sovereignty over the AAT is being undermined by the growing number of Chinese stations and exploration missions in its sector. At the same time, however, Australia plans to rely on Chinese users to recover costs for infrastructure improvements in Tasmania and Antarctica. The Australian government will soon need to reconcile these conflicts or be prepared to protect its sovereignty over the AAT and keep Antarctica free of conflict.

New Zealand

Like Australia, New Zealand's focus is on the Antarctic, where it also has a claim recognized under the Antarctic Treaty. New Zealand's priorities there include supporting scientific research, sustaining a presence in its territory, and protecting the Antarctic environment.[132] To support these priorities, New Zealand's plan for 2016–2020 emphasizes maintenance of existing infrastructure, strengthening relationships with other Antarctic nations and the research community, and supporting plans for future initiatives. Improvements being planned include a new Antarctic transport aircraft, replacement of facilities at Scott Base, and vehicles

128 Australia Antarctic Programme, *Australian Antarctic Strategy and 20 Year Action Plan, Commonwealth of Australia 2016* (Canberra: Commonwealth of Australia, 2016), p. 17, available at http://www.antarctica.gov.au/__data/assets/pdf_file/0008/180827/20YearStrategy_final.pdf.

129 Brady, *China's Expanding Antarctic Interests*, p. 19.

130 Sam Ikin, Rosemary Bolger, and Emilie Gamenz, "New $500 Million Icebreaker Australia's Biggest Investment the Antarctic Program, Prime Minister Says," *ABC News Australia*, October 29, 2015.

131 Australia Antarctic Programme, *Australian Antarctic Strategy and 20 Year Action Plan*, pp. 23–24.

132 Antarctica New Zealand, *Statement of Intent: 2016–2020* (Christchurch, New Zealand: New Zealand Government, 2016), p. 6, available at http://www.antarcticanz.govt.nz/assets/About-Us/governance/publications/2016-2020-SOI.pdf.

to tow research equipment over the Ross Ice Shelf.[133] New Zealand is not pursuing military operations in the Antarctic.

China

Although only an observer of the Arctic Council, China is a self-described "near-Arctic state."[134] Similarly, China is not a claimant in Antarctica, but is a consultative party to the Antarctic Treaty.[135] As a great power, however, China is very active in both polar regions. It established an Arctic and Antarctic Administration to manage polar operations and initiatives. Beijing has broad interests in the high latitudes including the environmental implications of climate change and melting sea ice, the impact of Arctic and Antarctic access on maritime trade, and natural resources available in both regions.[136]

In June 2017 China released its *Vision for Maritime Cooperation under the Belt and Road Initiative*. The strategy document listed use of the Northern Sea Route as a priority, describing a "blue economic passage . . . leading up to Europe via the Arctic Ocean."[137] The document marked the first time that China had formally articulated an element of Arctic policy, and the country remains the only Asian country in the Northern Pacific not to release a comprehensive Arctic strategy document.[138]

Beijing's Arctic policies can be inferred, in part, from its actions. To further its research efforts in the Arctic, China has operated the Yellow River research station in Svalbard, Norway since 2004, and it constructed a facility in Iceland in 2016.[139] It has also ramped up PLA Navy (PLAN) deployments to the Arctic, including periodic transits of the Bering Strait.[140] Although its military operations appear limited to transits of ice-free regions of the Arctic, the addition of under-ice modifications to future Chinese SSNs and SSBNs would be an indicator China plans to militarize the Arctic.[141]

China operates two light military icebreakers, which are employed for icebreaking duties in the Bohai Sea, and one light research icebreaker. Its first domestically-built icebreaker is

133 Ibid., p. 3.

134 Nengye Lie, "China's Emerging Arctic Policy," *The Diplomat*, December 14, 2016.

135 "Parties," Secretariat of the Antarctic Treaty website, available at http://www.ats.aq/devAS/ats_parties.aspx?lang=e.

136 See the China Arctic and Antarctic Administration website, available at http://www.chinare.gov.cn/english/gb_article.php?modid=10001.

137 *Vision for Maritime Cooperation under the Belt and Road Initiative* (Beijing: The State Council, The People's Republic of China, June 20, 2017), available at http://english.gov.cn/archive/publications/2017/06/20/content_281475691873460.htm.

138 Mia Bennett, "China's Belt and Road Initiative Moves into the Arctic," *Cryopolitics*, June 27, 2017.

139 Vala Hafstad, "Chinese Research Facility on Icelandic Farmland," *Iceland Review Online*, July 13, 2016.

140 Franz-Stefan Gady, "Russia and China in the Arctic: Is the US Facing an Icebreaker Gap?" *The Diplomat,* September 7, 2015, available at http://thediplomat.com/2015/09/russia-and-china-in-the-arctic-is-the-us-facing-an-icebreaker-gap/.

141 Rob Huebert, "The Future of Maritime Activity in the Arctic: The Return of the Great Game," Presentation at Maritime Security Challenges 2016, Victoria, British Columbia, October 5, 2016.

currently being built; it will support polar research when it enters service in 2019.[142] China's only operational research icebreaker, the *Xue Long*, attracted international attention in 2014 when it participated in the rescue of a trapped Russian icebreaker near Antarctica.[143]

China's Antarctic efforts, described in its 2017 white paper, emphasize scientific research, particularly regarding the progress and impacts of climate change, as well as economic development.[144] As noted in Chapter 3, the Chinese government is supporting these objectives with four research stations in Antarctica and a fifth under development on the Ross Ice Shelf. It is also pursuing establishment of an Antarctic Specially Managed Area (ASMA) that would encompass its facilities in East Antarctica (see Figure 7). Although the new area would still be within the AAT and subject to the Antarctic Treaty's protocols against mining and militarization, it would afford China an opportunity to increase its participation in Antarctic governance structures.

Beijing's economic ambitions in the Antarctic currently center on tourism, fisheries, and exploration of mineral and petroleum deposits. Chinese tourists are the second-largest nationality of Antarctic visitors, and China fields the largest fleet of krill fishing boats in Antarctic fisheries. Krill is used to feed farm-raised fish including salmon. Although the Madrid Protocol to the Antarctic Treaty prohibits mining in Antarctica, China's research and sustained presence there may be designed to facilitate future extraction if the Antarctic Treaty is dissolved or modified.

Summary

Many U.S. allies have security and economic interests in the Arctic and Antarctic. Because of geography and treaty agreements, those interests are not under threat or encroachment in the next several years. There is, however, the potential for future disputes as extended EEZs become more nationally important and contested and as the Antarctic Treaty comes under increasing pressure from governments and resource extracting industries. Shipping and tourism will also continue to increase, creating the potential for disagreements regarding access in EEZs and territorial waters.

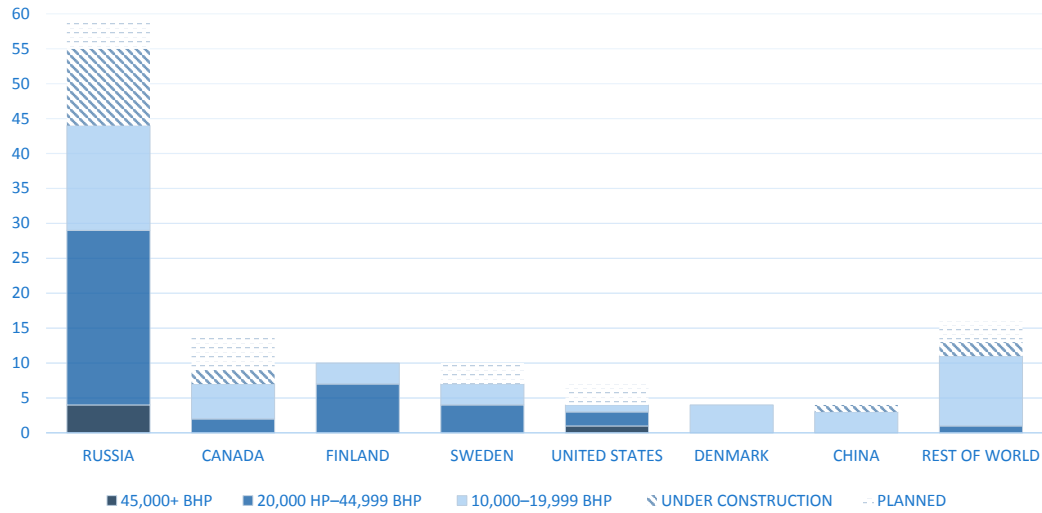
Each nation with polar interests is pursuing a combination of research stations, sensor and communication systems, and icebreakers to support their activities. Icebreakers are particularly important because they maintain access for research, military operations, and shipping and tourism; sometimes they are the only way to deliver supplies and equipment to Antarctic stations. As noted above, several countries are building new icebreakers to protect their polar interests (see Figure 9).

142 Gady, "China Begins Construction of Polar Icebreaker."

143 Alok Jha, "Antarctic Mission on Ice as Rescue Ship is Forced Back," *The Guardian*, December 27, 2013, available at https://www.theguardian.com/world/2013/dec/27/antarctic-mission-icebreaker-delay-rescue.

144 Nengye Lie, "Demystifying China in Antarctica," *The Diplomat,* June 9, 2017, available at http://thediplomat.com/2017/06/demystifying-china-in-antarctica/.

FIGURE 9: ICEBREAKER INVENTORY AND CONSTRUCTION



Data for this chart was provided by the U.S. Coast Guard. The categories correspond with light (10,000–19,999 BHP), medium (20,000–44,999 BHP), and heavy (45,000+ BHP).

Some analysts are concerned about the growing "icebreaker gap" between the United States and competitors like China or Russia.[145] The degree of the gap may be overstated when the size of each nation's fleet is compared to its polar requirements. For example, Russia's large icebreaking fleet is understandable given Russia's 13,000-mile Arctic coastline. Nevertheless, the United States has fewer icebreakers than other countries with significant polar interests, and its one operable heavy icebreaker is nearing retirement. Chapter 5 will address U.S. polar policy and plans, and Chapter 6 will provide recommendations to address the U.S. icebreaker fleet, as well as other investments.

145 Gady, "Russia and China in the Arctic."

CHAPTER 5

The United States' Polar Strategy and Capabilities

America has enduring interests in both the Arctic and Antarctic. The United States is an Arctic nation, has maintained a presence in Antarctica for more than a century, and is a party to the treaties and consultative bodies governing the polar regions. This chapter will describe U.S. policy for the Arctic and Antarctica, historical activities, and likely future interests in the high latitudes.

Arctic Strategy and Policy

The United States became an Arctic nation in 1867 when it purchased Alaska from Russia for $7.2 million.[146] U.S. policy in the Arctic has evolved from an initial focus on exploration and research to one of nuclear deterrence and early warning, evolving into today's multifaceted political, economic, and military approach.

In January 2009, the Bush administration issued the first U.S. policy specifically for the Arctic: National Security Presidential Directive 66 (NSPD-66). Previous policy documents were written for both the Arctic and Antarctic. NSPD-66 established six U.S. Arctic priorities:

1. Meet national security and homeland security needs relevant to the Arctic region;
2. Protect the Arctic environment and conserve its biological resources;
3. Ensure that natural resource management and economic development in the region are environmentally sustainable;

146 "Treaty with Russia for the Purchase of Alaska," The Library of Congress, updated April 25, 2017, available at https://www.loc.gov/rr/program/bib/ourdocs/Alaska.html.

4. Strengthen institutions for cooperation among the eight Arctic nations (the United States, Canada, Denmark, Finland, Iceland, Norway, the Russian Federation, and Sweden);

5. Involve the Arctic's indigenous communities in decisions that affect them; and

6. Enhance scientific monitoring and research into local, regional, and global environmental issues.[147]

NSPD-66 was supplemented in 2013 by the *National Strategy for the Arctic Region*. The *National Strategy* identified three lines of effort for the United States: advancing its security interests, pursuing responsible Arctic region stewardship, and strengthening international cooperation.[148] The *National Strategy* was followed by a detailed implementation plan in 2014 that established tasks for different agencies.

DoD also released an Arctic strategy in 2013. The DoD strategy defines the U.S. military's overall goal for the Arctic as "a secure and stable region where U.S. national interests are safeguarded, the U.S. homeland is defended, and nations work cooperatively to address challenges."[149] To achieve these goals, the United States seeks to "1) Ensure security, support safety, promote cooperation; and 2) prepare to respond to a wide range of challenges and contingencies . . . in order to maintain stability in the region."[150]

The USN followed DoD's Arctic strategy with an update to its 2009 Arctic strategy. The Navy's *Arctic Roadmap for 2014 to 2030*, published in February 2014, assessed that "since the end of the Cold War, the military threat environment in the Arctic region [had] diminished significantly and the risk of armed conflict in the Arctic Region [was] projected to remain low for the foreseeable future." Consequently, "as opposed to combat-related missions, Navy forces are far more likely to be employed in the Arctic region in support of Coast Guard search and rescue, disaster relief, law enforcement, and other civil emergency/civil support operations."[151] The *Roadmap* established several institutional goals, such as "[increasing] the number of personnel trained in Arctic operations," and laid out a path to progressively increase the Navy's Arctic presence from periodic in the 2020s to sustained in the 2030s and beyond.[152]

147 The White House, "Arctic Region Policy," National Security Presidential Directive/NSPD-66, January 9, 2009, available at https://fas.org/irp/offdocs/nspd/nspd-66.pdf.

148 *National Strategy for the Arctic Region* (Washington, DC: The White House, May 10, 2013), available at: https://obamawhitehouse.archives.gov/sites/default/files/docs/nat_arctic_strategy.pdf.

149 DoD, Under Secretary of Defense (Policy), *Report to Congress on Strategy to Protect United States National Security Interests in the Arctic Region*, p. 2.

150 Ibid., p. 2.

151 U.S. Navy, Chief of Naval Operations (CNO), *The United States Navy Arctic Roadmap for 2014 to 2030* (Washington, DC: DoD, February 2014), p. 13.

152 U.S. Navy, CNO, *The United States Navy Arctic Roadmap for 2014 to 2030*, pp. 17-18.

The USCG's Arctic strategy was released in 2013. The strategy's goal is to ensure that maritime activity in the Arctic is, "safe, secure, and environmentally responsible," during a period when, "the Arctic environment is changing dramatically."[153] The strategy outlined three overarching goals for USCG Arctic policy: improving awareness, modernizing governance, and broadening partnerships. To accomplish those goals, the USCG identified 13 tasks, including enhancing Arctic operations and exercises, improving maritime domain awareness, and ensuring that the USCG fields an adequate number of Arctic-capable surface and air platforms along with their associated infrastructure.[154]

The most recent U.S. government Arctic strategy document is DoD's 2016 *Report to Congress on Strategy to Protect United States National Security Interests in the Arctic Region*. The 2016 report updates DoD's 2013 strategy and provides more detail on the Defense Department's view of the other Arctic powers, including U.S. disagreements with Russia and Canada about the status of Arctic shipping routes. The report also highlights current gaps in U.S. military Arctic capabilities, including "shortfalls in observations, remote sensing capabilities, ice prediction, and weather forecasting; lack of navigational aids; challenges in high-latitude electronic communications; and limited inventory of ice-capable vessels and ground transportation; and infrastructure." [155]

Antarctic Strategy and Policy

As noted in Chapter 3, the United States maintains a continuous presence in Antarctica and is the source of more visitors to Antarctica than any other nation. Given the limits of the Antarctic Treaty, U.S. interests in Antarctica focus mostly on research, logistics, environmental protection, and fisheries management. U.S. Antarctic policy is designed to follow the following imperatives:

- The United States recognizes no foreign territorial claims.
- The United States reserves the right to participate in any future uses of the region.
- Antarctica shall be used for peaceful purposes only.
- There shall be free access for scientific investigation and other peaceful pursuits.[156]

Like other countries described in Chapter 4, some American activities in Antarctica, such as satellite communication and navigation systems, have dual military and civilian uses.

153 *U.S. Coast Guard Arctic Strategy* (Washington, DC: U.S. Coast Guard Headquarters, 2013), p. 9.

154 U.S. Government Accountability Office (GAO), *Coast Guard: Arctic Strategy is Underway, but Agency Could Better Assess How Its Actions Mitigate Known Arctic Capability Gaps* (Washington, DC: GAO, June 2016), p. 21.

155 Ibid., p. 13.

156 "U.S. Policy for Antarctica," National Science Foundation, available at https://www.nsf.gov/geo/opp/antarct/uspolicy.jsp.

Security Considerations in the Polar Regions

A military engagement in the polar regions could fall into one of three categories: nuclear conflict, conventional conflict, or constabulary operations.

Nuclear conflict in the Arctic would likely consist of its use by ballistic missiles or long-range bombers flying between Asia and North America. The United States, Russia, and Canada have devoted significant investment and effort to establish long-range surveillance and warning systems in the Arctic to detect and classify these threats, enabling interdiction by Arctic-based aircraft or missile interceptors.

Conventional military operations in the Arctic would most likely consist of either strikes against Arctic bases or the interdiction of military or civilian platforms transiting through the high latitudes. During World War II, German naval forces attempted to intercept allied supply convoys transiting as far north as Murmansk and Arkhangelsk, and USCG cutters of the Greenland Patrol captured and destroyed German weather stations in Greenland.[157] In a future conflict, U.S. forces might attempt to attack Russian surface vessels or submarines transiting from their Arctic bases through the Barents and Norwegian Seas. Given the harsh climate and the lack of habitable area, it is unlikely that conventional ground operations would occur in the Arctic or that countries would attempt to seize and hold territory there.

The Antarctic is also not likely to be a significant theater for conventional or nuclear conflict due to its remoteness from likely areas of operation such as Eastern Europe or the Western Pacific. Physical or electronic attacks could be made against satellite communication systems in Antarctica, provided they could be undetected or were not attributable. Otherwise, the benefit of such attacks might not be worth the diplomatic damage created by overt military operations on the continent, in violation of the Antarctic Treaty.

Constabulary operations are the most likely type of security activity to take place in the Arctic and Antarctic. As traffic in the polar regions increases, the demand for law enforcement, maritime surveillance, and SAR capabilities will go up as well. Many ports throughout the Arctic are ill-prepared to handle the forecasted growth in Arctic activity and lack basic safety and security infrastructure such as border control services and coastal surveillance sensors. Similarly, SAR services along the Arctic SLOCs are sparse and inadequate given current levels of Arctic activity. The disabling or sinking of an ocean liner like the *Crystal Serenity* would likely strain those SAR resources and could result in large losses of life if rescuers are unable to arrive quickly.

Because of the Antarctic Treaty's limitations, the region will not experience significant oil and gas exploration or military activity. Tourism, fishing, and shipping, however, are likely

157 Scott T. Price, "Arctic Combat: The Capture of the German Naval Auxiliary Externsteine by the Coast Guard Icebreakers Eastwind & Southwind in Greenland, 1944," U.S. Coast Guard, December 21, 2016, available at https://www.uscg.mil/history/articles/externsteine.asp.

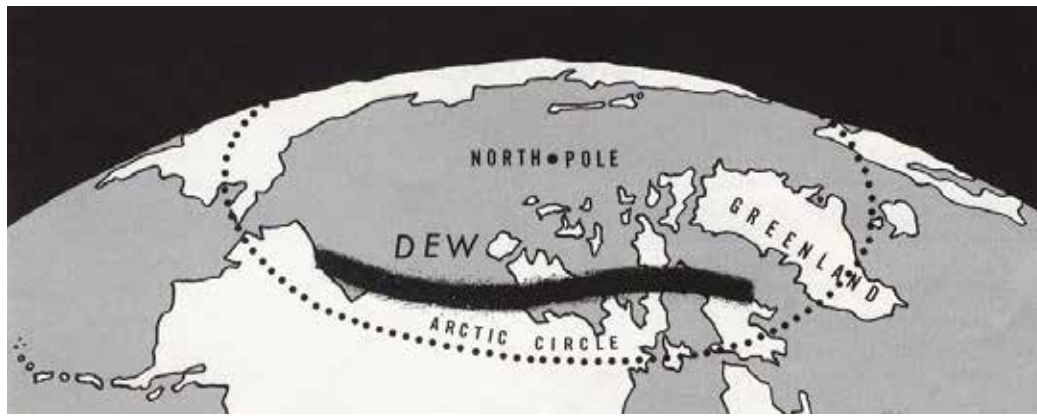
to increase there as polar ice clears. Because it is more remote from larger population centers and has more challenging conditions, Antarctica has even less infrastructure and logistics capacity than the Arctic to support SAR or environmental response operations that may be needed with the growth of activity at sea.

Military Activity in the Arctic During the Cold War

Prior to the Cold War, the United States took only a limited interest in the Arctic. During World War II, U.S. forces escorted convoys traveling to northern Russian ports, but the United States only maintained a minimal military presence in the high latitudes. As the nuclear competition between the Soviet Union and the United States heated up, the Arctic became critical terrain for fighting the Cold War.

During the 1950s, both the United States and the USSR relied on bombers as their primary nuclear delivery platform. The Arctic offered the quickest, most direct route between the two countries, and U.S. Air Force (USAF) and Soviet crews routinely practiced high latitude operations. In response to the threat posed by the USSR bomber force, the United States and Canada established the DEW Line of radar warning stations stretching from Alaska to Greenland through the Canadian Arctic Archipelago. U.S. icebreakers played a crucial role in building and resupplying the DEW stations.[158]

FIGURE 10: AN APPROXIMATION OF THE LOCATION OF THE DEW LINE



U.S. Government illustration.

The advent of both intercontinental ballistic missiles (ICBM) and submarine-launched ballistic missiles (SLBM) in the late 1950s led the United States to invest in a supplement to the DEW Line, the Ballistic Missile Early Warning System (BMEWS). Two of the 12 BMEWS stations were in the Arctic: one at Clear Air Force Base (AFB), Alaska, and the other at Thule

158 Ken S. Coates, P. Whitney Lackenbauer, William R. Morrison, and Greg Poelzer, *Arctic Front: Defending Canada in the Far North* (Toronto, Ontario: Thomas Allen Publishers, 2008).

AFB, Greenland. Both sites have since been upgraded with advanced phase array radars, and they continue to provide missile early warning and space surveillance.[159]

U.S. submarines have transited under the Arctic since the *Nautilus'* first transpolar voyage in 1958, but the polar seas did not become a strategically important region for undersea warfare until a decade later. In 1973, the Soviets began to field the Delta-class SSBN with SLBMs that had sufficient range to strike the United States from the Arctic Ocean.[160] The Deltas could hide under the noisy Arctic ice, where they were protected by rings of Soviet surface and subsurface platforms, rather than run a gauntlet of U.S. and NATO ASW barriers to reach the Atlantic Ocean.

The United States responded to the Soviet bastion strategy by adopting a "forward strategic ASW approach" that required the Navy to hold at risk Soviet SSBNs in their Arctic patrol areas. The only platforms capable of carrying out under-ice ASW operations were SSNs. Undersea operations in the Arctic against Soviet SSBNs were carried out by U.S. SSNs throughout the Cold War and continued after the fall of the Soviet Union, a fact revealed in 1993 when a U.S. SSN collided with a Russian SSBN it had been trailing near Murmansk.[161]

Post-Cold War Military Activity in the Arctic

The 1990s were a period of reduced activity for U.S. forces in the Arctic. DoD closed some of its Alaskan military installations, including Naval Air Facility Adak in the Aleutian Islands, and the frequency of SSN patrols in the Arctic was probably reduced.[162] However, U.S. forces in Alaska continued to carry out many of the same missions as during the Cold War, including ICBM early warning. Missile defense was added to the responsibilities of Alaska-based forces in 2001 when Fort Greely, Alaska, was selected as a host site for the Ground-based Midcourse Defense (GMD) program.[163]

The United States continued to carry out large-scale exercises in Alaska during the 1990s. A joint Alaskan exercise that had been successively labeled Jack Frost, Brim Frost, and Arctic Warrior was renamed Northern Edge in 1993 and continues today.[164] Similarly, in 1993 the

159 "Ballistic Missile Early Warning System," Air Force Space Command, March 22, 2017, available at http://www.afspc.af.mil/About-Us/Fact-Sheets/Display/Article/1126401/ballistic-missile-early-warning-system/.

160 Owen R. Cote Jr., *The Third Battle: Innovation in the U.S. Navy's Silent Cold War Struggle with Soviet Submarines* (Newport, RI: Naval War College, 2003), pp. 63–64.

161 Michael R. Gordon, "U.S. and Russian Subs in Collision in Arctic Ocean Near Murmansk," *The New York Times*, March 23, 1993.

162 Zellen, *The Fast-Changing Arctic*, loc. 4275.

163 "Welcome to Fort Greely Alaska Handbook," U.S. Army brochure, 2007, p. 4, available at https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwjR8Yzo0OzVAhVISyYKHTP3DYMQFggoMAA&url=https%3A%2F%2Fwww.greely.army.mil%2Fdocs%2FWelcome_Booklet.pdf&usg=AFQjCNGXxUwtJNVx3hH-FgnB7mV3mn417Q.

164 Naomi Klouda, "Northern Edge Exercise Takes to Alaska Skies, Seas," *Alaska Journal of Commerce*, May 3, 2017.

Air Force moved its Cope Thunder exercise from the Philippines to Alaska and subsequently renamed it Red Flag-Alaska in 2006.[165]

The capabilities of the USAF's 3d Wing, stationed at Joint Base Elmendorf-Richardson (JBER), were boosted in 2007 when the 90th and 525th Fighter Squadrons replaced their F-15 Eagles with F-22 Raptors. In addition to worldwide deployments, these aircraft regularly intercept Russian surveillance flights off the coast of Alaska.[166]

USCG Activity in the Arctic

The USCG has been active in the high latitudes since its early days as the Revenue Cutter Service. The first U.S. vessel to reach Alaska after it was purchased was the cutter *Lincoln*. Since then, cutters provided a vital service in allowing the United States to execute the basic functions of governance in the remote and challenging Alaskan conditions. During the 19th and 20th centuries, cutters and Cutter Service crews undertook a wide variety of missions:

> For the Department of Justice they enforced the law, apprehended criminals, and transported "floating courts." For the Navy Department they gathered military intelligence. For the Post Office Department they carried the mail. For the Department of the Interior they carried teachers to their posts and checked up on sanitation. For the Department of Agriculture they guarded timber and game. For the Department of Commerce they made surveys of the coast and of regional industries. Medical and dental care reached isolated villages, brought by cutters carrying Public Health Service doctors and nurses.[167]

Today, the USCG is responsible both by statute and intergovernmental agreement for a host of maritime security and safety missions, many of which are applicable in the Arctic. These tasks include maintaining and operating navigational aids, operating icebreakers, carrying out maritime SAR operations, protecting U.S. borders, protecting the marine environment, conducting law enforcement in U.S. waters, and providing logistics support to the Antarctic research program.[168]

In response to the growth in commercial activity in the Arctic, the USCG has increased its summer operations in the high latitudes. Arctic Crossroads operations were initiated in 2008 and subsequently renamed Arctic Shield in 2012. Arctic Shield is held annually during the summer months. During these operations, the USCG deploys "personnel, cutters, and aircraft within the Arctic region and to small villages on the Arctic coast such as Barrow, Kotzebue,

165 Juliana Gittler, "At Cope Thunder, 'Realistic' Training for Air Force Pilots," *Stars and Stripes*, October 15, 2005; and "Red Flag-Alaska," factsheet, Eielson Air Force Base, June 8, 2012, available at http://www.eielson.af.mil/About-Us/Fact-Sheets/Display/Article/382359/red-flag-alaska/.

166 Zachary Cohen and Ryan Browne, "U.S. F-22s Intercept Russian Bombers Off Alaska Coast," *CNN*, April 18, 2017.

167 *Coast Guard History* (Washington, DC: U.S. Coast Guard Headquarters, Public Information Division, 1950), p. 28, available at https://www.uscg.mil/history/articles/genhist/CG-213_USCG_History.pdf.

168 *United States Coast Guard High Latitude Region Mission Analysis Capstone Summary* (Arlington, VA: ABS Consulting, 2010), p. 4.

and Nome."[169] In 2016 the USCG established a seasonal base in Kotzebue to host a two-aircraft detachment of MH-60 Jayhawk helicopters from July to October to supplement the Arctic Shield operations.[170]

Military Arctic Infrastructure and Force Posture

The importance of the Arctic to U.S. military operations is evidenced by the U.S. military posture in the region (see Figure 11). The United States maintains only one permanent installation (excluding the mostly unattended nodes of the Alaska Radar System) north of 66.6° latitude: Thule AFB. Thule AFB is home to a component of the BMEWS, and the base infrastructure includes a 10,000-foot runway, ramp space, a 20 million-gallon fuel storage facility, and an eight-bed hospital.[171]

The largest DoD facility in Alaska is JBER, with a total population of over 12,000. JBER is home to the USAF's 3d Wing and its mix of F-22s, C-130 Hercules, C-17 Globemasters, and E-3 AWACS. In 2006, the 176th Wing (Alaska Air National Guard) moved its C-130 and HH-60 Pavehawk combat search and rescue (CSAR) aircraft from Kullis Air National Guard (ANG) Base, Alaska to JBER. The 176th is one of two wings in the Air Force equipped with an Arctic aviation capability—the other is the 109th Wing (New York Air National Guard) based at Stratton ANG Base, New York—and its addition to the JBER roster of units gives the base a unique high latitude SAR capability.[172]

The USAF also operates a second fighter base in Alaska: Eielson AFB. Eielson AFB is currently home to the "northernmost U.S. fighter wing in the world," the 354th Fighter Wing and its F-16 Falcons.[173] The 354th is expected to begin transitioning to the F-35 Lightning in 2020.[174]

The U.S. Army bases two Brigade Combat Teams (BCT) in Alaska, one at Fort Wainwright, Fairbanks, and the other at JBER. In addition, the 19th Missile Defense Battalion operates the GMD architecture at Fort Greely.

169 DoD, Under Secretary of Defense (Policy), *Report to Congress on Strategy to Protect United States National Security Interests in the Arctic Region*, p. 2.

170 Laurel Andrews, "Coast Guard Launches Seasonal Home Base in Kotzebue," *Alaska Dispatch News*, June 26, 2016.

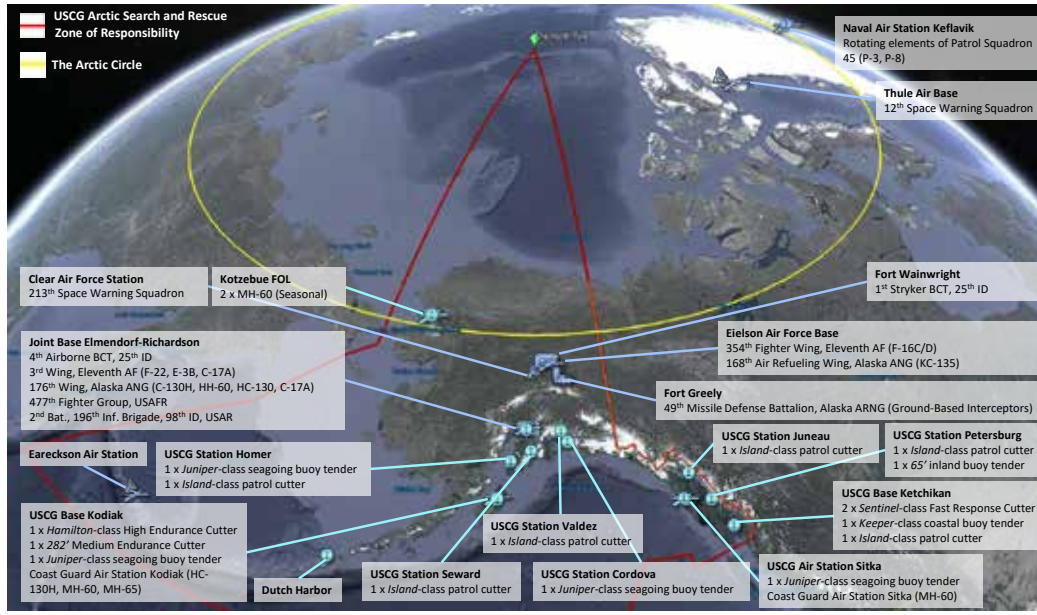
171 DoD, Under Secretary of Defense (Policy), *Report to Congress on Strategy to Protect United States National Security Interests in the Arctic Region*, p. 8.

172 Ibid., pp. 5–6.

173 "354th Fighter Wing," factsheet, Eielson Air Force Base, March 21, 2012, available at http://www.eielson.af.mil/About-Us/Fact-Sheets/Display/Article/382368/354th-fighter-wing/.

174 Karen J. Tomasik, "Eielson Selected to Receive Operational F-35A Aircraft," *Eielson Air Force Base News*, April 7, 2016, available at http://www.eielson.af.mil/News/Article-Display/Article/715889/eielson-selected-to-receive-operational-f-35a-aircraft/.

FIGURE 11: U.S. FORCE POSTURE IN THE HIGH LATITUDES



USCG Arctic Infrastructure and Force Posture

The USCG operates one seasonal facility north of 66.6° latitude: the Kotzebue air station described above. The State of Alaska and the U.S. Army Corps of Engineers are evaluating the feasibility of creating a deep draft Arctic port that could potentially host USCG cutters with drafts of 35 to 40 feet.[175] If a deep draft Arctic port is built, the USCG may elect to place a permanent installation there.

USCG Air Station (CGAS) Kodiak is the northernmost year-round USCG air facility. CGAS Kodiak is 945 miles south of Barrow, Alaska, the northernmost U.S. city. HC-130 Hercules, HH-65 Dolphin helicopters, and MH-60s all operate out of CGAS Kodiak. The USCG also bases MH-60s at CGAS Sitka in southern Alaska.

There are 14 USCG vessels homeported in Alaska. The most capable of these is the *Hamilton*-class high-endurance cutter *Munro*. *Munro*'s range of 14,000 nm at 11 knots allows the ship to carry out patrols in northern Alaskan waters even after making a lengthy transit around the Aleutian Islands from its home port in Kodiak.[176] *Munro* was commissioned in 1971 and is likely to be retired in the next few years as part of the USCG's fleet-wide replacement of *Hamilton*-class cutters by the new Legend-class National Security Cutter (NSC). No NSCs

175 O'Rourke, *Changes in the Arctic* (2016), p. 26.

176 Congressional Budget Office (CBO), *Options for Combining the Navy's and the Coast Guard's Small Combatant Programs* (Washington, DC: CBO, 2009), p. 6.

are scheduled to be homeported in Alaska. Instead, they will sail to Kodiak from their base in Alameda, California, before moving into the Arctic to conduct patrols.[177]

FIGURE 12: ILLUSTRATION OF THE DISTANCES BETWEEN NORTHERN ALASKA AND THE NORTHERNMOST CGAS OR USCG DEEP DRAFT SEAPORT

U.S. GAO, *Coast Guard*, p. 19.

Icebreaker Capacity

The USCG has two heavy icebreakers, the *Polar Star* and the *Polar Sea*, and a medium icebreaker, the *Healy*. The *Polar Sea* has been unable to deploy since she suffered an engine casualty in 2010, leaving the *Polar Star* and the *Healy* as the only two operational USCG icebreakers.[178] The USCG completed an assessment in 2017 that concluded that the costs of returning the *Polar Sea* to service are prohibitively high, and the ship has been re-designated as a "parts donor" to the *Polar Star*.[179]

177 Scott Truver, "Arctic Missions Demand More High-Endurance Cutters," *Armed Forces Journal*, April 1, 2014.

178 U.S. GAO, *Coast Guard*, p. 35.

179 Sam LaGrone, "Coast Guard: Icebreaker Polar Sea Now a 'Parts Donor;' Refurbishment Deemed Too Expensive," *USNI News*, February 17, 2017.

FIGURE 13: USCGC *POLAR STAR*

U.S. Coast Guard Photo.

The *Polar Star* entered service in 1976. The ship was refurbished in 2012, extending its service life to 2023. The *Polar Star* is the only operational heavy U.S. icebreaker and is primarily used to support Antarctic research and the resupply of McMurdo Station.[180] Following the conclusion of the annual McMurdo resupply mission in January, the *Polar Star* typically goes through a maintenance period in dry dock.[181]

FIGURE 14: USCGC *HEALY*

U.S. Coast Guard Photo.

The *Healy* was commissioned in 1999 and is expected to serve until 2030.[182] The *Healy* is primarily used for Arctic research purposes, although it can operate in either polar region. As a medium icebreaker, it can clear ice in shoulder seasons, but not year-round.

180 NAS, *Acquisition and Operation of Polar Icebreakers*, p. 24.

181 Ibid., p. 35.

182 U.S. GAO, *Coast Guard*, p. 18.

The USCG has established a requirement for three heavy icebreakers and three medium icebreakers.[183] To begin addressing this need, it established a Heavy Polar Icebreaker acquisition program to replace the *Polar Sea* and *Polar Star* in its 2013 budget request. From 2013 to 2016 the program received $15.6 million in funding.[184] In 2017, $175 million was appropriated: $25 million in the USCG's shipbuilding account and $150 million in the Navy's shipbuilding account.[185] The USCG seeks to purchase three ships, the first of which would be delivered in 2023. The average cost of each ship has been estimated at between $790 million and $1.1 billion.[186]

In addition to the Coast Guard's icebreakers, the U.S. National Science Foundation operates a light icebreaker, the *Nathaniel B. Palmer*, and two ice-capable ships, the *Sikuliaq* and the *Laurence M. Gould*.[187]

Summary

The United States has relied largely on its Cold War-era platforms and infrastructure to support its evolving policy and increasing activity in the high latitudes. Although environmental and economic factors will temper the increase needed in USN and USCG polar operations, additional investment and capabilities will likely be needed to address logistics for Antarctic operations, SAR and maritime safety operations for shipping and tourism, and maritime domain awareness and homeland defense. These recommendations are described in Chapter 6.

183 "Polar Icebreaking Recapitalization Project Mission Need Statement, Version 1.0," Department of Homeland Security, approved by DHS June 28, 2013, pp. 1, 2, 9, 10, 11, 12.

184 O'Rourke, *Changes in the Arctic* (2016), p. 47.

185 Ronald O'Rourke, *Changes in the Arctic: Background and Issues for Congress* (Washington, DC: Congressional Research Service, August 17, 2017), p. 46.

186 NAS, *Acquisition and Operation of Polar Icebreakers*, pp. 101–102.

187 Ibid., p. 31.

CHAPTER 6

Recommendations and Conclusion

The United States is entering a period of great power competition with Russia and China as their military capabilities and revanchist objectives collide with the interests of America and its allies. This competition is already incorporating the polar regions. All three great powers have a presence in the Arctic and Antarctic that will only grow in importance during the coming decades given the value of the polar regions for military operations and economic activity, especially as the rapidly changing physical environment enables increased access.

Growing activity by great powers, regional states, and commercial interests in polar areas will bring new demands for logistical support, SAR operations, surveillance, communications, and environmental response. As described in previous chapters, these demands are not likely to increase dramatically, but instead will rise steadily as the polar regions become more accessible and economically viable as areas for resource exploitation and transit. The USN, USCG, and allied fleets, however, lack the capacity for even a moderate expansion of these missions. Further, there is insufficient port and communications infrastructure ashore in the Arctic or Antarctic regions to support a greater operational tempo, particularly of USN or USCG ships or aircraft that lack the endurance to deploy to the Arctic or Antarctic from outside the region.

The USN and USCG will need to adopt new concepts and invest in additional capabilities or capacity, as described below, to support increased polar operations and protect freedom of navigation in the upper latitudes. These concepts include new ways for the Navy to support the USCG and civilian activities.

New Roles and Missions

The USN has the world's largest military fleet, centered on large, highly capable warships such as CVNs and amphibious assault ships (LHA/LHD). It also has strong capabilities in logistics, including at-sea replenishment, and platforms to deliver these capabilities like Combat

Logistics Force (CLF) ships such as oilers or innovative new platforms like the Expeditionary Support Base (T-ESB), Expeditionary Support Dock (T-ESD), or Expeditionary Fast Transport (T-EPF).

Despite its capability and capacity, the USN conducts few operations in the polar regions. Only SSNs can operate in areas with any ice coverage. Guided-missile destroyers (DDG) and cruisers (CG) are not ice-capable and are needed elsewhere for their primary missions of air and missile defense, surface warfare, and ASW. Littoral Combat Ships (LCS) are armed consistent with patrol craft like Norway's *Svalbard*-class and are intended for maritime security missions, but they lack the endurance to operate in the polar regions where refueling stops are often 1000 nm or more apart.[188]

The USCG is the lead U.S. service for polar operations,[189] but all its permanently-based forces in Alaska are below the Arctic Circle, more than 1000 nm from operating areas on the northern Alaskan coast. They are even further from Antarctica and the Southern Ocean. USCG *Legend*-class National Security Cutters have the range to transit to and operate in polar regions during the summer, but they are not able to operate in icy conditions during the winter or shoulder seasons. More importantly, the USCG only plans to have nine NSCs, which will have other demands to meet outside the Arctic. The USCG additionally faces gaps in its polar communication capabilities and logistics support in the Arctic and Antarctic.[190]

The need for more polar presence and improved coverage for communications, surveillance, and SAR operations suggest some opportunities for the USN to affordably support the USCG. The Navy could leverage its at-sea logistics capabilities to sustain the greater USCG operational tempo anticipated in polar regions by augmenting shore facilities that are small, sparse, and likely to be affected by melting permafrost. It could also contribute to polar missions using non-combatant ships or small surface combatants carrying USCG law enforcement detachments (LEDET), similar to how the USN supports constabulary operations by partner nations overseas. This model, used today in Joint Interagency Task Force-South (JIATF-South) to support USCG counter-trafficking operations in the Caribbean, could also be applied to a "JIATF-Arctic" operation.

The U.S. military's surveillance systems in the Arctic are currently focused on air and missile defense, and its communication capabilities are designed to support military satellite communication and navigation networks in the polar regions. These systems are of little use for SAR operations, traffic management, environmental monitoring and response, and border control.

188 The LCS endurance is between 1000 nm and 4000 nm depending on speed. See "Freedom Variant, Littoral Combat Ship: Full Speed Ahead," Lockheed Martin brochure, 2012, p. 2, available at http://www.lockheedmartin.com/content/dam/lockheed/data/ms2/documents/LCS-trifold-brochure.pdf.

189 U.S. Coast Guard, *Coast Guard Concept of Operations for Offshore Assets*, Fiscal Year 2016 Report to Congress (Washington, DC: U.S. Department of Homeland Security, January 23, 2017), p. 2, available at https://www.dhs.gov/sites/default/files/publications/USCG%20-%20Concept%20of%20Operations%20for%20Offshore%20Assets_0.pdf.

190 *United States Coast Guard High Latitude Region Mission Analysis Capstone Summary* (2010), p. 11.

More activity at the poles will increase the importance of surface surveillance and civilian communication and navigation capabilities. The Navy and USCG could leverage improving unmanned aerial vehicles (UAV) technology to provide these capabilities in the polar regions, with the Navy providing larger, more persistent systems such as large Tier 1 and 2 UAVs and the USCG providing smaller UAVs.

These new roles and missions will allow the Navy's more robust and diverse force structure to better support the USCG, which will continue to be the lead service for polar operations. It will also help mitigate the cost of increased polar operations by relying on platforms and systems that can be used in other parts of the world during the polar winters when the Arctic and Southern Oceans are less accessible.

Arctic and Antarctic Posture

The USCG will need to increase its posture in polar regions to address projected growth in Arctic and Antarctic activity. First among needed improvements will be restoring icebreaking capacity to enable access for logistics, research, and SAR operations outside of summer, as well as to clear shipping routes in the early summer. This is especially important to support permanent installations in Antarctica such as McMurdo station. The USCG assesses that only heavy icebreakers like the *Polar Star* can conduct this mission.

Icebreaking only sustains access, however. The growing need for other missions in the polar regions will require additional surface ships and aircraft. An analysis conducted for the USCG in 2010 estimated a posture of three cutters would be needed during summer to address needs in the Bering Strait, the Chukchi Sea, and the north coast of Alaska, augmented by a forward operating location ashore for aircraft.[191] Without at-sea support capabilities, the USCG would need to support this requirement with 12 long-endurance NSCs because smaller cutters would lack the endurance to operate far from appropriate shore support facilities.

An alternative posture could address these requirements with a combination of one to two NSCs, Navy surface combatants with LEDETs, and smaller cutters supported at-sea by Navy logistics and support ships. To expand their sensor coverage and supplement or replace shore-based aviation, cutters and support ships could also deploy small UAVs. The USCG recently completed experiments with small UAVs from NSCs that demonstrated their value in maintaining maritime domain awareness.[192]

During the summer, the Navy could deploy to the Arctic at-sea logistics and support platforms such as Expeditionary Support Bases (ESB) or Expeditionary Support Docks (ESD) that could host UAVs, LEDETs, and small boats as well as refuel and resupply NSCs or smaller cutters

191 Ibid., p. 14.

192 Admiral Paul Zukunft, Commandant of the U.S. Coast Guard, "Requirements, Priorities, and Future Acquisition Plans," testimony on the future of the U.S. Coast Guard before the House Appropriations Homeland Security Subcommittee, May 18, 2017, p. 3.

(see Figure 15 and Figure 16). The ESBs and ESDs could be resupplied, if needed, by CLF ships from CONUS. At the beginning of summer, ESDs and ESBs could transport smaller ships and aircraft to the Arctic and then operate in calmer coastal areas to allow NSCs and smaller cutters to come alongside for refueling and supply or personnel transfers. This would enable USCG ships to remain on station longer by not having to transit to distant ports for logistics.

FIGURE 15: EXPEDITIONARY SUPPORT BASE (ESB)

Military Sealift Command Photo.

FIGURE 16: EXPEDITIONARY SUPPORT DOCK (ESD)

U.S. Navy Photo.

This posture would likely need to be continuous during the Arctic summer because of the higher level of activity there and the proximity of U.S. territory in Alaska. These ships could then deploy to other regions, including Antarctica, during the rest of the year. A benefit of using ESBs and ESDs for this mission is they are rotationally crewed by civilian mariners contracted by the Maritime Sealift Command. This reduces costs for the ship compared to a USN or USCG ship because civilian mariners are less expensive than sailors or Coast Guardsmen, and crews can be reduced to a caretaker detachment when the ship is not deployed.

The USN and USCG could use UAVs in the Arctic to improve over-the-horizon (OTH) surveillance and communications coverage. High-altitude long endurance UAVs such as the USN MQ-4 Triton could operate out of the Navy's P-8 base on Whidbey Island, Washington to conduct regular Arctic orbits in summer for surveillance and to act as OTH communication relays for civilian marine radios. Smaller, shipboard USN UAVs could operate from ESBs or ESDs and perform a similar function over smaller areas when MQ-4s are not available.

Polar Platforms and Systems

The improved Arctic and Antarctic posture described above will not necessarily require new platforms, but additional platforms currently planned or in production could support increased polar operations. Using existing ships, aircraft, and unmanned vehicles will allow the USN and USCG to employ them in other regions outside the Arctic or Antarctic summer, or during years when ice coverage remains high and activity remains low. The following platforms and systems will be needed to implement U.S. Arctic and Antarctic policy.

- High-Endurance Cutters. As described above, the USCG estimated 12 NSCs would be needed to support its lowest risk Arctic posture of three NSCs on station around Alaska during the summer. With at-sea refueling and logistics support, this 12 could be reduced to around three to six by keeping NSCs on station during more of their deployment and augmenting them with smaller cutters, UAVs, and helicopters supported by ESBs or ESDs. Given the USCG currently plans to maintain one NSC near Alaska during the summer, construction of an additional two to five NSCs would enable full coverage of Alaskan waters during ice-free months.

- Support ships. The Navy is building ESBs and ESDs to support expeditionary operations in the Western Pacific and Middle East. An ESB can act as an afloat staging base for small boats, UAVs, and helicopters, and it is equipped with cranes, storage and berthing areas, hangars, and a flight deck able to host four to six helicopters at once along with several UAVs. An ESD is essentially an ESB without the flight deck and hangar, but with the additional capability to flood down its ballast tanks and allow smaller ships to be floated onto the deck for transport. This could enable an ESD to carry smaller cutters to the Arctic for operations during the summer. The Navy could support the USCG's anticipated requirements in the Arctic with one to two additional ESBs or ESDs. Because the

designs of ESBs and ESDs may make them better for different types of operations, the Navy should construct one additional hull of each variant to support Arctic operations.

- Guided missile frigates (FFG). The USN is planning to build a new class of FFGs to succeed the LCS. These ships, two examples of which are shown in Figures 17 and 18, would be multi-mission surface combatants focused on surveillance, ASW, and surface warfare (SUW).[193] The FFG would be similar in size and have similar capabilities for surveillance, communications, SAR operations, and maritime security as the NSC and the generation of polar patrol ships being fielded by other Arctic nations. The Navy plans to build up to 20 FFGs initially as part of its 355-ship fleet.[194] The Navy used its previous class of *Oliver Hazard Perry*-class FFGs to carry USCG LEDETs for counter-trafficking operations as part of JIATF-South. The Navy could similarly use its new FFGs to augment USCG operations in the Arctic by carrying USCG detachments for maritime security and SAR operations. Because the FFGs will be rotationally crewed, the USN could maintain a posture of one FFG in the Arctic during summer with two to three additional FFGs overall.[195]

FIGURE 17: PROPOSED PATROL FRIGATE

An artist's conception of Huntington Ingalls Industries Patrol Frigate design, courtesy of HII.

193 "FFG(X)—US Navy Guided Missile Frigate Replacement Program," Request for Information (RFI) N0002418R2300, U.S. Navy, Naval Sea Systems Command, July 10, 2017, available via *FedBizOps.gov* at https://www.fbo.gov/index?s=opportunity&mode=form&id=cdf24447b8015337e910d330a87518c6&tab=core&_cview=0.

194 Office of the Secretary of the Navy, "Secretary of the Navy Announces Need for 355-ship Navy," *Navy News Service,* December 12, 2016, available at http://www.navy.mil/submit/display.asp?story_id=98160.

195 The Navy currently plans for FFGs to use the same Blue/Gold rotational crews as LCSs, with an additional single-crewed ship in each FFG section dedicated to training crews when they are not on board their ship. Thus, one ship deployed would only require two or three ships in total. See Dr. Regan Campbell, *FFG(X) Industry Day Briefing* (Washington, DC: U.S. Navy, 2017), p. 9; and "Littoral Combat Ships—Fleet Introduction and Sustainment—LCS," factsheet, U.S. Navy, May 5, 2017, available at http://www.navy.mil/navydata/fact_display.asp?cid=4200&ct=4&tid=1650.

FIGURE 18: ITALIAN FREMM FRIGATE

Photo courtesy of Fincantieri.

- Icebreakers. The USCG assesses it requires three heavy icebreakers to assure year-round access to the polar regions and three medium icebreakers to maintain a full-time presence in the Arctic to support research and SAR needs.[196] Today the USCG only has one medium and one soon-to-retire heavy icebreaker, as well as partial funding to construct one heavy icebreaker.

  In addition to leaving the USCG short of its icebreaking requirement, the current recapitalization plan will result in a complete lack of heavy icebreakers between 2020 and 2026 after the *Polar Star* retires and until the new heavy icebreaker is completed. The USCG will need to pursue options to extend the *Polar Star's* service life and lease the services of a foreign or commercial heavy icebreaker to support resupply of McMurdo Station during this period.

  Longer term, the USCG should pursue options to reduce the cost of icebreaker construction to help reach its requirement. Most importantly, instead of pursuing a mixed icebreaking force, the USCG could save money by purchasing only heavy icebreakers and do so using multi-year procurement or "block buy" procurement contracts. This would enable shipbuilders to buy materials and equipment in more economic quantities and take advantage of the "learning curve" that lowers ship construction costs as more ships

196 U.S. Coast Guard, *Coast Guard Concept of Operations for Offshore Assets,* p. 13.

of the same type are built. These changes would likely reduce costs by 7 to 10 percent per ship.[197]

To maximize availability and further reduce costs, the USCG should follow the recommendations of the National Science Foundation regarding icebreaker recapitalization.[198] These include using rotational crews on icebreakers and constructing four heavy icebreakers. A two-crew arrangement on heavy icebreakers would enable two heavy icebreakers to sustain year-round access to the Arctic and one icebreaker to support logistics for Antarctica. A single heavy icebreaker with rotational crews could support the full-time research and SAR requirements the USCG proposes addressing with a medium icebreaker. A fourth heavy icebreaker would be needed to account for overhauls that will take icebreakers out of service. With an estimated cost of $1.6 billion per icebreaker, this plan would save more than $3 billion compared with the USCG plan. Further, if these icebreakers were procured using multi-year or block buy procurement contracts, the USCG could save another $300 million.[199]

- UAVs. As noted above, the USCG is experimenting with small man-portable UAVs equipped with visual and infrared sensors. The reach of USCG cutters and USN FFGs could be expanded further with larger shipboard UAVs in use or under development such as the DARPA Tactically Exploited Reconnaissance Node (TERN) or the MQ-8C Firescout (see Figure 19 and Figure 20).

  These UAVs can carry larger payloads than man-portable UAVs, including passive radio-frequency sensors and radars that would provide more accurate surveillance information over wider areas. They could also carry emergency supplies that could be dropped to mariners in distress and provide line-of-sight communication relays for polar areas not well covered by satellite communications.

  The Navy should consider supplementing satellite and shipboard surveillance and communication systems with large, fixed-wing UAVs. A high-altitude, long-endurance UAV such as the MQ-4 Triton at 60,000 feet altitude would have a field of view with a nearly 300 nm radius and an endurance of 30 hours. A continuous orbit would normally

197 Under a multi-year procurement (MYP) contract, the government agrees to buy multiple ships over several years, which allows shipbuilders to purchase all materials for multiple ships at once. A block buy contract agrees to a price for multiple ships, but then funds the ships individually; the government can fund and authorize shipbuilders to purchase some materials and equipment for multiple ships up front, but not an entire ships' worth of materials. The savings from a MYP approach will, therefore, generally be larger than those from a block buy approach. See "Multiyear Procurements," *Defense Procurement and Procurement Policy*, Defense Acquisition University (DAU), available at http://www.acq.osd.mil/dpap/pass/pa/multiyear_procurement.html.

198 NAS, *Acquisition and Operation of Polar Icebreakers*, p. 10.

199 The Congressional Research Service estimates the savings from a block buy contract with up-front purchases of some material and equipment would save 7 percent on icebreaker construction; DoD requires MYP contracts to save at least 10 percent. See "Multiyear Procurements," DAU; and Ronald O'Rourke and Moshe Schwartz, *Multiyear Procurement and Block Buy Contracting in Defense Acquisition: Background and Issues for Congress* (Washington, DC: Congressional Research Service, August 8, 2017), p. 3, available at https://fas.org/sgp/crs/natsec/R41909.pdf.

require three to four aircraft, which could be based at an airfield outside the polar regions. Because heightened activity is only likely during the summer, and the MQ-4 would be augmenting satellite-based surveillance and communication systems, a detachment of one or two aircraft would likely be sufficient to address OTH coverage gaps.

FIGURE 19: TACTICALLY EXPLOITED RECONNAISSANCE NODE (TERN)

DARPA concept graphic.

FIGURE 20: MQ-8C FIRESCOUT

Photo courtesy of Northop Grumman.

Conclusion

Rapidly changing conditions are likely to increase maritime activity and interest in the polar regions, creating new pressures on U.S. interests in the Arctic and Antarctic. These new demands come as the United States faces intensifying great power competition with Russia and China, both countries with significant polar presence and capability.

The USCG, America's primary force for polar operations, lacks the capacity to support the anticipated requirements for future maritime operations in the Arctic and Antarctic. With some additional capacity and more innovative use of USN and USCG capabilities, the United States can be better prepared to protect its interests in the high latitudes. Without this investment and creativity, America risks losing its ability to protect these sensitive regions from resource exploitation or environmental damage, as well as secure the sovereignty of the United States and its allies.

LIST OF ACRONYMS

AAT	Australian Antarctic Territory
AFB	Air Force Base
ANG	Air National Guard
ANWR	Arctic National Wildlife Refuge
AOPS	Arctic Offshore Patrol Ship
ASCM	anti-ship cruise missile
ASMA	Antarctic Specially Managed Areas
ASW	anti-submarine warfare
BCT	brigade combat team
BMEWS	Ballistic Missile Early Warning System
CG	guided missile cruiser
CGAS	Coast Guard Air Station
CLF	Combat Logistics Force
CONUS	Continental United States
CSAR	combat search and rescue
CSBA	Center for Strategic and Budgetary Assessments
CVN	aircraft carrier
DARPA	Defense Advanced Research Projects Agency
DDG	guided missile destroyer
DEW	Distant Early Warning
DoD	U.S. Department of Defense
ECS	extended continental shelf
EEZ	Economic Exclusion Zone
FFG	guided missile frigate
GEO	geosynchronous Earth orbit
GMD	Ground-based Midcourse Defense
GPS	Global Positioning System
ICBM	intercontinental ballistic missile
JBER	Joint Base Elmendorf-Richardson
LCS	Littoral Combat Ship
LEDET	law enforcement detachment
LEO	low Earth orbit
LHA/LHD	amphibious assault ship
LNG	liquified natural gas

LIST OF ACRONYMS

MEO	medium Earth orbit
NPR-A	National Petroleum Reserve-Alaska
NSC	National Security Cutter
NSPD-66	National Security Presidential Directive 66
OPV	offshore patrol vessel
PLAN	People's Liberation Army Navy
SAM	surface-to-air missile
SAR	search and rescue
SLBM	submarine-launched ballistic missile
SLOC	sea lines of communication
SOSUS	sound surveillance system
SSBN	nuclear ballistic missile submarine
SSN	nuclear attack submarine
SUW	surface warfare
TAPS	Trans-Alaska Pipeline System
T-EPF	Expeditionary Fast Transport
TERN	Tactically Exploitable Reconnaissance Node
T-ESB	Expeditionary Support Base
T-ESD	Expeditionary Support Dock
UAV	unmanned aerial vehicles
UNCLOS	United Nation Convention on the Law of the Sea
USAF	U.S. Air Force
USCG	U.S. Coast Guard
USGS	U.S. Geological Survey
USN	U.S. Navy

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